THURBER ENGINEERING LTD.

October 26, 2022 File No.: 32122

Alberta Transportation
Construction and Maintenance Division
North Central Region
Box 4596, 4513 – 62 Avenue
Barrhead, Alberta
T7N 1A5

Attention: Ms. Amy Driessen, P.Eng.

**ALBERTA TRANSPORTATION GRMP (CON0022163)**
**NORTH CENTRAL (ATHABASCA AND FORT McMURRAY DISTRICTS)**
**INSTRUMENTATION MONITORING RESULTS – FALL 2022**

**SECTION C**

**SITE NC099: HWY 63:10 HANGINGSTONE RIVER BRIDGE**

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'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. OBSERVATIONS

### 1.1 Field Program and Instrumentation Status

Eight slope inclinometers (SI14-01 to SI14-02, and SI15-05 to SI15-10), sixteen vibrating wire piezometers (PZ14-01 to PZ14-04 and PZ15-01 to PZ15-12) and two settlement gauges (SG14-01 and SG14-02) were read at the Hwy 63:10 Hangingstone River Bridge site on September 22, 2022 by Mr. Niraj Regmi, G.I.T. and Mr. Kyle Crooymans, 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 vibrating wire piezometers and settlement gauges were read using an RST VW2106 readout.

## 2. DATA PRESENTATION

### 2.1 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.

### 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 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.

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## TABLE NC099-1
## FALL 2022 – HWY 63:10 HANGINGSTONE RIVER BRIDGE
## SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY

Date Monitored: September 22, 2022

| INSTRUMENT # | DATE INITIALIZED | TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm) | MAXIMUM RATE OF MOVEMENT (mm/yr) | CURRENT STATUS | DATE OF LATEST READING | 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** | | | | | | | | | |
| SI15-05 | April 6, 2015 | No discernible movement | N/A | Operational | September 22, 2022 | May 30, 2022 | N/A | N/A | N/A |
| SI15-06 | March 4, 2015 | No discernible movement | N/A | Operational | September 22, 2022 | May 30, 2022 | N/A | N/A | N/A |
| SI15-07 | March 4 2015 | No discernible movement | N/A | Operational | September 22, 2022 | May 30, 2022 | N/A | N/A | N/A |
| SI15-08 | March 4 2015 | No discernible movement | N/A | Operational | September 22, 2022 | May 30, 2022 | N/A | N/A | N/A |
| SI15-09 | March 4, 2015 | 26.4 mm over 2.7 m to 4.0 m in 24° direction | 13.0 on June 9, 2015 | Operational | September 22, 2022 | May 30, 2022 | 2.9 | 9.3 | 6.9 |
| | | 11.3 mm over 6.4 m to 7.6 m in 309° direction | 4.9 on September 22, 2022 | | | | 1.5 | 4.9 | 3.2 |
| | | 37.8 mm over 10.1 m to 11.9 m in 332° direction | 46.9 on March 16, 2015 | | | | 0.3 | 0.9 | 0 |
| SI15-10 | March 4, 2015 | 2.9 mm over 11.9 m to 13.1 m in 303° direction | 4.3 on March 16, 2015 | Operational | September 22, 2022 | May 30, 2022 | 0.2 | 0.6 | 0.2 |
| | | 5.0 mm over 16.2 m to 17.4 m in 348° direction | 11.9 on March 16, 2015 | | | | 0.3 | 0.8 | 0.4 |

Drawings 32122-NC099-1 and 32122-NC099-2 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

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## TABLE NC099-1– CONTINUED…
## FALL 2022 – HWY 63:10 HANGINGSTONE RIVER BRIDGE
## SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY

Date Monitored: September 22, 2022

| INSTRUMENT # | DATE INITIALIZED | TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm) | MAXIMUM RATE OF MOVEMENT (mm/yr) | CURRENT STATUS | DATE OF LATEST READING | 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** | | | | | | | | | |
| SI14-01 | September 4, 2014 | 247.6 mm over 6.1 m to 30.5 m in 229° direction | 1447.1 on November 17, 2014 | Operational | September 22, 2022 | May 30, 2022 | 2.0 | 6.4 | 0 |
| SI14-02 | August 29, 2014 | 158.1 mm over 5.5 m to 31.7 m in 54° direction | 2686.7 on November 17, 2014 | Operational | September 22, 2022 | May 30, 2022 | 1.8 | 5.6 | 1.9 |
| *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* | *N/A* | *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* | *N/A* | *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 and 32122-NC099-2 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

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## TABLE NC099-2
## FALL 2022– HWY 63:10 HANGINGSTONE RIVER BRIDGE
## VIBRATING WIRE PIEZOMETER INSTRUMENTATION READING SUMMARY

Date Monitored: September 22, 2022

| 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** | | | | | | | | |
| PZ15-01 (31269) | March 4, 2015 | 512.86 | 533.27 | Operational | 516.71 on June 27, 2021 | 516.56 | 516.69 | -0.13 |
| PZ15-02 (31268) | March 4, 2015 | 504.63 | 533.27 | Operational | 518.13 on March 16, 2015 | 515.69 | 515.86 | -0.17 |
| PZ15-03 (31267) | March 4, 2015 | 514.10 | 533.99 | Operational | 519.34 on March 4, 2015 | 517.68 | 517.82 | -0.14 |
| PZ15-04 (31266) | March 4, 2015 | 505.10 | 533.99 | Operational | 519.03 on March 4, 2015 | 516.07 | 516.17 | -0.10 |
| PZ15-05 (31261) | March 4, 2015 | 514.19 | 524.62 | Operational | 516.83 on March 4, 2015 | 514.24 | 514.24 | 0.0 |
| PZ15-06 (31260) | March 4, 2015 | 505.08 | 524.62 | Operational | 516.63 on March 4, 2015 | 508.77 | 508.77 | 0.0 |
| PZ15-07 (31259) | March 4, 2015 | 517.88 | 528.88 | Operational | 520.20 on March 4, 2015 | 517.95 | 518.23 | -0.28 |
| PZ15-08 (31258) | March 4, 2015 | 508.89 | 528.88 | Operational | 518.50 on March 4, 2015 | 515.99 | 516.21 | -0.22 |
| PZ15-09 (31265) | March 4, 2015 | 514.32 | 516.62 | Operational | 516.37 on September 2, 2016 | 515.07 | 515.44 | -0.37 |

Drawings 32122-NC099-1 and 32122-NC099-2 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

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## TABLE NC099-2– CONTINUED…
## FALL 2022 – HWY 63:10 HANGINGSTONE RIVER BRIDGE
## VIBRATING WIRE PIEZOMETER INSTRUMENTATION READING SUMMARY

Date Monitored: September 22, 2022

| 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 – Continued** | | | | | | | | |
| PZ15-10 (31264) | March 4, 2015 | 505.33 | 516.62 | Operational | 513.62 on September 2, 2016 | 509.83 | 511.92 | -2.09 |
| PZ15-11 (31263) | March 4, 2015 | 516.88 | 520.83 | Operational | 519.40 on March 16, 2015 | 518.37 | 518.53 | -0.16 |
| PZ15-12 (31262) | March 4, 2015 | 509.87 | 520.83 | Operational | 518.69 on March 16, 2015 | 517.15 | 517.30 | 0.15 |
| **Hangingstone River Bridge Abutments** | | | | | | | | |
| PZ14-01 (30106) | September 17, 2014 | 482.17 | 504.00 | Operational | 497.31 on November 8, 2014 | 495.55 | 495.72 | -0.17 |
| PZ14-02 (30107) | September 17, 2014 | 487.17 | 504.00 | Operational | 497.65 on September 17, 2014 | 491.98 | 492.11 | -0.13 |
| PZ14-03 (30109) | September 19, 2014 | 481.92 | 502.80 | Operational | 502.14 on November 11, 2014 | 495.31 | 495.46 | -0.15 |
| PZ14-04 (30108) | September 19, 2014 | 486.92 | 502.80 | Operational | 500.82 on November 11, 2014 | 494.28 | 494.39 | -0.11 |

Drawings 32122-NC099-1 and 32122-NC099-2 in Appendix A provide sketches of the approximate location of the monitoring instrumentation for this site.

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## TABLE NC099-3
## FALL 2022 – HWY 63:10 HANGINGSTONE RIVER BRIDGE
## SETTLEMENT GAUGE INSTRUMENTATION READING SUMMARY

Date Monitored: September 22, 2022

| INSTRUMENT # | DATE INITIALIZED | CURRENT STATUS | CURRENT SETTLEMENT (mm) | PREVIOUS SETTLEMENT (mm) | CHANGE IN SETTLEMENT (mm) (1) |
|---|---|---|---|---|---|
| **Hangingstone River Bridge Abutments** | | | | | |
| SG14-01 | September 17, 2014 | Operational | -197.69 | -196.68 | 1.01 |
| SG14-02 | September 19, 2014 | Operational | -341.94 | -337.52 | 4.42 |

Drawings 32122-NC099-1 and 32122-NC099-2 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

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

Slope inclinometer SI15-09 shows current rates of movement of 9.3 mm/yr, 4.9 mm/yr and 0.9 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 2022 readings. The current rate of movement over the 2.7 m to 4.0 m depth zone is the highest rate ever recorded within this zone in SI15-09. SI15-10 showed a rate of movement of 0.6 mm/yr over 11.9 m to 13.1 m depth and 0.8 mm/yr over 16.2 m to 17.4 m depth since the spring of 2022 readings.

SI14-01, located in the pile wall of the bridge north approach fill, showed a rate of movement of 6.4 mm/yr over the length of the pile from 6.1 m to 30.5 m depth, corresponding to an incremental movement of 2 mm since the spring of 2022 readings. SI14-02, located in the pile wall of the bridge south approach fill, shows a current rate of movement of 5.6 mm/yr over the length of the pile from 5.5 m to 31.7 m depth. Overall, SI14-01 and SI14-02 appear to be slowing from the relatively high movement rates observed over the past several readings cycles. The current pile head movement in SI14-01 and SI14-02 is 247.6 mm and 158.1 mm, respectively.

