



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 SH003: HWY 49:12, LITTLE SMOKY RIVER (NORTH OF BRIDGE)

Dear Mr. Shannon:

This report provides the results of the bi-annual geotechnical instrumentation monitoring for the above-mentioned site as part of Alberta Transportation's Geohazard Risk Management Program (GRMP) 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 (SI96-4, SI96-5, SI96-6 and SI31a), two pneumatic piezometers (PZ01-1 and PZ01-3) and two vibrating wire piezometers (VW07-1 and VW07-1A) were read at the Hwy 49:12 Little Smoky River (north of bridge) site on September 26, 2022, by Mr. Niraj Regmi, G.I.T., and Mr. Kyle Crooymans, both of Thurber Engineering Ltd.

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 readout. The vibrating wire piezometers were read using a GEOKON GK 404 vibrating wire readout.

2. DATA PRESENTATION

2.1 General

SI plots for A and B directions are included in 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

A potential zone of movement has been observed in SI31a over 15.7 m to 16.9 m depth, which was not reported during previous readings cycles.

Zones of movements are summarized in Table SH003-1 below. Table SH003-1 below 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 SH003-1
FALL 2022 – HWY 49:12 LITTLE SMOKY RIVER (NORTH OF BRIDGE)
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: September 26, 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)
SI96-4	November 6, 1996, new initial reading of June 5, 2017 used	No discernible movement	N/A	Operational	June 10, 2022	N/A	N/A	N/A
SI96-5		No discernible movement	N/A	Operational	June 10, 2022	N/A	N/A	N/A
SI96-6		No discernible movement	N/A	Operational	June 10, 2022	N/A	N/A	N/A
SI31a	December 16, 1998, new initial reading of June 5, 2017 used	2.8 mm over 15.7 m to 16.9 m depth in 286°	2.9 mm/yr in September 2019	Operational (read from above shear plane at 22.5 m)	June 10, 2022	0.6	2.0	1.8
SI01-3	January 19, 2001	8.7 mm over 22.5 m to 24.9 m in 325° direction	-	<i>Discontinued by Alberta Transportation in Spring 2014</i>	October 22, 2013	N/A	N/A	N/A
		10.0 mm over 34.1 m to 39.0 m in 280° direction	-					
		52.0 mm over 48.1 m to 49.3 m in 310° direction	-					

Drawing 32121-SH003 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.



**TABLE SH003-2
FALL 2022– HWY 49:12 LITTLE SMOKY RIVER (NORTH OF BRIDGE)
PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: September 26, 2022

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	MAXIMUM GROUNDWATER ELEVATION (m)	MEASURED PORE PRESSURE (kPa)	CURRENT GROUNDWATER ELEVATION (m)	PREVIOUS GROUNDWATER ELEVATION (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PZ01-1	January 20, 2001	528.33	542.96	Operational	543.4 in January 2001	114.60	540.02	540.09	-0.07
PZ01-3	January 13, 2001	502.20	517.00	Operational	516.0 in January 2001	126.7	515.12	515.22	-0.10

Drawing 32121-SH003 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.



**TABLE SH003-3
FALL 2022 – HWY 49:12 LITTLE SMOKY RIVER (NORTH OF BRIDGE)
VIBRATING WIRE PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: September 26, 2022

INSTRUMENT	DATE INITIALIZED	TIP DEPTH (m)	CURRENT STATUS	MAXIMUM GROUNDWATER LEVEL (mBGS)	CURRENT GROUNDWATER DEPTH (mBGS)	PREVIOUS GROUNDWATER DEPTH (mBGS)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
VW07-1	March 27, 2007	35.60	Operational	13.33 in June 2014	13.65	13.75	0.10
VW07-1A	March 27, 2007	50.60	Operational	17.50 in May 2007	18.19	18.24	0.05
VW07-1B	March 27, 2007	66.10	Damaged	8.95 in May 2007	N/A	N/A	N/A

Drawing 32121-SH003 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

Note: BGS = below ground surface



3. INTERPRETATION OF MONITORING RESULTS

Slope inclinometers SI96-4, SI96-5, and SI96-6 continued to show no discernible movement. Based on the readings from other sheared inclinometers, these SIs are likely too shallow to capture the main slide movements.

SI31a was previously sheared off at 22.5 m depth in September 1999. Readings were continued above this shear plane. No discernible zones of movement had previously been reported for this zone, however, a rate of movement of 2.0 mm/yr over 15.7 m to 16.9 m depth was observed since the spring of 2022 readings. The instrument appears to show a creep rate of movement over this zone starting in the fall of 2019, with a total cumulative movement of under 3 mm to date.

Pneumatic piezometers PZ01-1 and PZ01-3 showed decreases in groundwater level of 0.07 m and 0.10 m, respectively, since the spring of 2022 readings. Pneumatic piezometer results are summarized in Table SH003-2 above and are plotted in Figure SH003-1 in Appendix A.

Vibrating wire piezometers VW07-1 and VW07-1A showed increases in groundwater level of 0.10 m and 0.05 m, respectively, since the spring of 2022 readings. The vibrating wire piezometer results are summarized in Table SH003-3 above and are plotted in Figure SH003-2 in Appendix A. Both the pneumatic and vibrating wire piezometer water levels have been relatively steady over the last five years.

4. RECOMMENDATIONS

4.1 Future Work

The instruments should be read again in the spring of 2023.

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

Bruce Nestor, P.Eng.
Geotechnical Engineer
/s/

Attachments:

- Statement of Limitations and Conditions
- Appendix A
 - Field Inspector's report
 - Site Plan Showing Approximate Instrument Locations (Drawing No. 32121-SH003)
 - SI Reading Plots
 - Figure SH003-1 (Pneumatic Piezometer Elevations)
 - Figure SH003-2 (Vibrating Wire Piezometer 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.



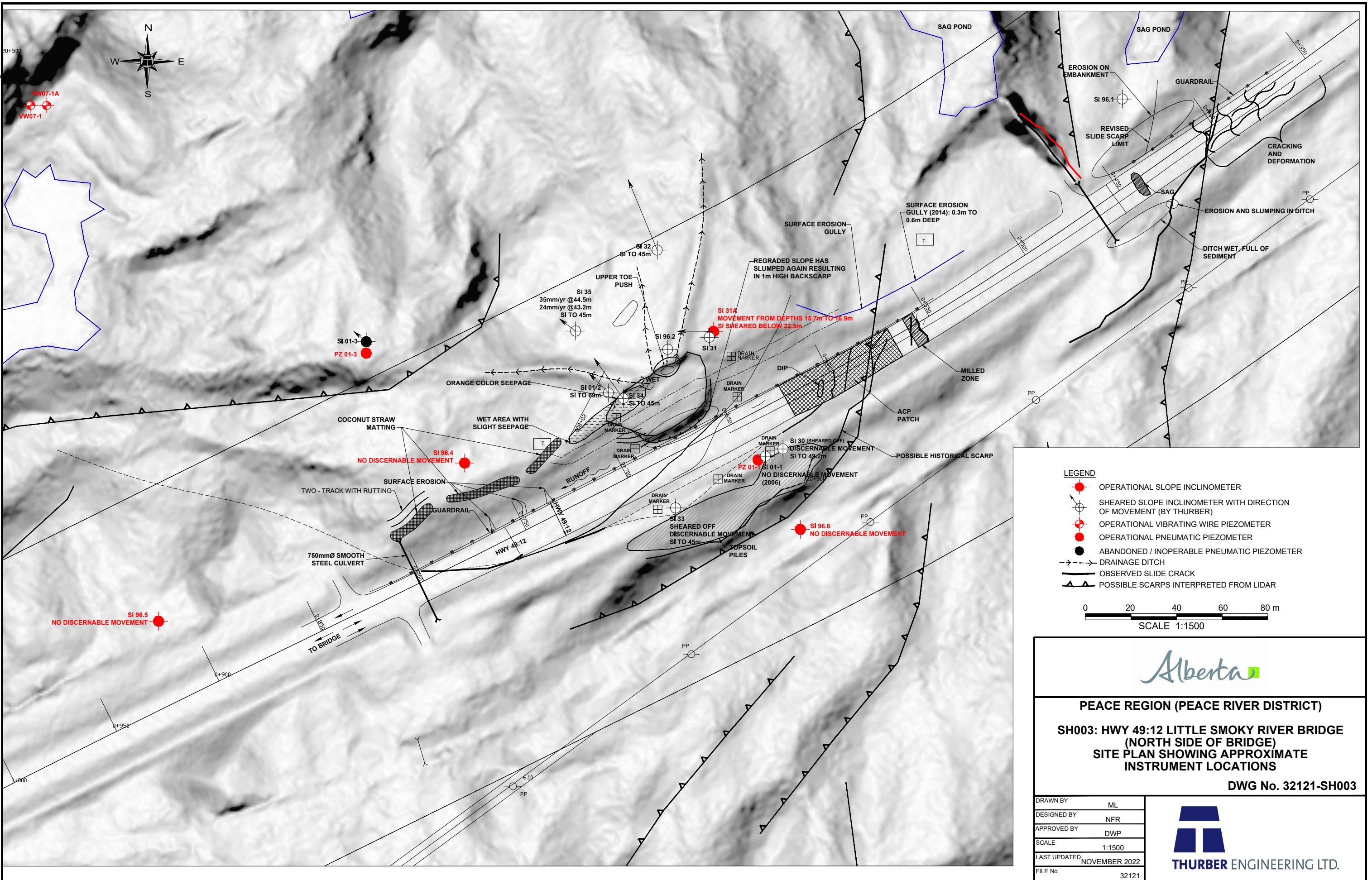
**ALBERTA TRANSPORTATION GRMP (CON0022164)
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INSTRUMENTATION MONITORING RESULTS**

FALL 2022

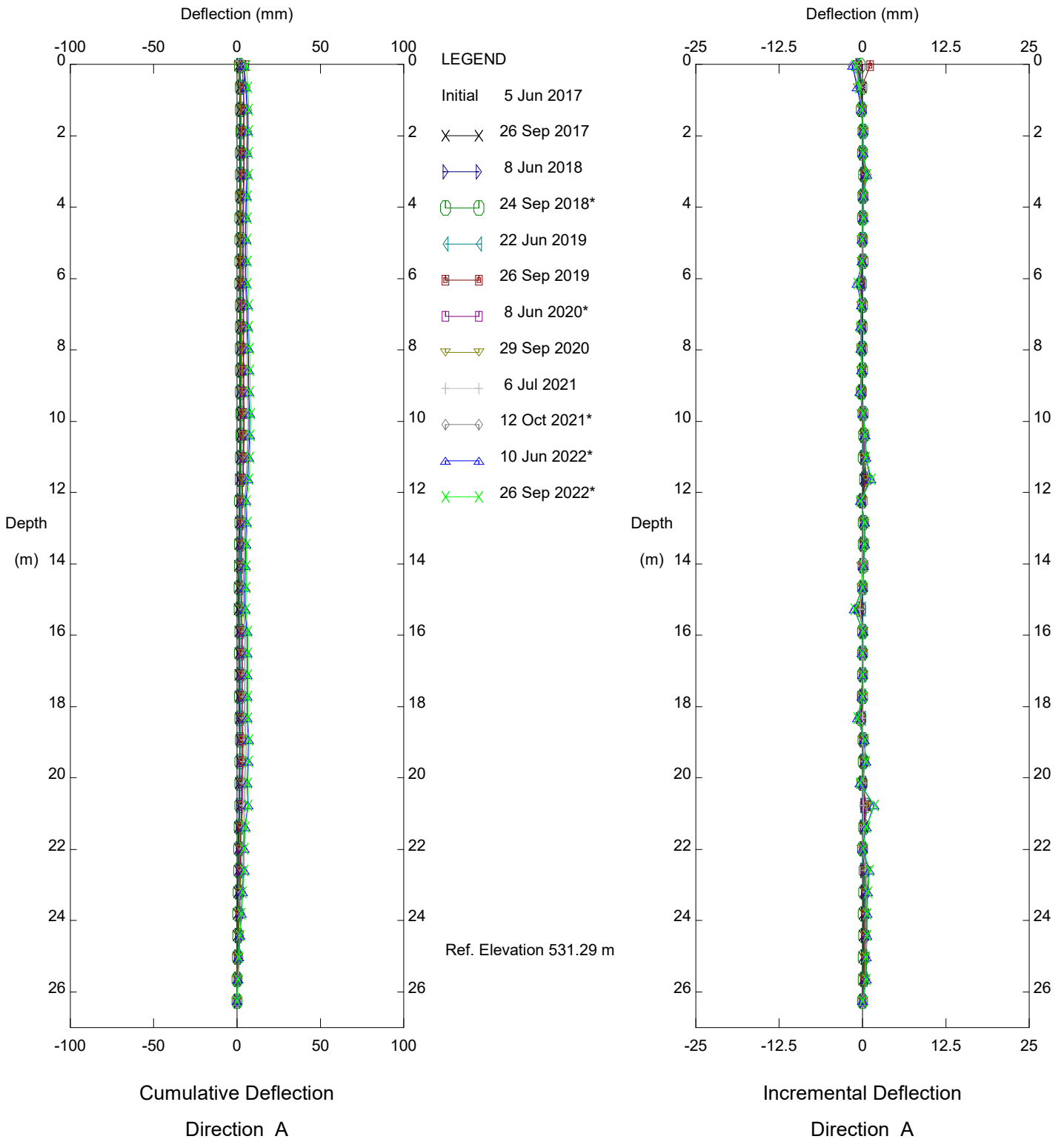
**APPENDIX A
DATA PRESENTATION**

SITE SH003: HWY 49:12, LITTLE SMOKY RIVER (NORTH OF BRIDGE)