The groundwater levels decreased in vibrating wire piezometers in PZ15-01, PZ15-02, PZ15-03, PZ15-04, PZ15-07, PZ15-08, PZ15-09, PZ15-10, PZ15-11, and PZ15-12 since the spring of 2022 readings. The decreases in groundwater level ranged from 0.1 m in PZ15-04 to 2.09 m in PZ15-10. The groundwater level has remained relatively unchanged in PZ15-05 and PZ15-06 since the spring of 2022 readings.

PZ14-01 and PZ14-02, installed in the east highway approach fill, showed decreases in groundwater level of 0.17 m and 0.13 m, respectively, since the spring of 2022 readings. PZ14-03 and PZ14-04, installed in the west bridge approach fill, showed decreases in groundwater level of 0.15 m and 0.11 m, respectively, since the spring of 2022 readings. The vibrating wire piezometer readings are summarized in Table NC099-2.

SG14-01 and SG14-02 showed increases in ground settlement of 1.01 mm and 4.42 mm, respectively, since the spring of 2022 readings. The settlement gauge readings are summarized in Table NC099-3.

The vibrating wire piezometer and settlement gauge reading plots are shown on Figures NC099-1 to NC099-10 in Appendix A.

## 4. RECOMMENDATIONS

### 4.1 Future Work

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

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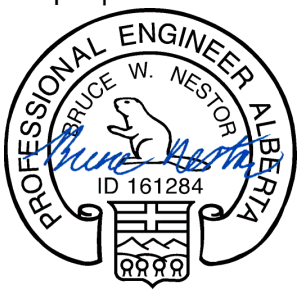
### 4.2 Instrumentation Repairs

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.
Principal | Senior Geotechnical Engineer




November 10, 2022

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE:
RM APEGA ID #: 91085
DATE: November 10, 2022
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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-NC099-1 and 32122-NC099-2)
  - SI Reading Plots
  - Figures NC099-1 to NC099-10 (Piezometric Depths and Settlement Plots)

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# 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.

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

## FALL 2022

## APPENDIX A
## DATA PRESENTATION AND SITE PLANS

## SITE NC099: HWY 63:10 HANGINGSTONE RIVER BRIDGE

**ALBERTA TRANSPORTATION**
**NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS**
**INSTRUMENTATION MONITORING FIELD SUMMARY (NC099)**
**FALL 2022**

| | |
|---|---|
| **Location:** Hwy 63:10 over Hangingstone River (BF75907) | **Readout:** RST VW2106 Unit 2/GK404 S/N 364 |
| **File Number:** 32122 | **Casing Diameter** 2.75"/3.34" |
| **Probe:** RST Set 5R/8R | **Temp (deg C):** 11 |
| **Cable:** RST Set 5R/8R | **Read by:** KTC/NKR |

**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 | 22-Sep-22 | 1.27 | 99 to 5 | 222 | -73 | 86 | 222 | -240 | 5R/5R | Casing Size 2.75" |
| SI14-02 | 6252634 | 476895 | 22-Sep-22 | 1.28 | 103 to 3 | 60 | 92 | -82 | 248 | -261 | 5R/5R | Casing Size 2.75" |
| SI15-05 | 6252255 | 476637 | 22-Sep-22 | 0.52 | 118 to 4 | 308 | -596 | 611 | 41 | -66 | 5R/5R | Casing Size 3.34" |
| SI15-06 | 6252220 | 476535 | 22-Sep-22 | 0.61 | 118 to 2 | 308 | -518 | 540 | 129 | -116 | 8R/8R | Casing Size 3.34" |
| SI15-07 | 6252299 | 476609 | 22-Sep-22 | 0.48 | 88 to 4 | 318 | -211 | 228 | 244 | -267 | 5R/5R | Casing Size 3.34" |
| SI15-08 | 6252246 | 476520 | 22-Sep-22 | 0.47 | 88 to 2 | 306 | -305 | 328 | 50 | -34 | 8R/8R | Casing Size 3.34" |
| SI15-09 | 6252336 | 476583 | 22-Sep-22 | 0.52 | 58 to 4 | 295 | -321 | 340 | 45 | -67 | 5R/5R | Casing Size 3.34" |
| SI15-10 | 6252283 | 476495 | 22-Sep-22 | 0.55 | 58 to 2 | 304 | -265 | 286 | 443 | -434 | 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 | 22-Sep-22 | 7867.3 | 4.6 | 30106 | MS-01 | 3906 | 6252624 | 476955 | Manual Reading |
| PZ14-02 | 22-Sep-22 | 8521.7 | 4.9 | 30107 | MS-01 | 3906 | 6252624 | 476955 | Manual Reading |
| PZ14-03 | 22-Sep-22 | 7709.8 | 4.9 | 30108 | MS-02 | 3905 | 6252660 | 476918 | Manual Reading |
| PZ14-04 | 22-Sep-22 | 8194.6 | 4.7 | 30109 | MS-02 | 3905 | 6255572 | -23127 | Manual Reading |
| PZ15-01 | 22-Sep-22 | 8637.4 | 4.4 | 31269 | - | - | 6252255 | 476637 | Attached to SI15-05 |
| PZ15-02 | 22-Sep-22 | 8064.2 | 4.2 | 31268 | - | - | 6252255 | 476637 | Attached to SI15-05 |
| PZ15-03 | 22-Sep-22 | 8622.7 | 3.8 | 31267 | - | - | 6252220 | 476535 | Attached to SI15-06 |
| PZ15-04 | 22-Sep-22 | 8072.3 | 3.8 | 31266 | - | - | 6252220 | 476535 | Attached to SI15-06 |
| PZ15-05 | 22-Sep-22 | 8910.1 | 3.9 | 31261 | - | - | 6252299 | 476609 | Attached to SI15-07 |
| PZ15-06 | 22-Sep-22 | 8674.3 | 4.2 | 31260 | - | - | 6252299 | 476609 | Attached to SI15-07 |
| PZ15-07 | 22-Sep-22 | 8878.5 | 3 | 31259 | - | - | 6252246 | 476520 | Attached to SI15-08 |
| PZ15-08 | 22-Sep-22 | 8396.4 | 3 | 31258 | - | - | 6252246 | 476520 | Attached to SI15-08 |
| PZ15-09 | 22-Sep-22 | 8841.7 | 7.8 | 31265 | - | - | 6252336 | 476583 | Attached to SI15-09 |
| PZ15-10 | 22-Sep-22 | 8529.1 | 3.9 | 31264 | - | - | 6252336 | 476583 | Attached to SI15-09 |
| PZ15-11 | 22-Sep-22 | 8905.3 | 7.5 | 31263 | - | - | 6252283 | 476495 | Attached to SI15-10 |
| PZ15-12 | 22-Sep-22 | 8289.6 | 4.1 | 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 | 22-Sep-22 | 5470.9 | 4.1 | 1428194 | MS-01 | 3906 | 6255616 | -23070 | Manual Reading |
| SG14-02 | 22-Sep-22 | 6161 | 4.3 | 1428195 | MS-02 | 3905 | 6255572 | -23127 | Manual Reading |

**INSPECTOR REPORT**

| |
|---|
| MS-01 and MS-02 take manual readings |
| |
| |
| |

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NE 32 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**
**DWG No. 32122-NC099-1**

| | |
|---|---|
| DRAWN BY | ML |
| DESIGNED BY | BWN |
| APPROVED BY | TSA |
| SCALE | 1:1000 |
| DATE | JULY 2021 |
| FILE No. | 32122 |

THURBER ENGINEERING LTD.

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NW33 85-9-4
CROWN UNTITLED

CONSTRUCTION LIMIT

(NOT FUNCTIONING)
MS14-01

(NOT FUNCTIONING)
MS14-02

(SHEARED AT 18.9m)
SI14-03
PZ14-01
PZ14-02
SG14-01
SI14-01

(SHEARED AT 15.8m)
SI14-04
PZ14-03
PZ14-04
SG14-02
SI14-02

℄ RIVER

CHN EQN
264+300.000 AHEAD
=64+298.492 BACK

64+200

ST 64+178.577

N25 N20 N15 N10 N5 N1
S25 S20 S15 S10 S5 S1

5.0

NBL
HWY 63

264+400

264+600

PILE WALL

HWY 63 (PROP SBL)