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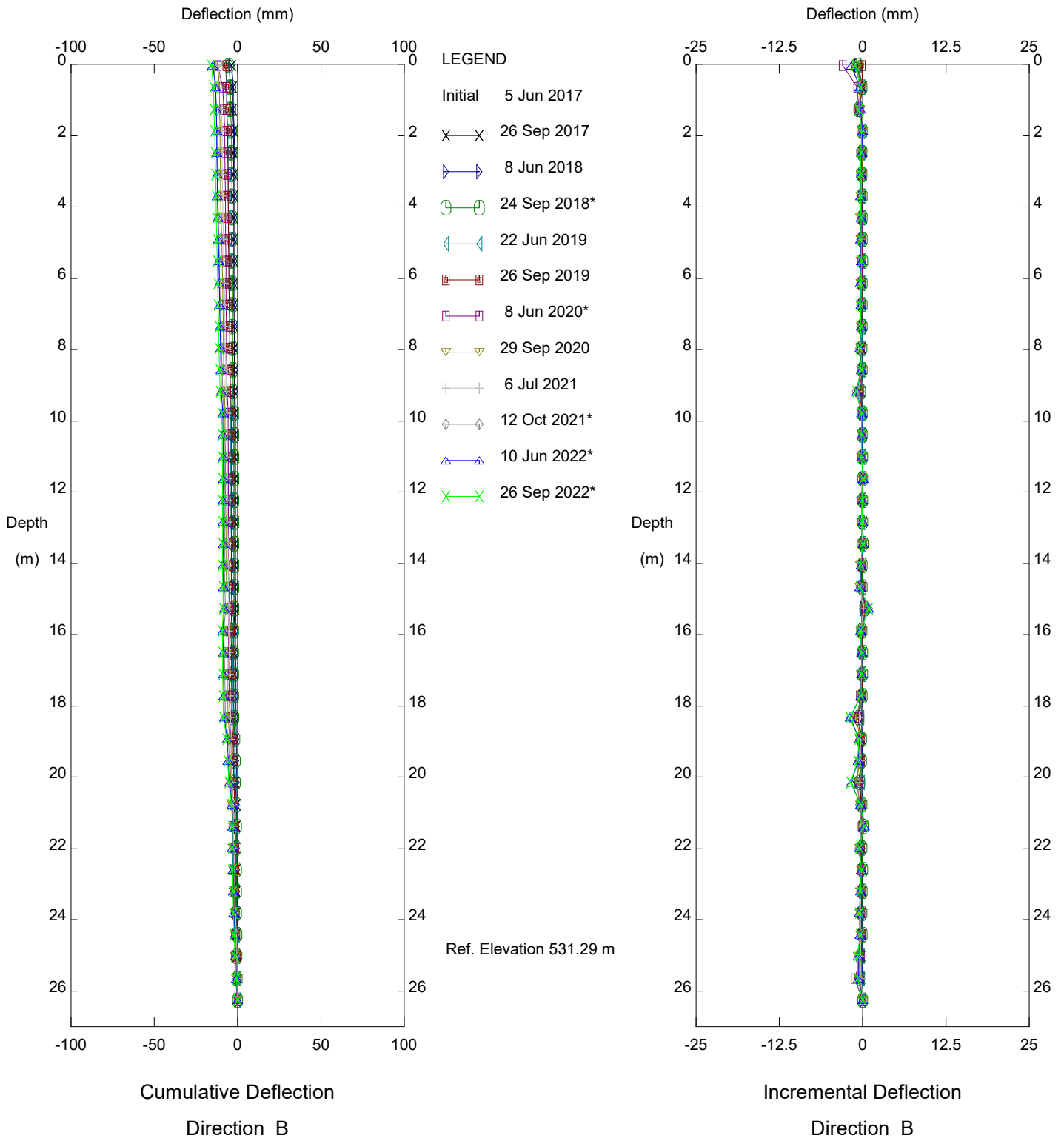


SH003, North of Little Smoky Bridge, Inclinometer SI 96-4

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

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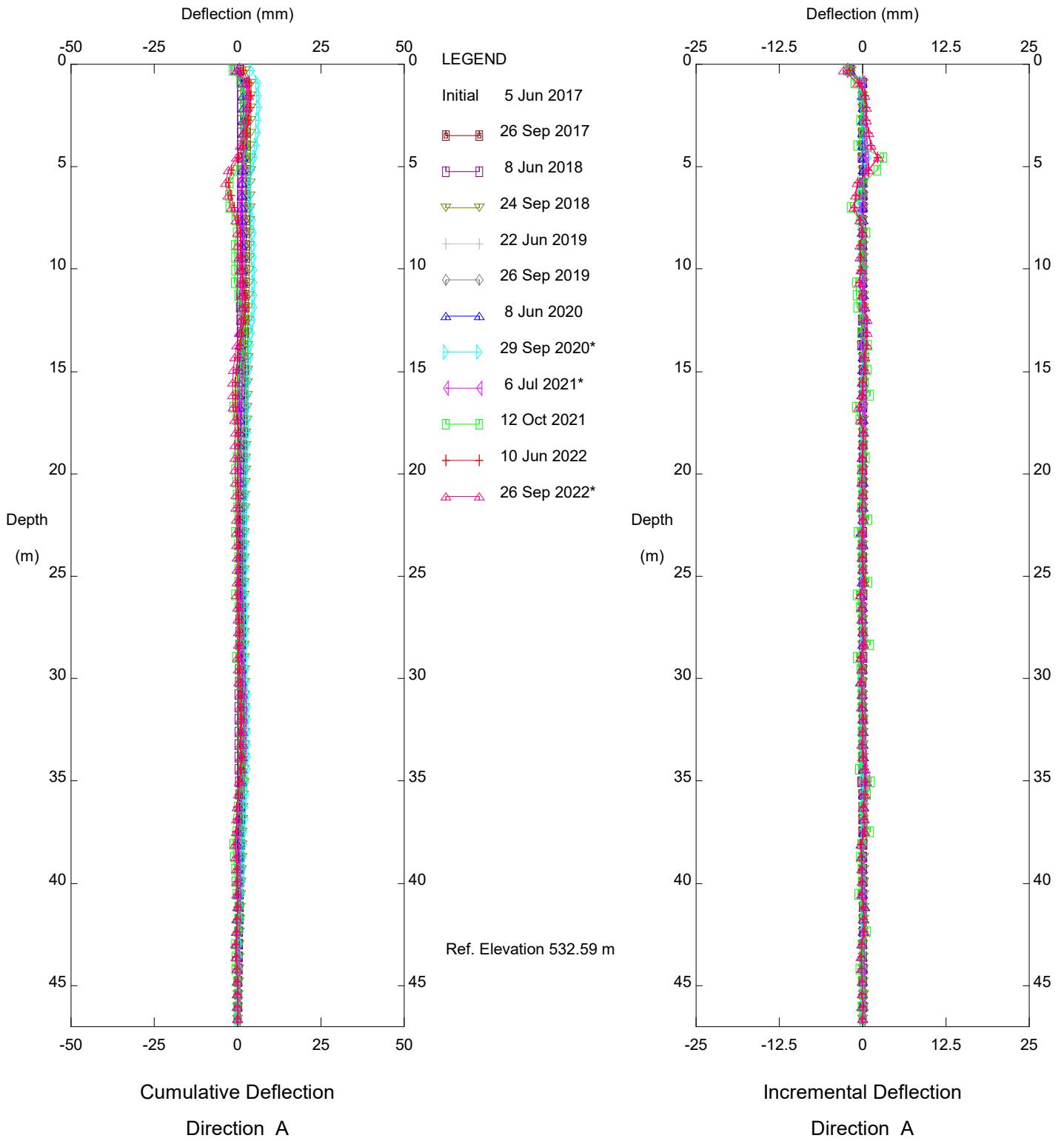


SH003, North of Little Smoky Bridge, Inclinometer SI 96-4

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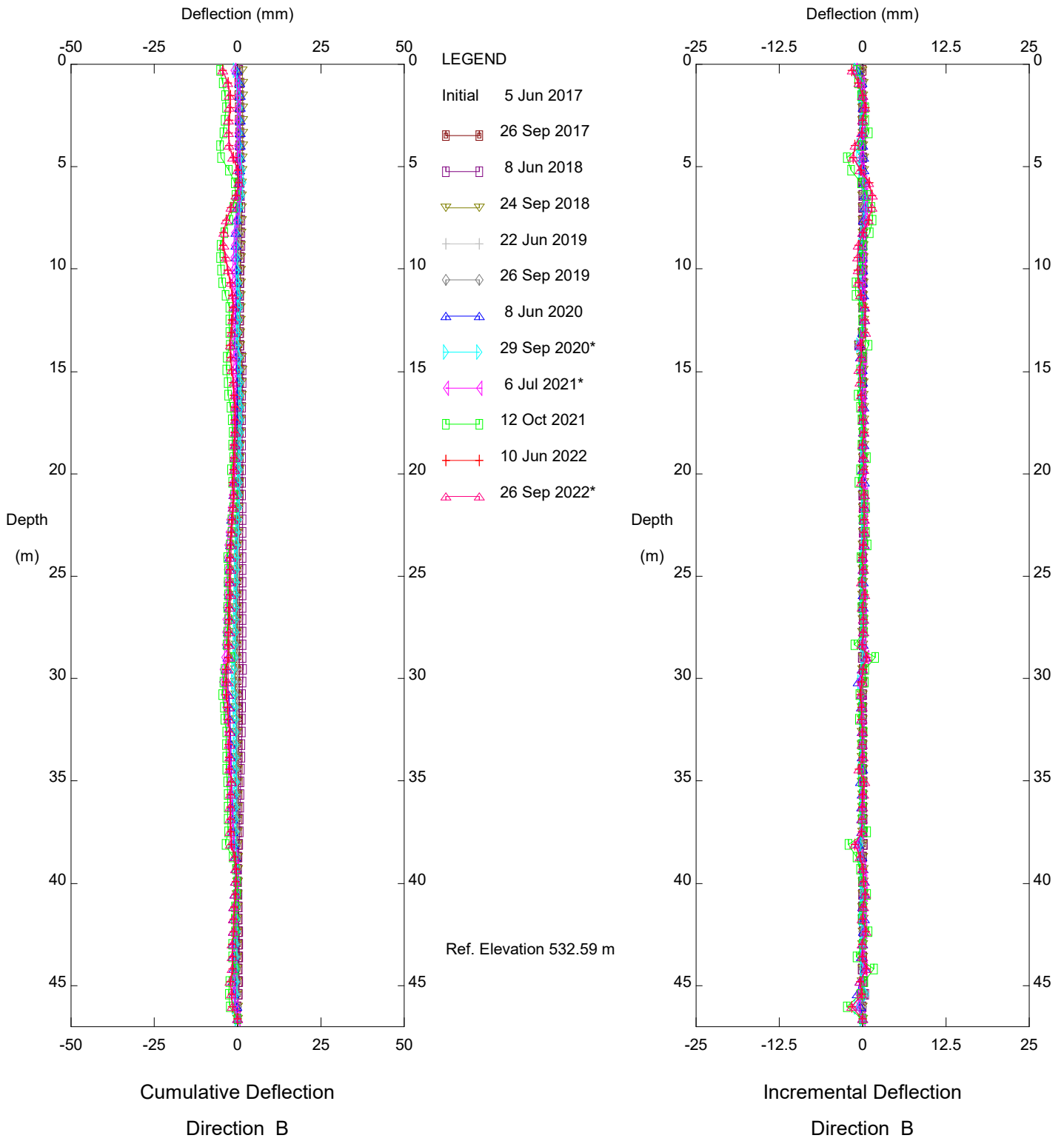