64+350 HANGINGSTONE RIVER BRIDGE ABUTMENTS

LEGEND

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

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

BASE PLAN PROVIDED BY TETRA TECH

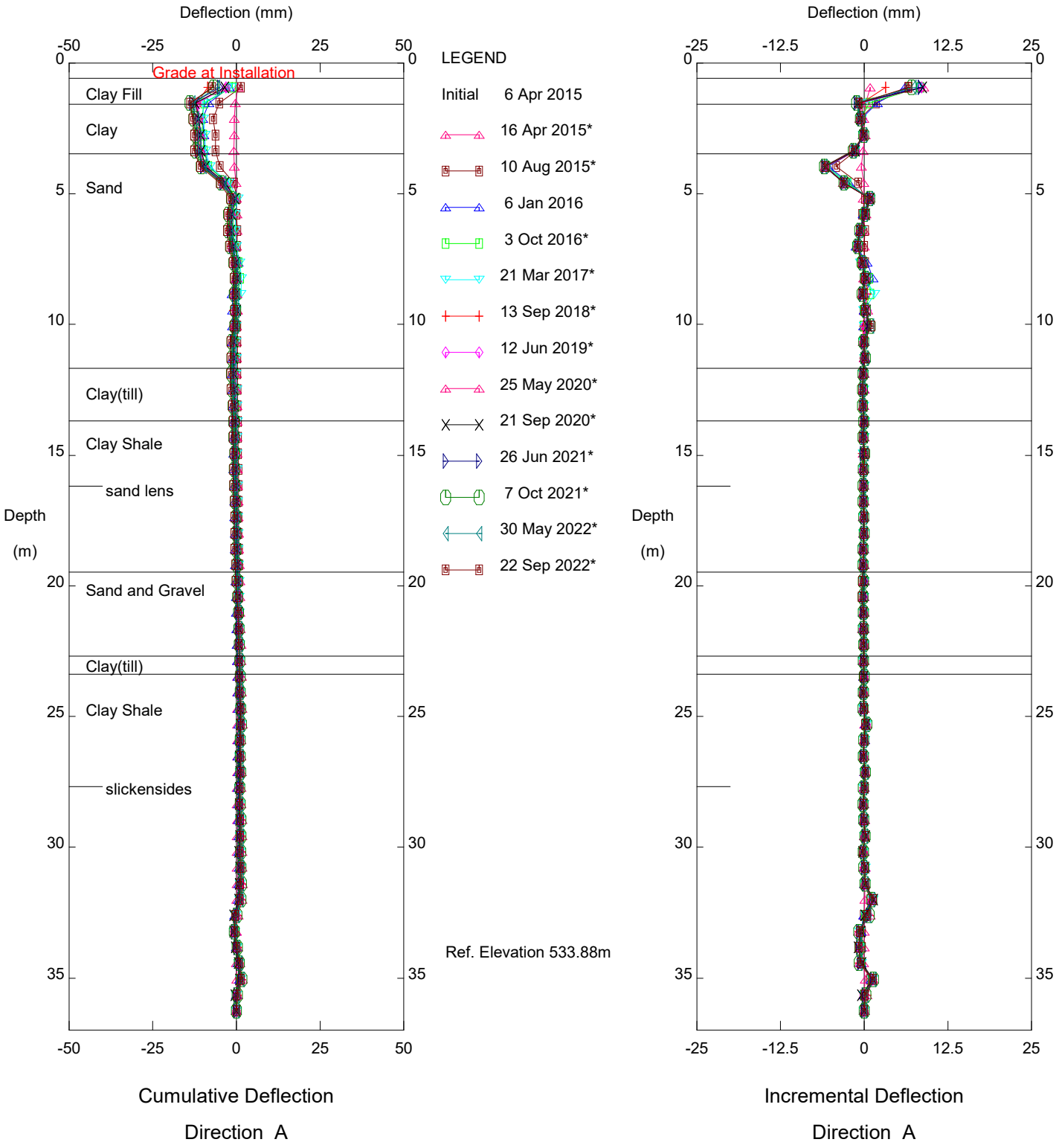
Alberta

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

| | |
|---|---|
| DRAWN BY | ML |
| DESIGNED BY | BWN |
| APPROVED BY | TSA |
| SCALE | 1:1000 |
| DATE | NOVEMBER 2021 |
| 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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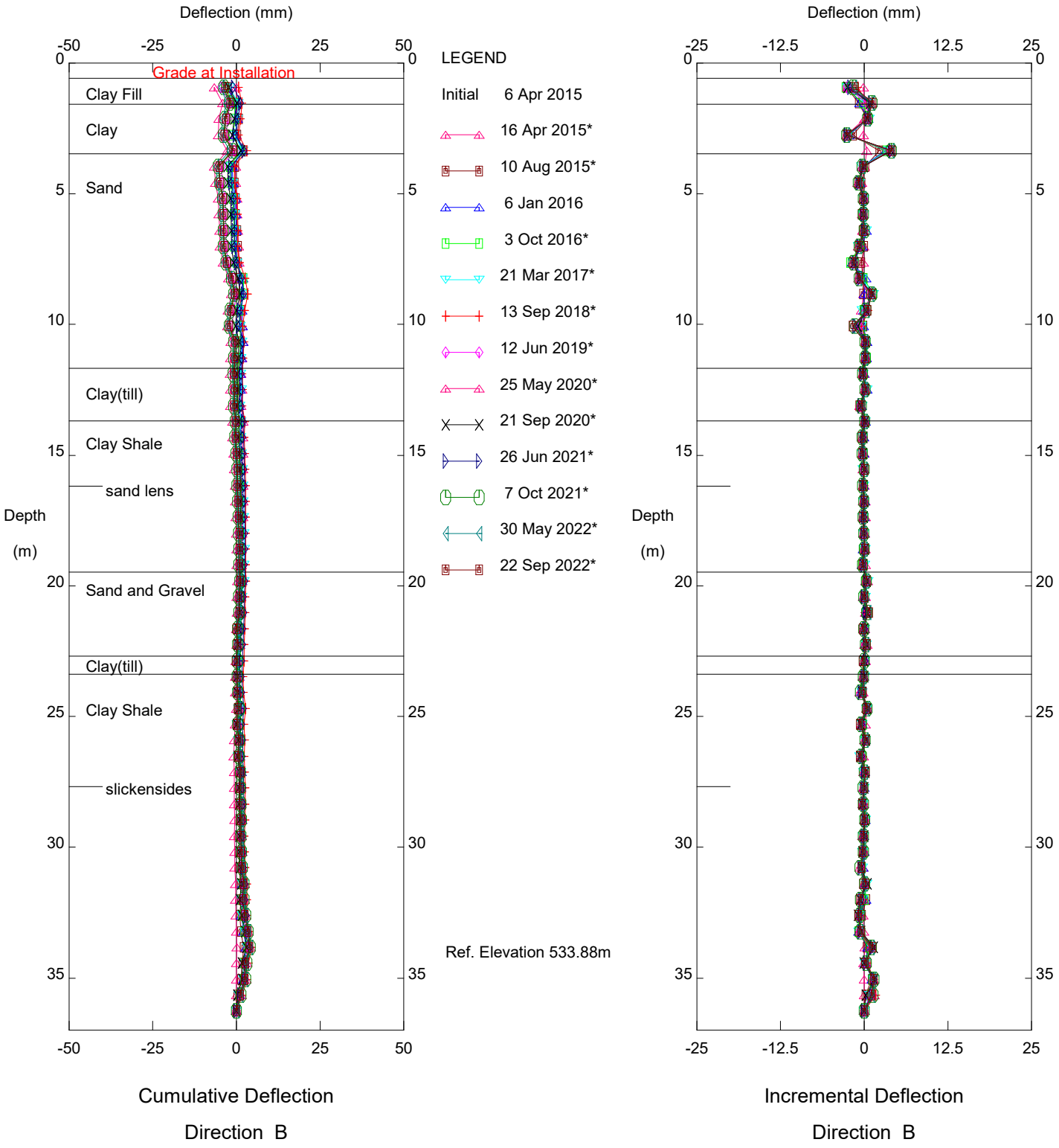


Cumulative Deflection

Direction B

Incremental Deflection

Direction B

NC099 Cut Slope - Crest, Inclinometer 15-05

Alberta Transportation

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

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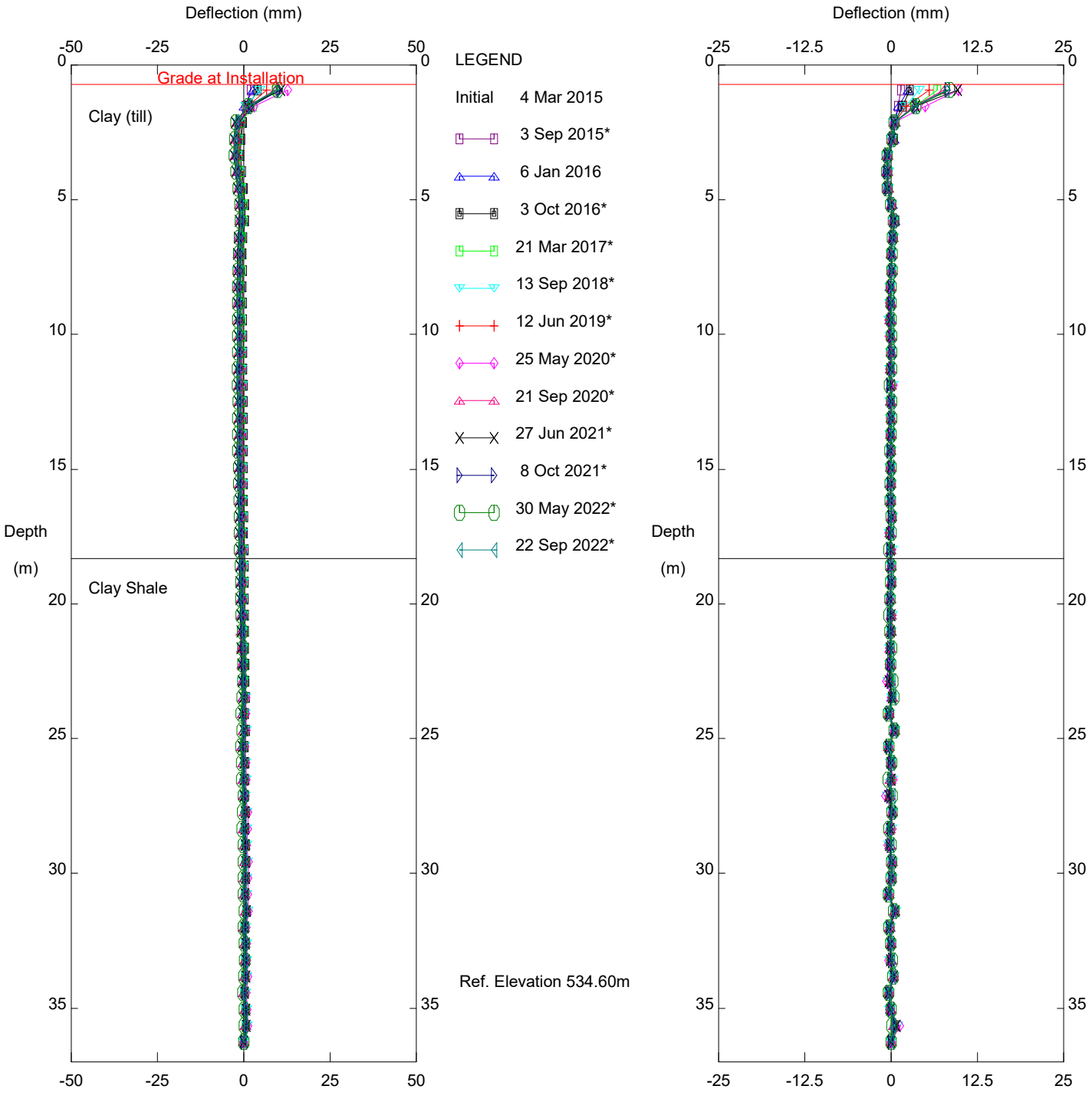