SH003, North of Little Smoky Bridge, Inclinometer SI 96-5

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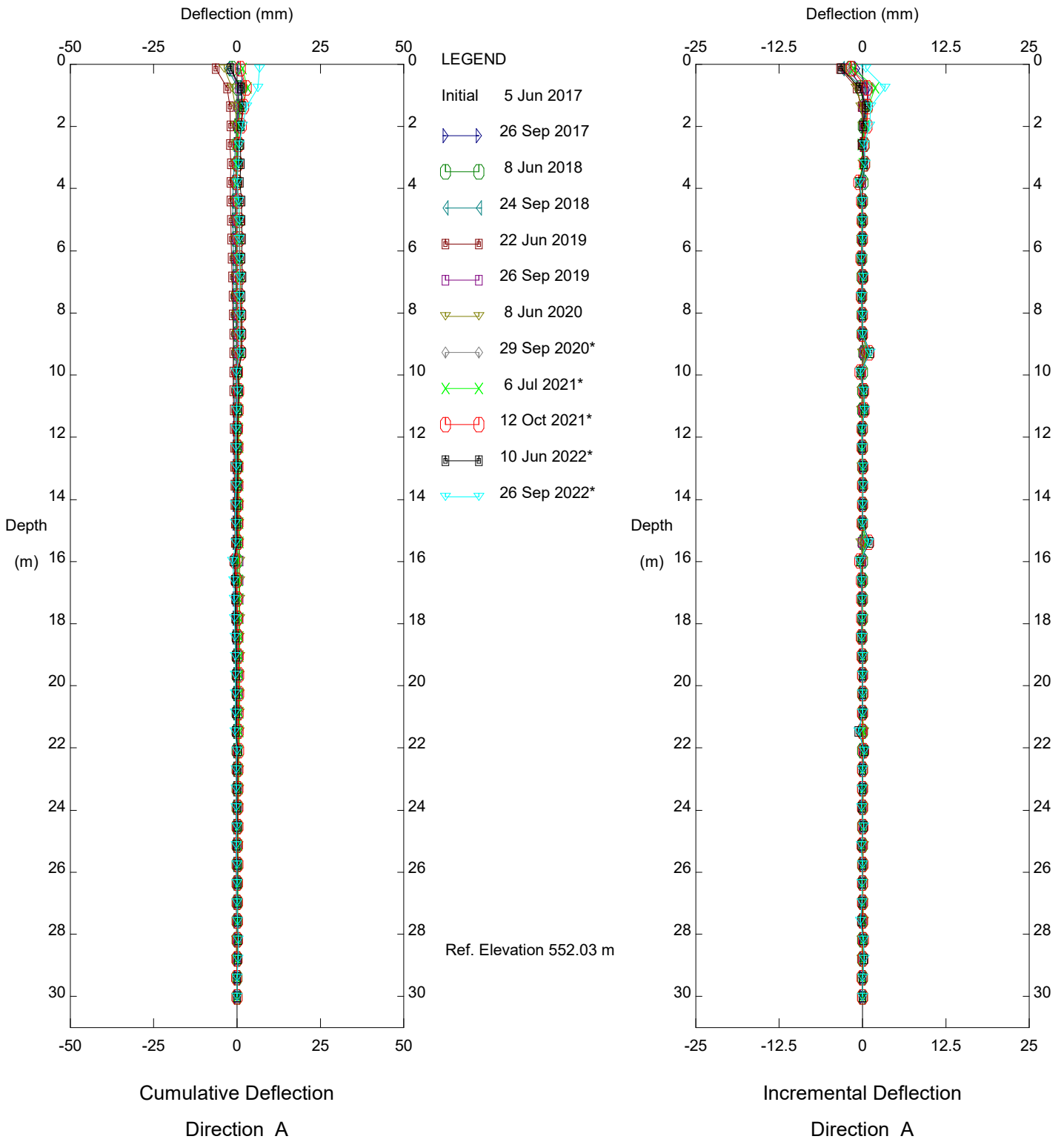


SH003, North of Little Smoky Bridge, Inclinometer SI 96-5

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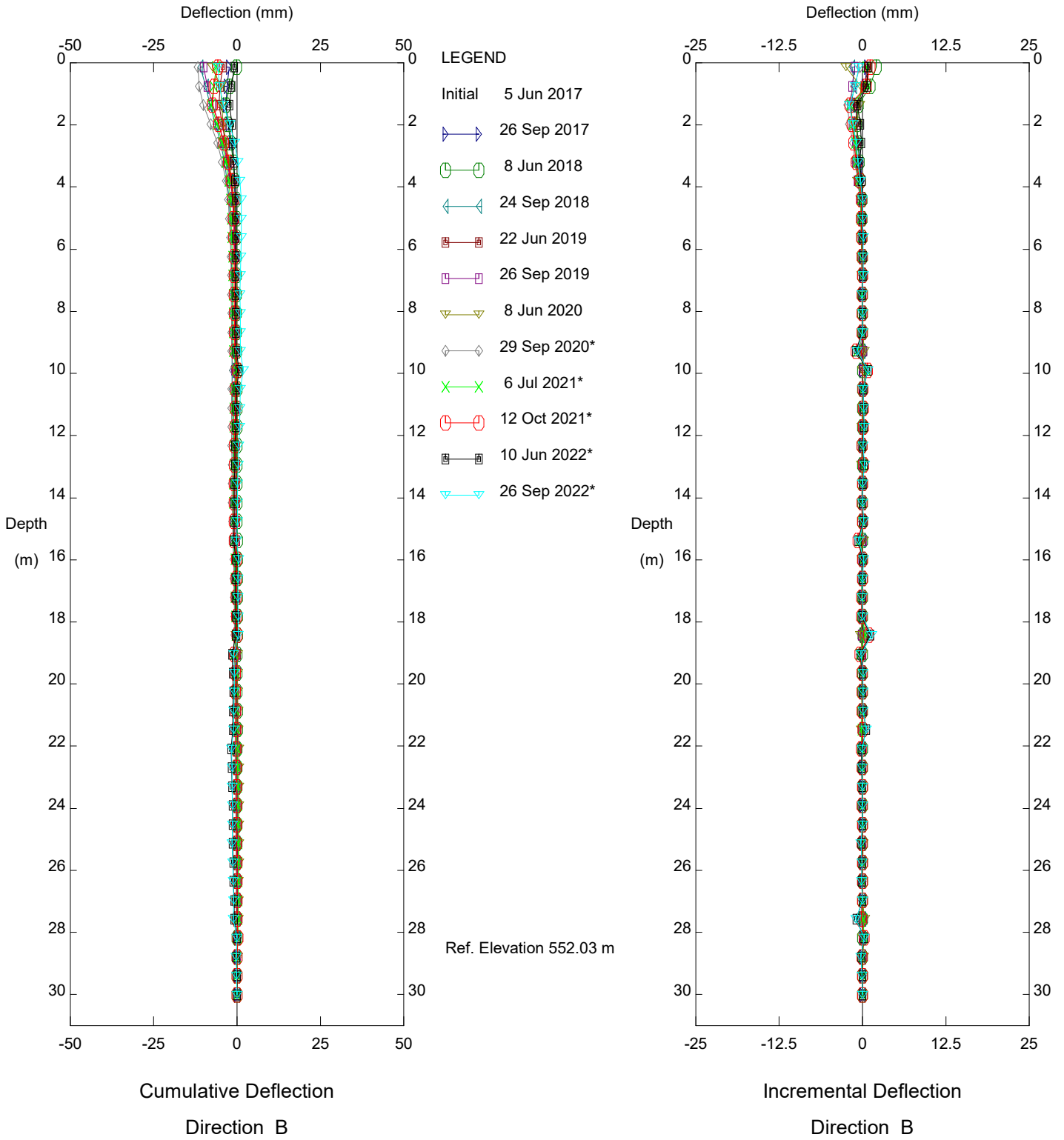


SH003, North of Little Smoky Bridge, Inclinometer SI 96-6

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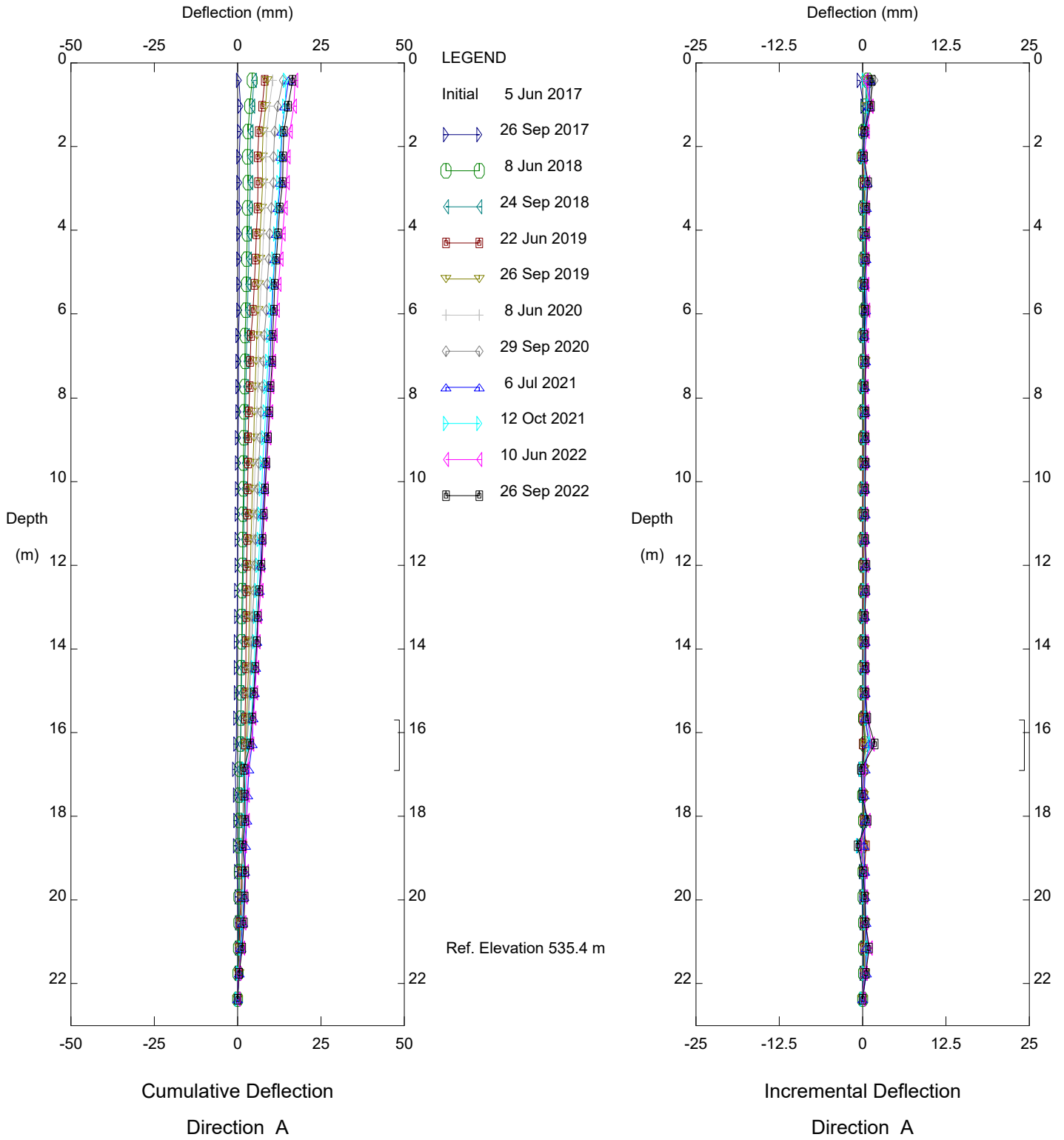


SH003, North of Little Smoky Bridge, Inclinometer SI 96-6

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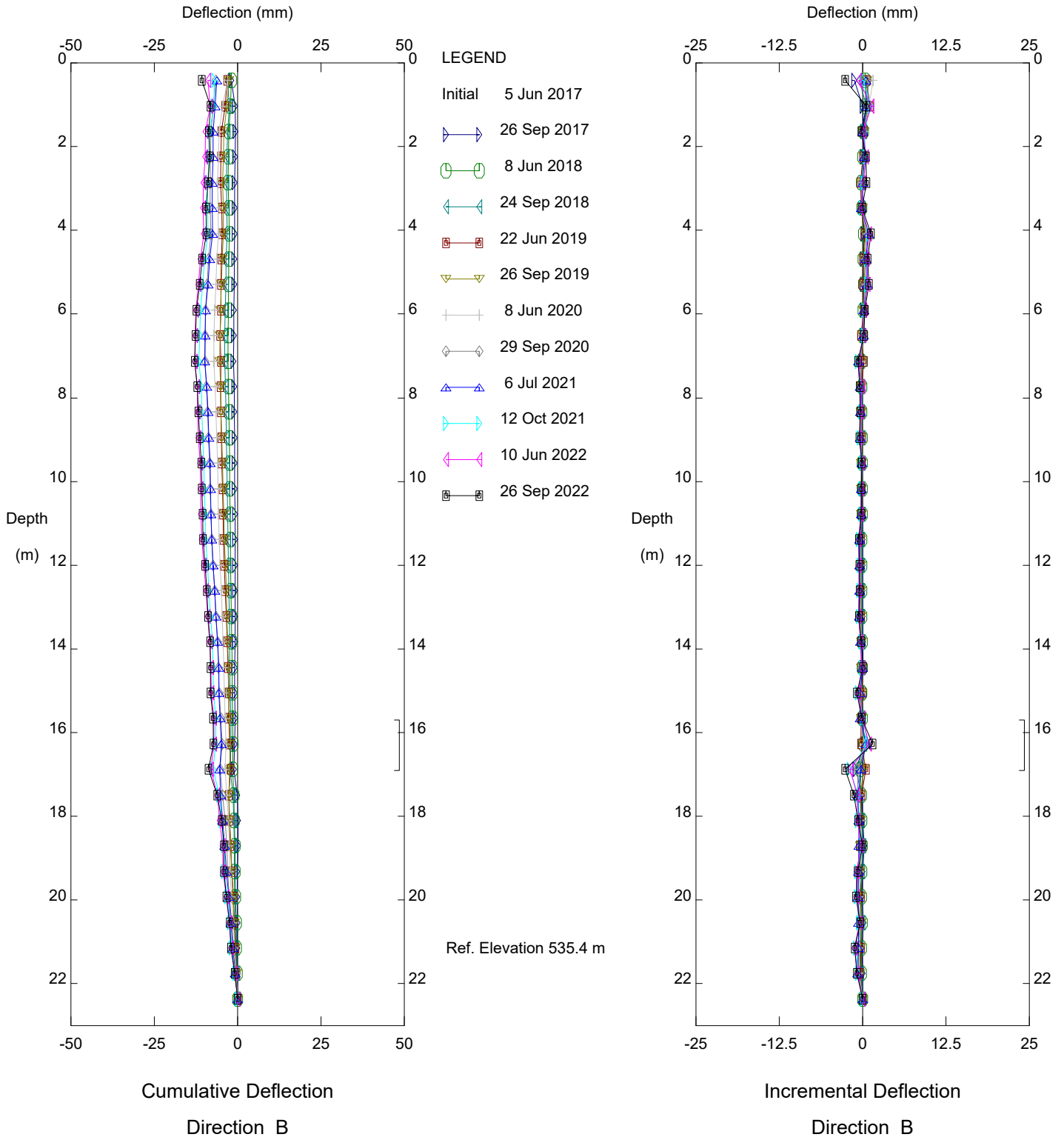
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SH003, North of Little Smoky Bridge, Inclinometer SI31a