Cumulative Deflection

Direction A

Incremental Deflection

Direction A

NC099 Cut Slope - Crest, Inclinometer 15-06

Alberta Transportation

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

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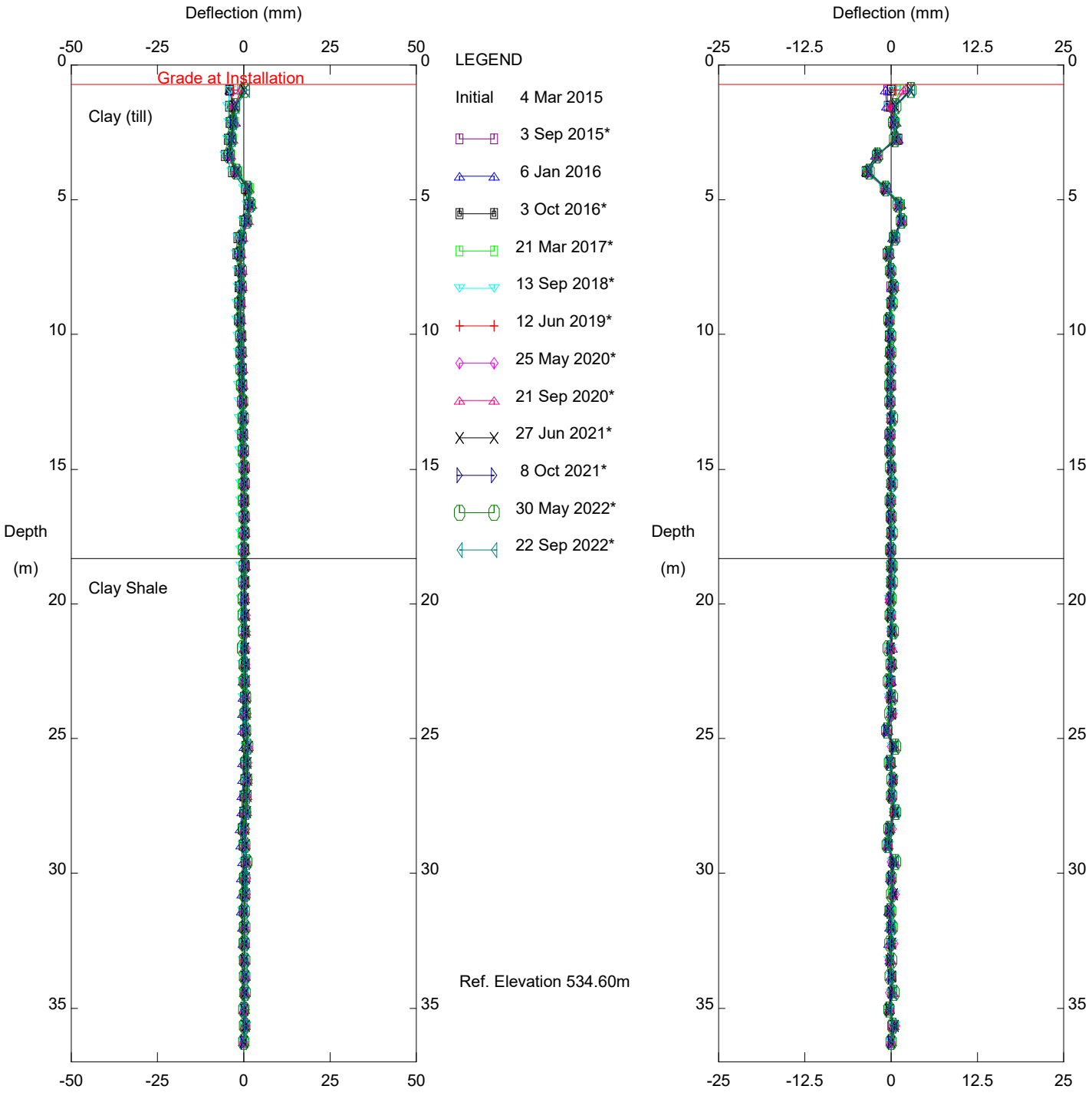


Cumulative Deflection

Direction B

Incremental Deflection

Direction B

NC099 Cut Slope - Crest, Inclinometer 15-06

Alberta Transportation

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

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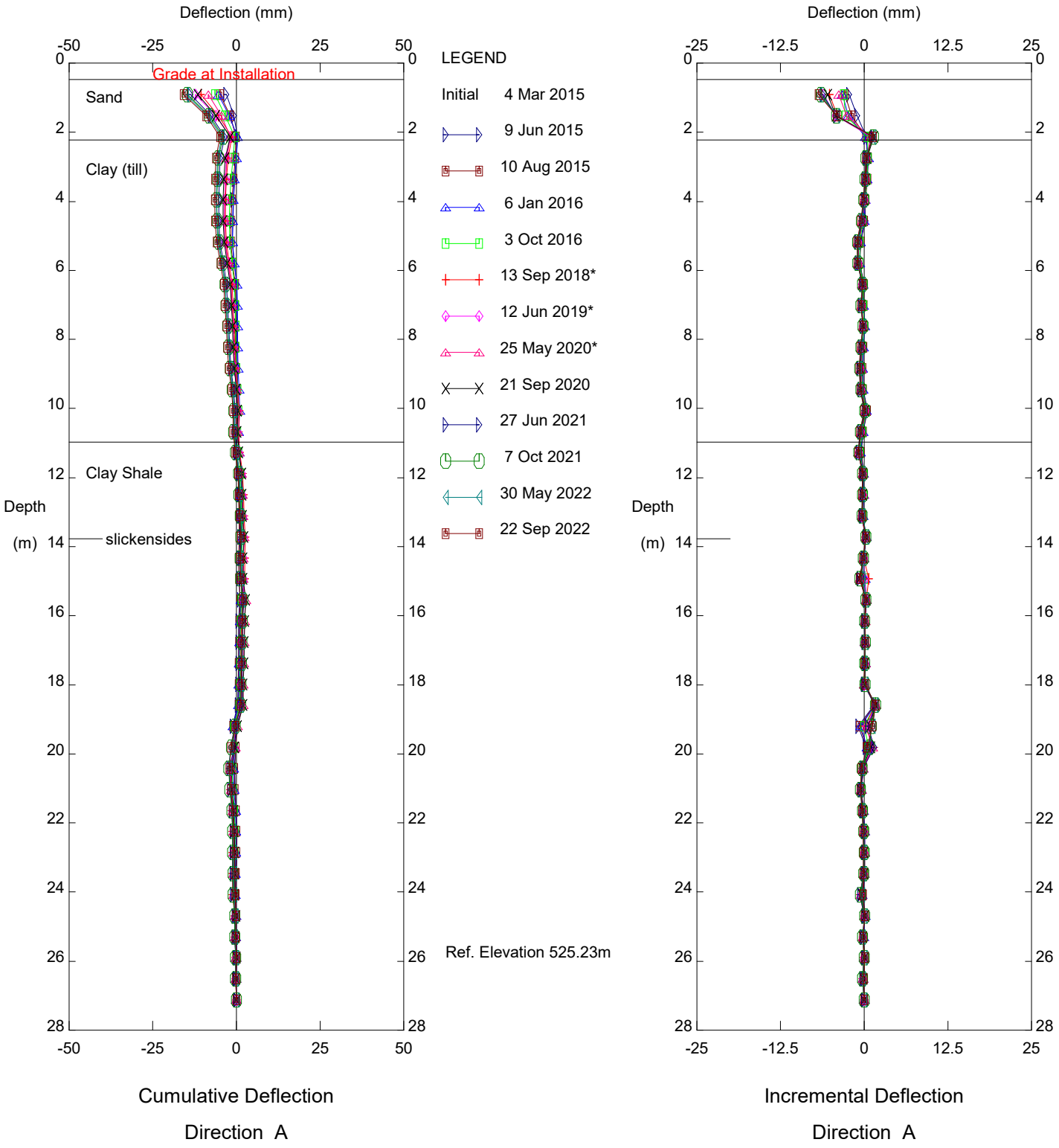


Cumulative Deflection

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.

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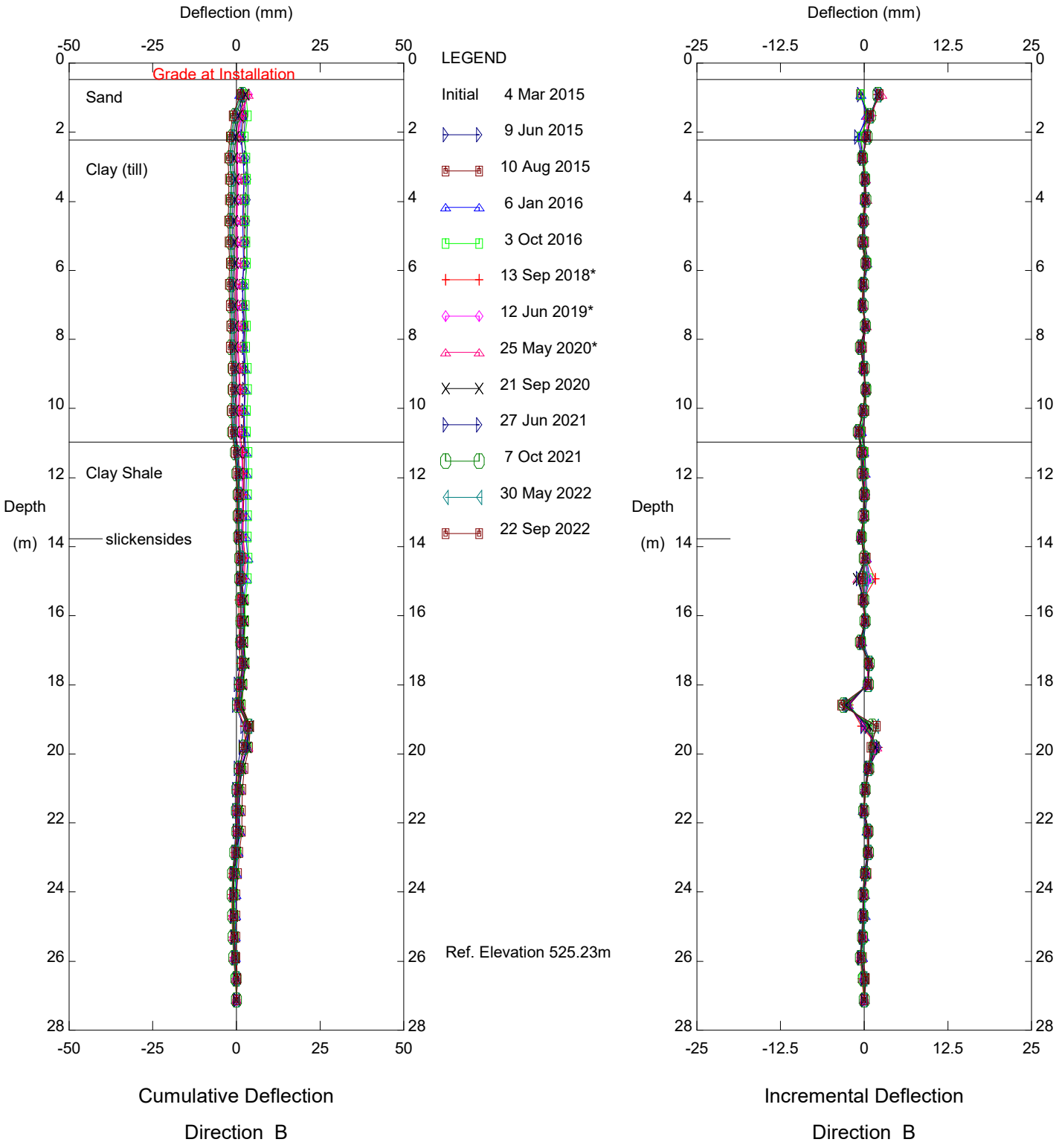


Cumulative Deflection

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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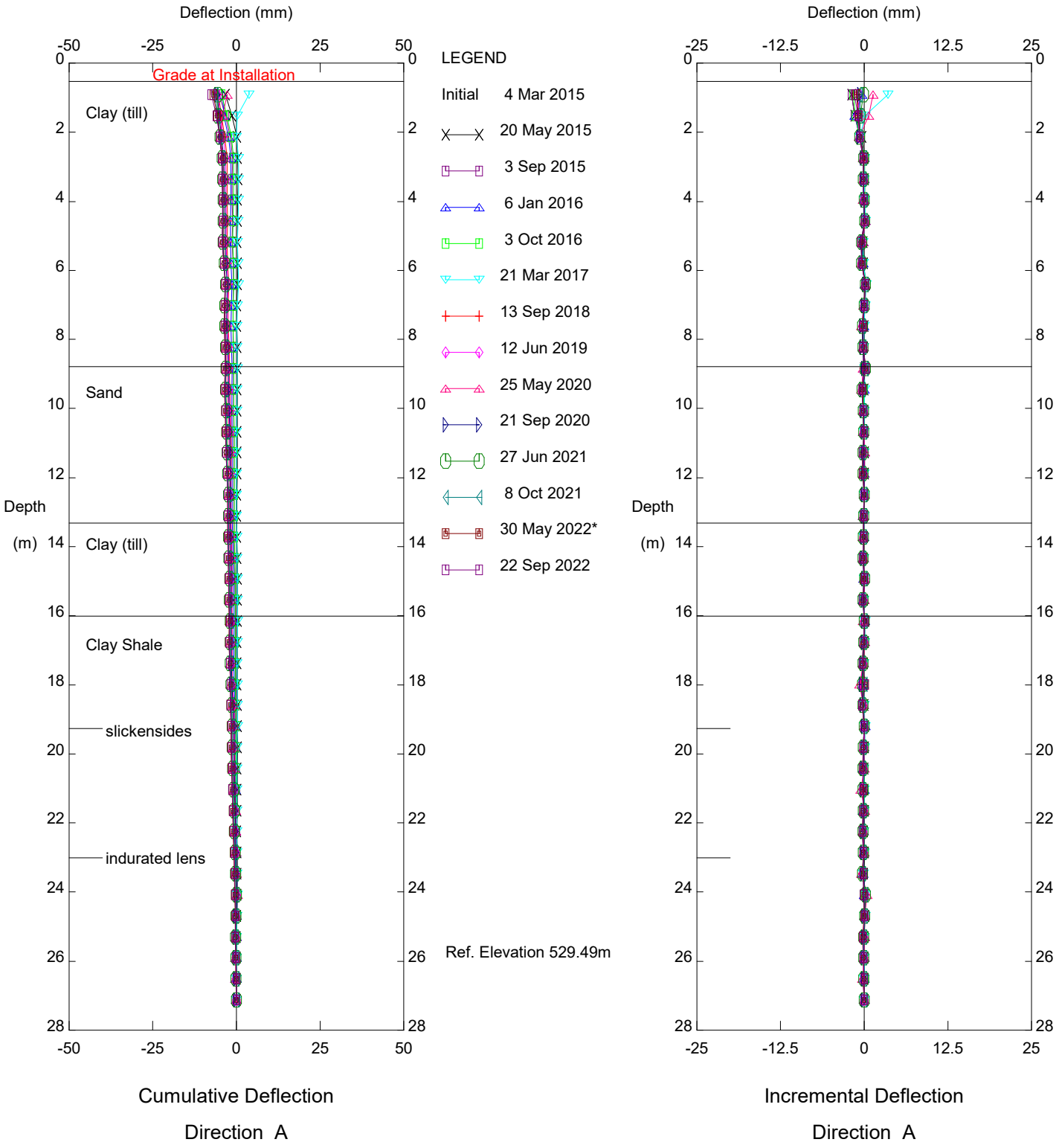


Cumulative Deflection

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.

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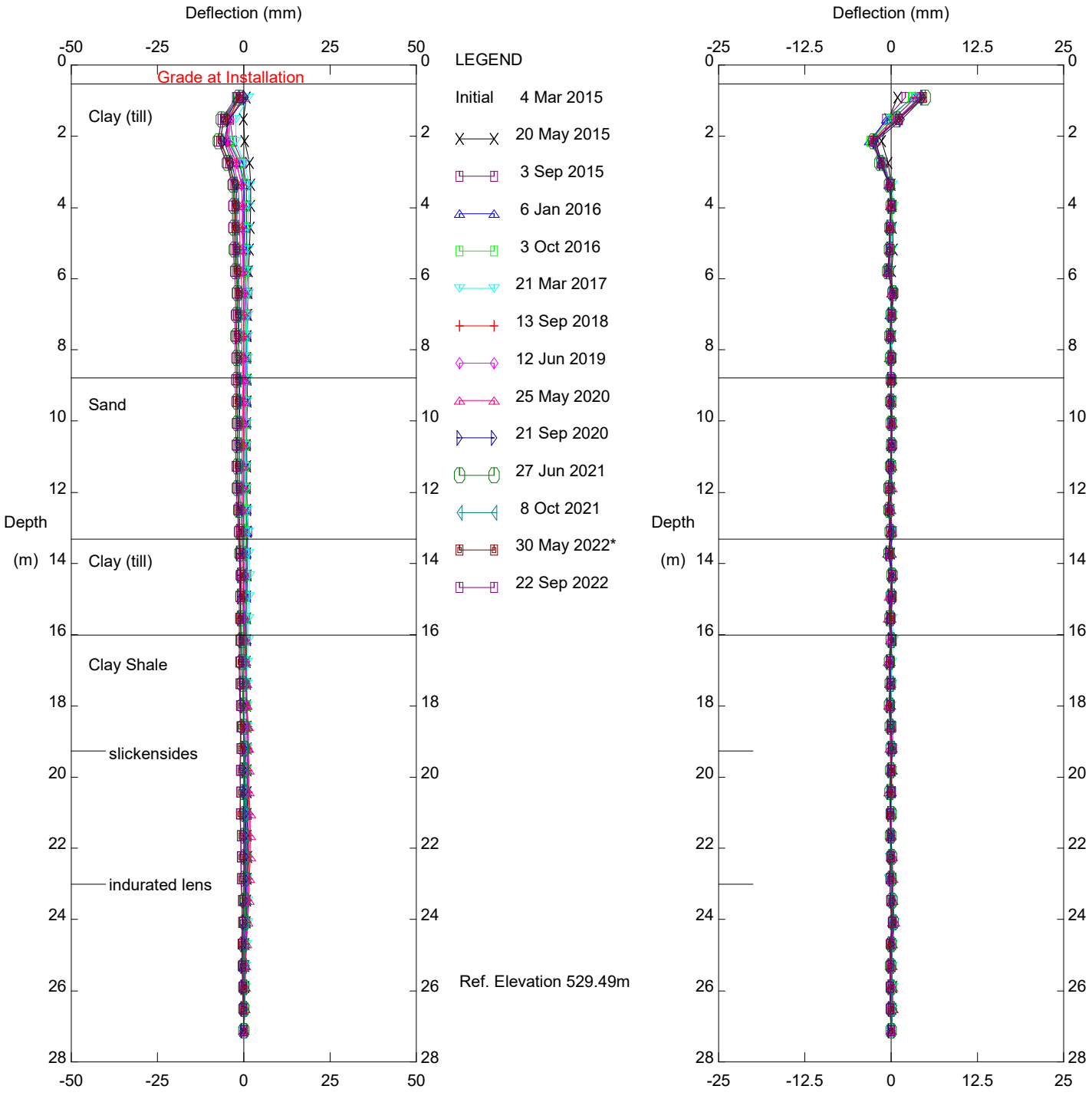


Cumulative Deflection

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.