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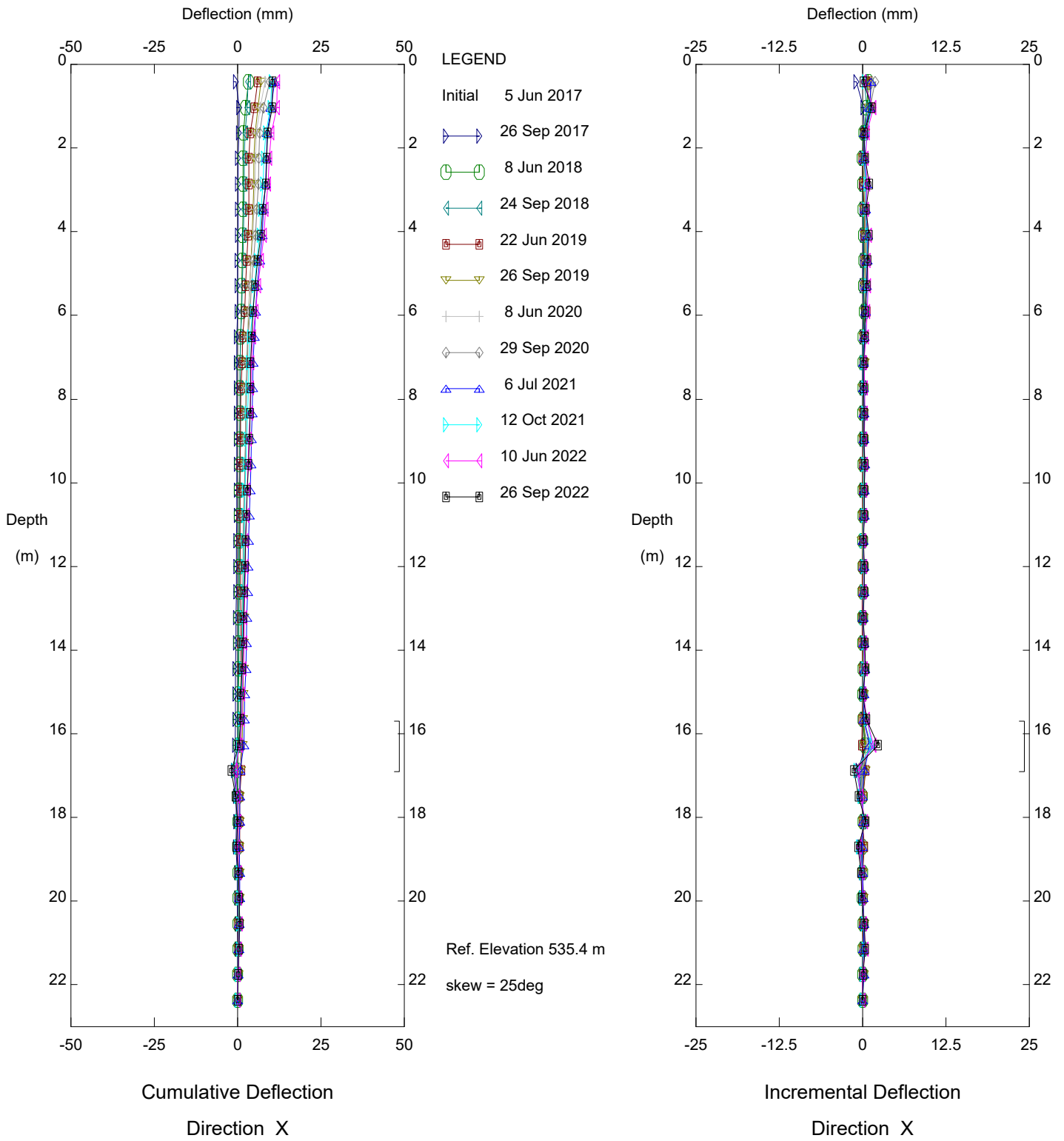
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SH003, North of Little Smoky Bridge, Inclinometer SI31a