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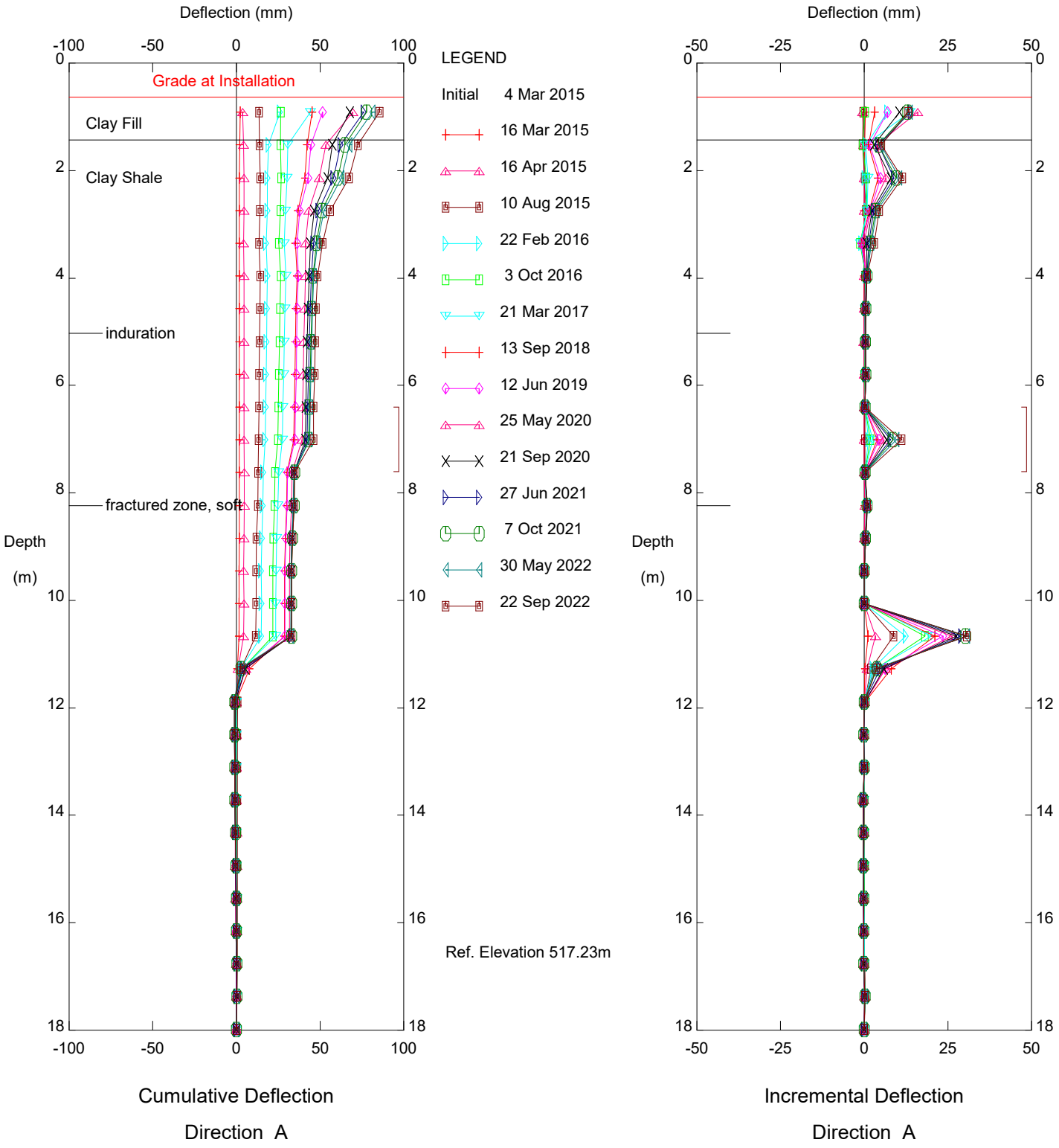


Cumulative Deflection

Direction A

Incremental Deflection

Direction A

NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

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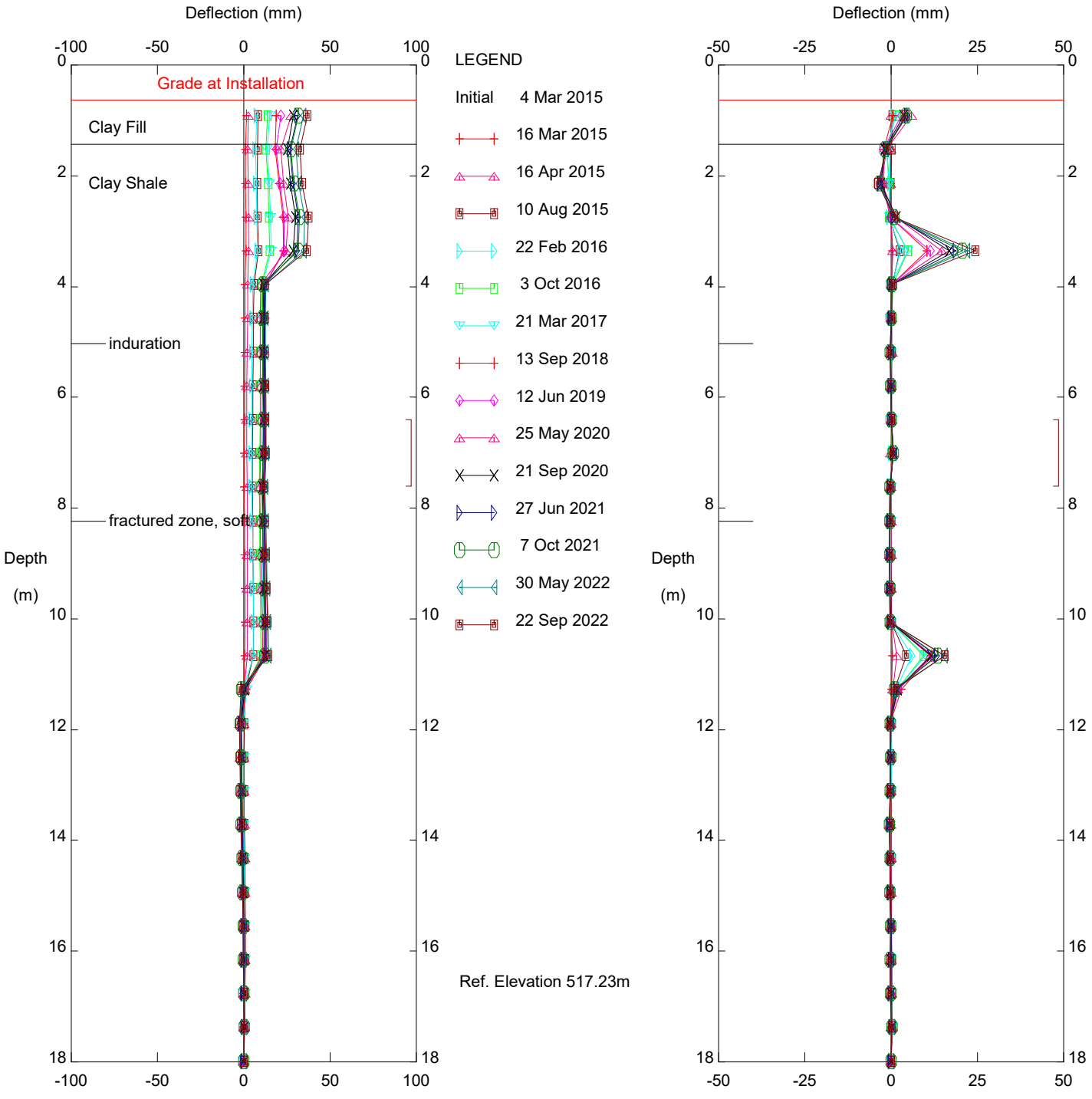


Cumulative Deflection

Direction B

Incremental Deflection

Direction B

NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

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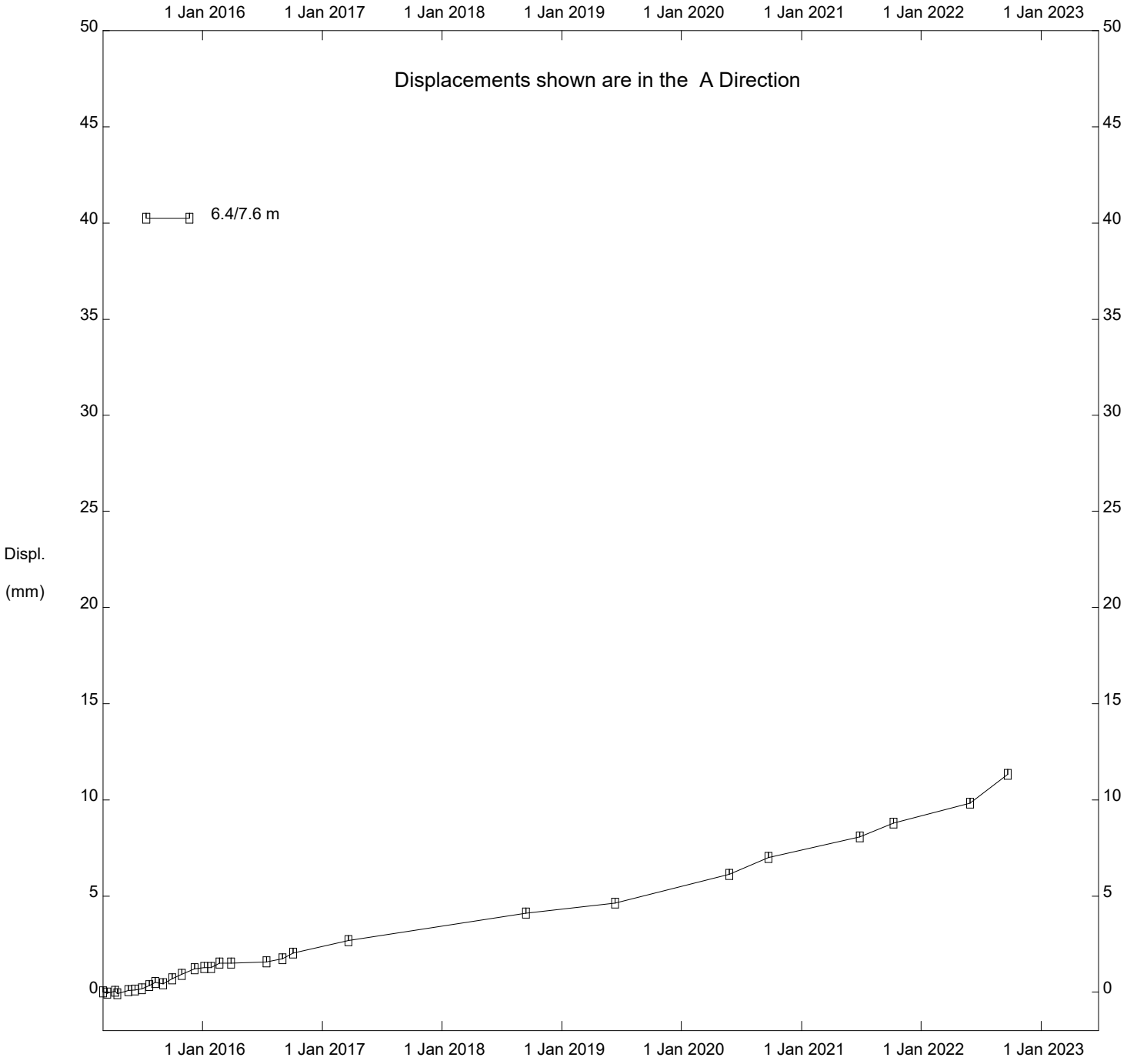
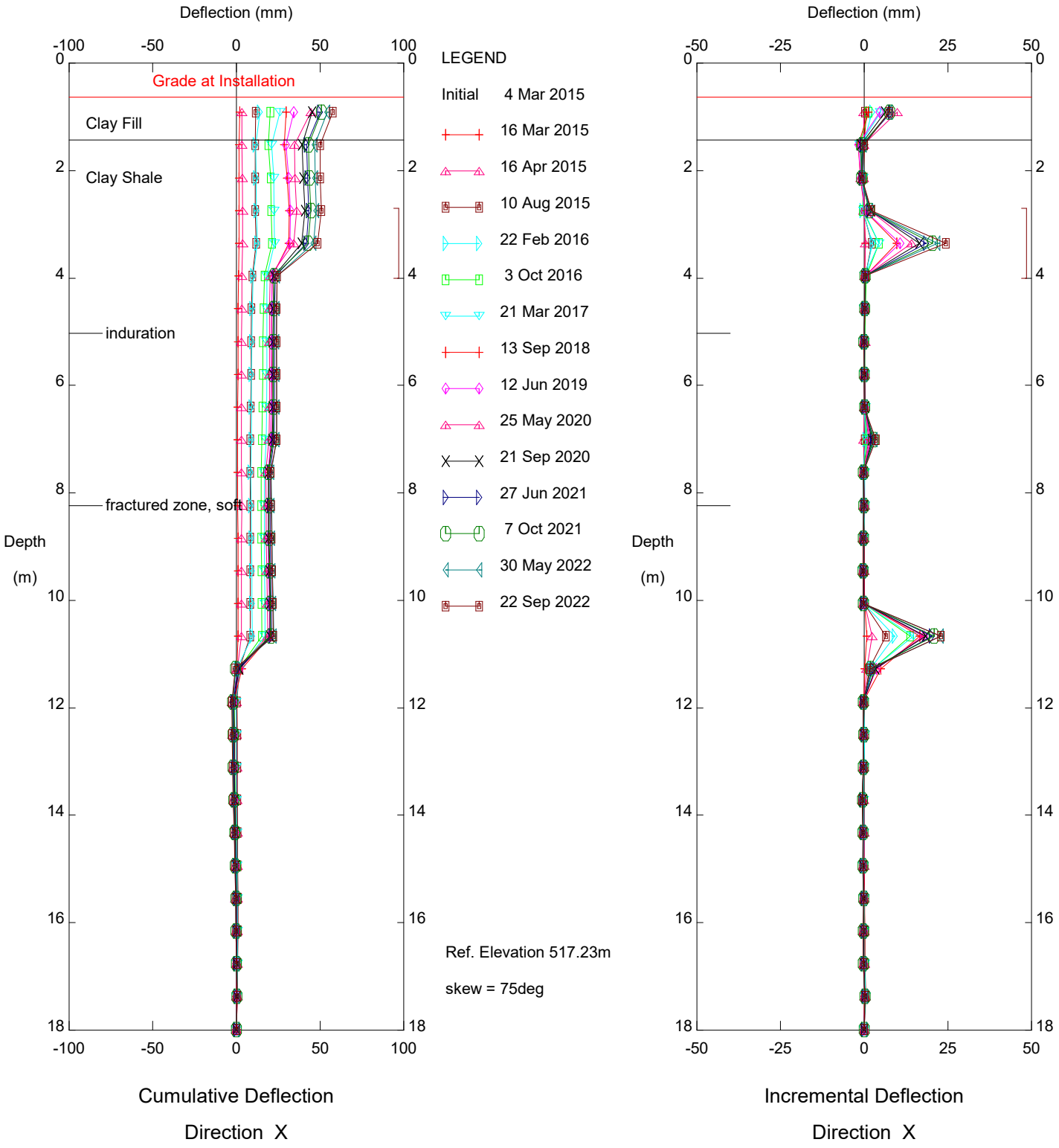



NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

Thurber Engineering Ltd.




Cumulative Deflection

Direction X

Incremental Deflection

Direction X

NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

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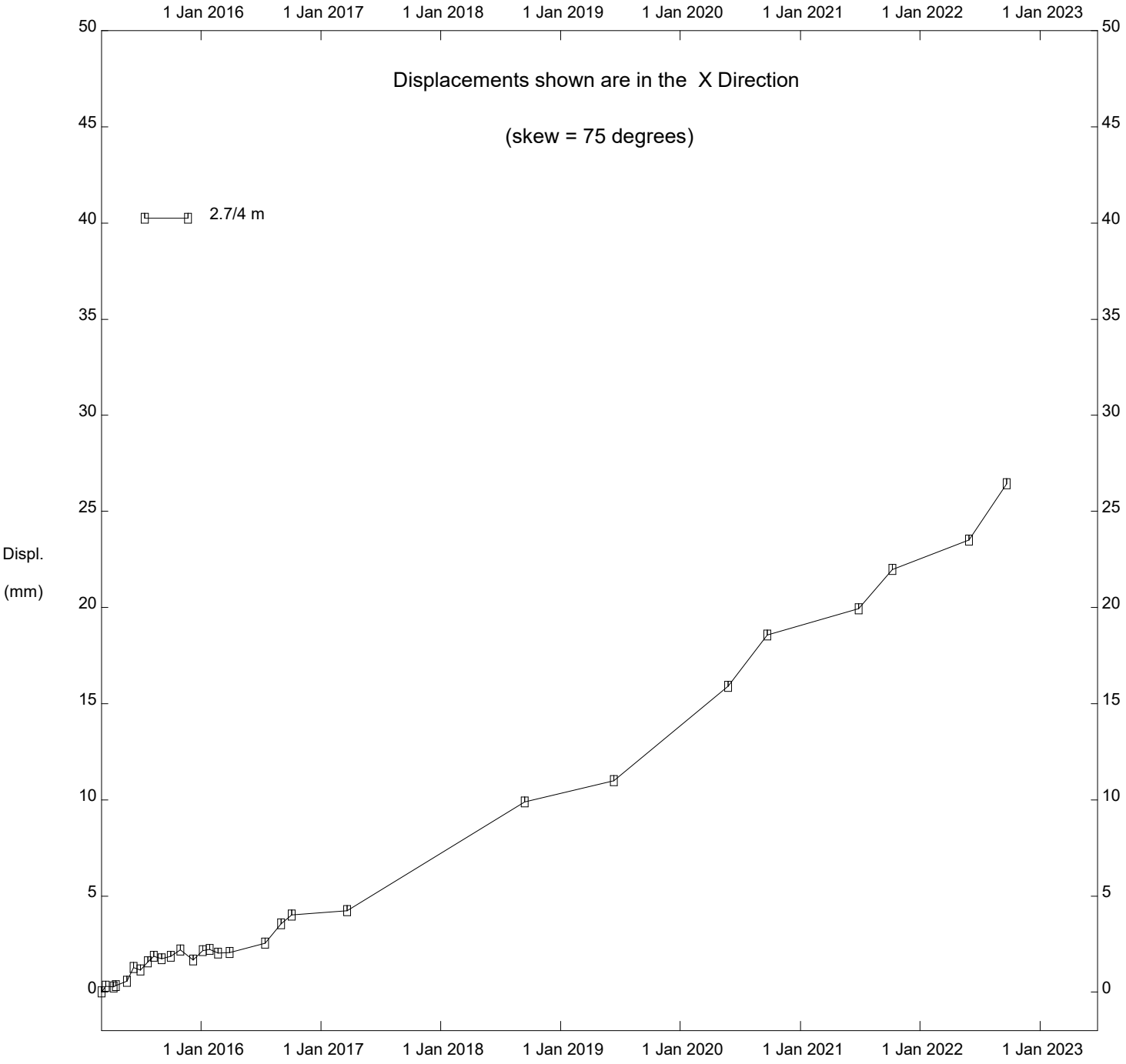
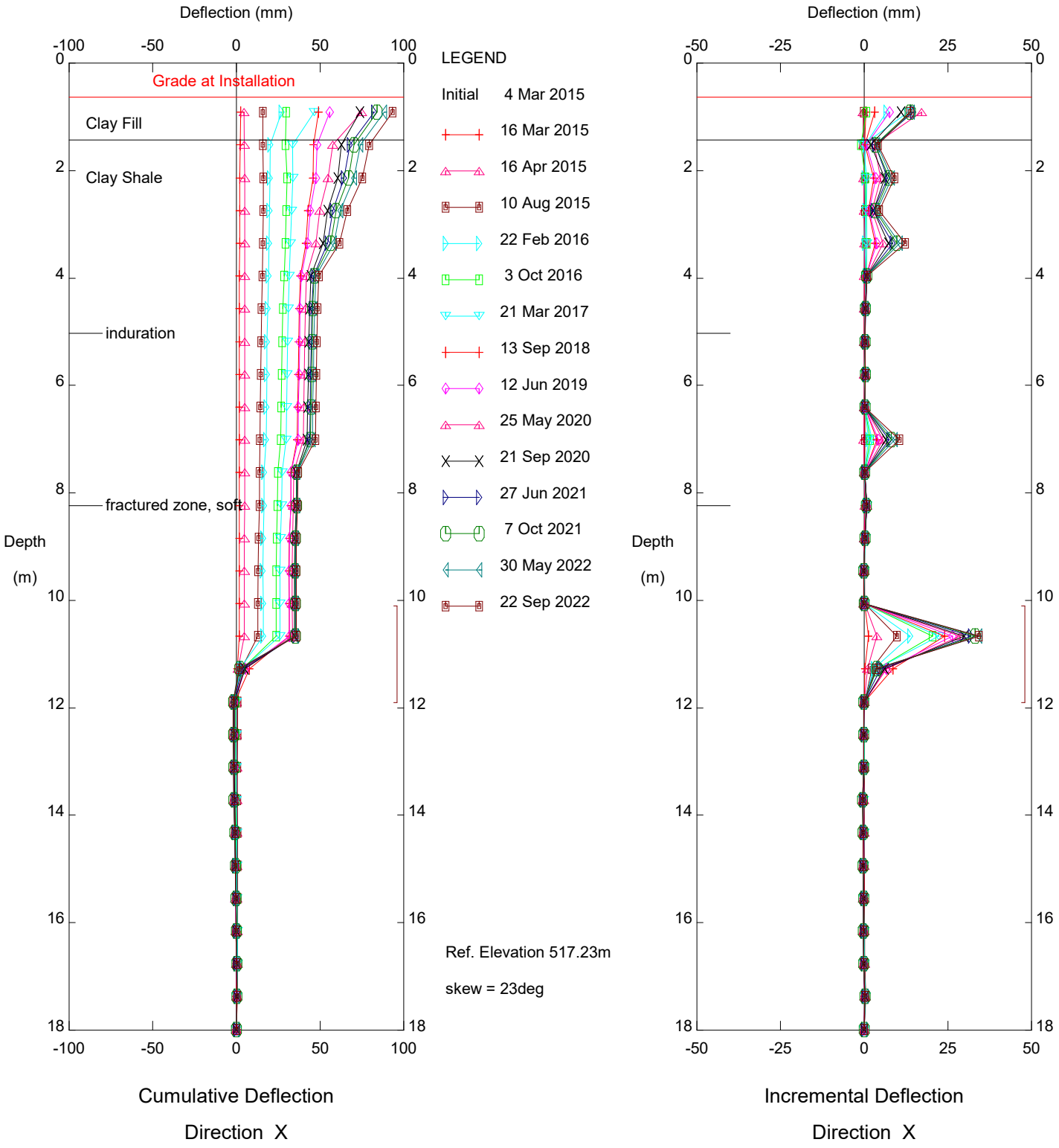