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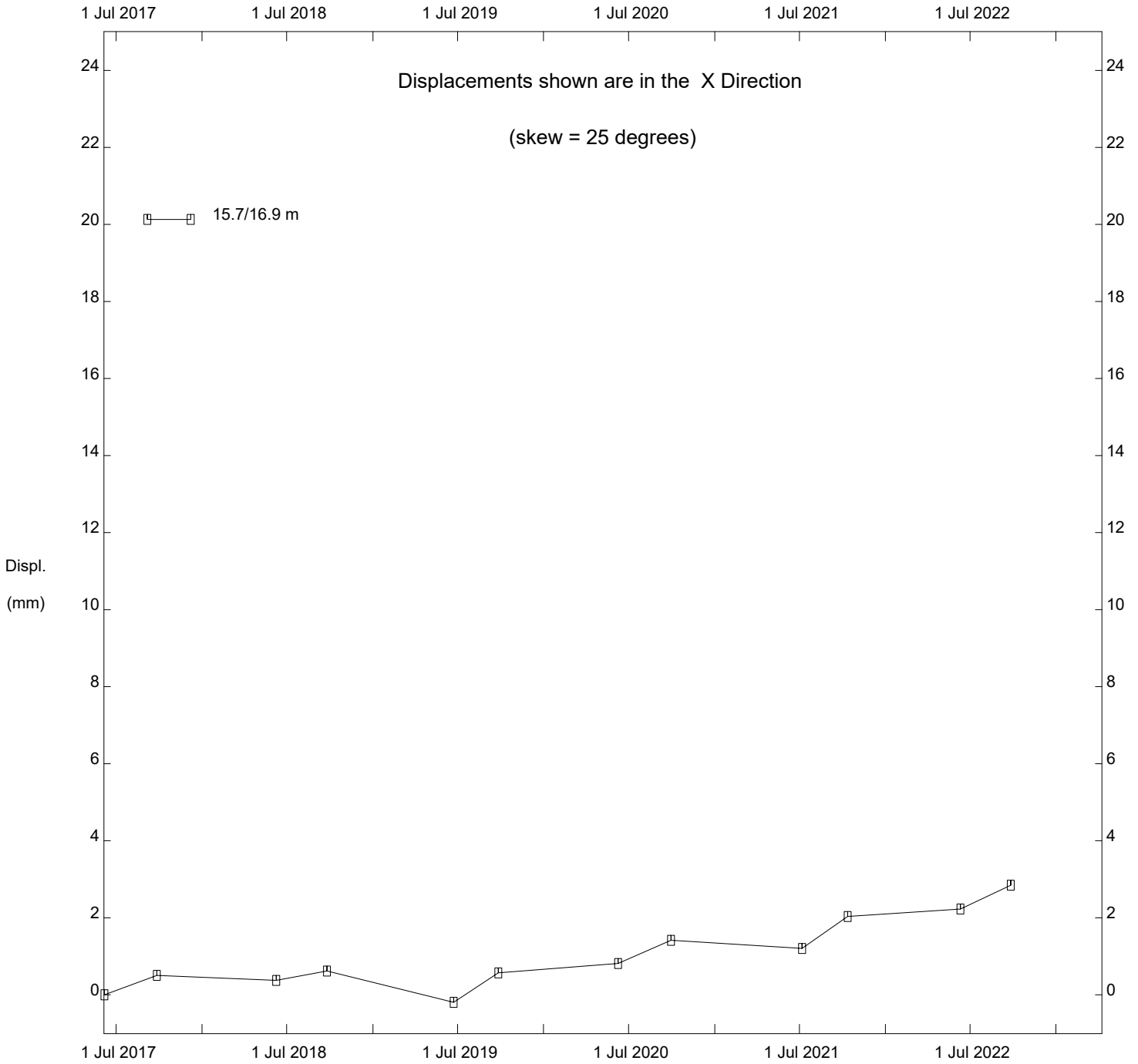
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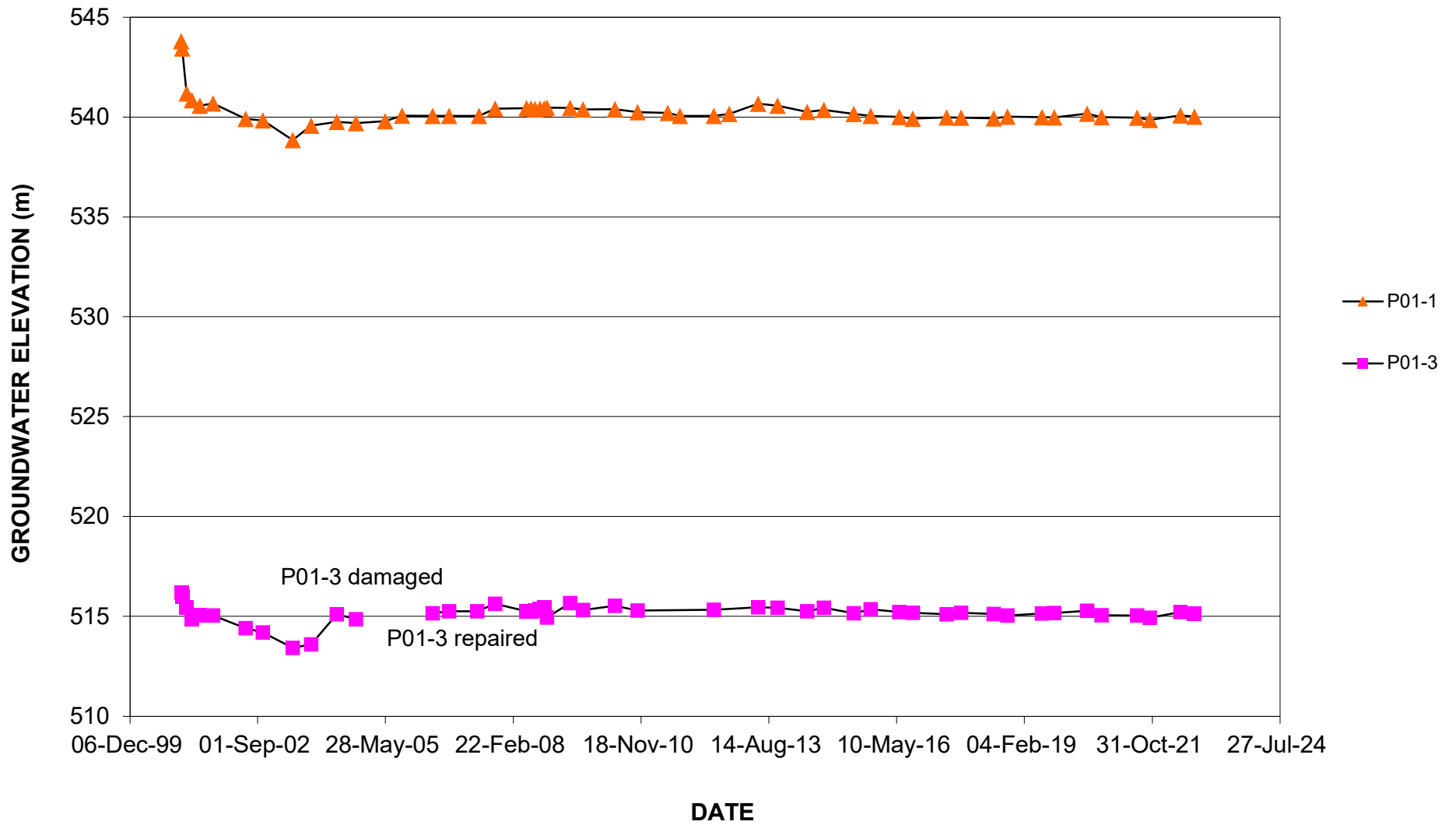
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SH003, North of Little Smoky Bridge, Inclinator SI31a

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FIGURE SH003-1
HWY 49:12 LITTLE SMOKY RIVER (NORTH OF BRIDGE)
PNEUMATIC PIEZOMETER READINGS



**FIGURE SH003-2
HWY 49:12 LITTLE SMOKY RIVER (NORTH OF BRIDGE)
VIBRATING WIRE PIEZOMETER READINGS**