NC099 Cut Slope - Bench 1, Inclinometer 15-09

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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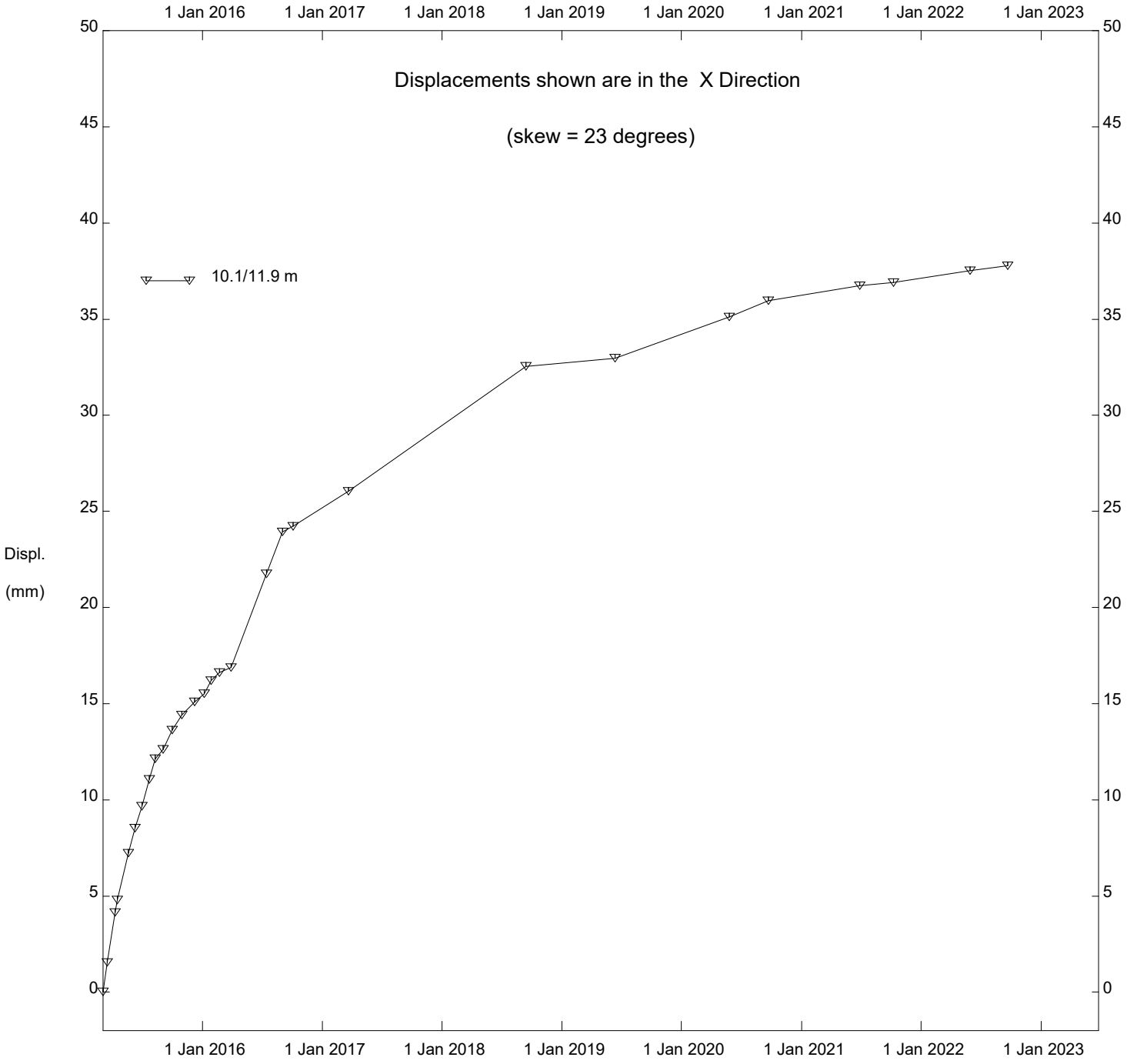


NC099 Cut Slope - Bench 1, Inclinometer 15-09

Alberta Transportation

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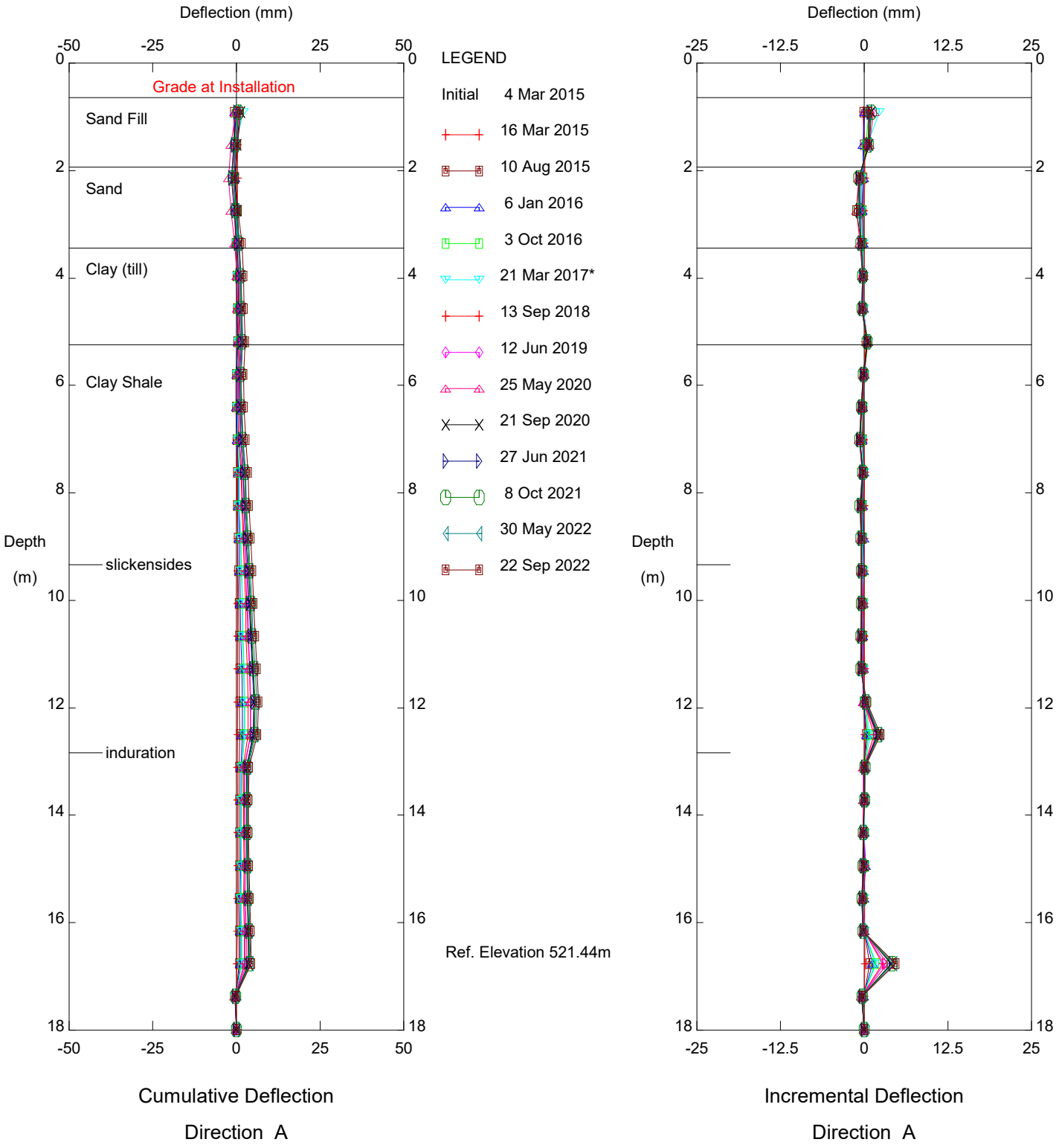


Cumulative Deflection

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.

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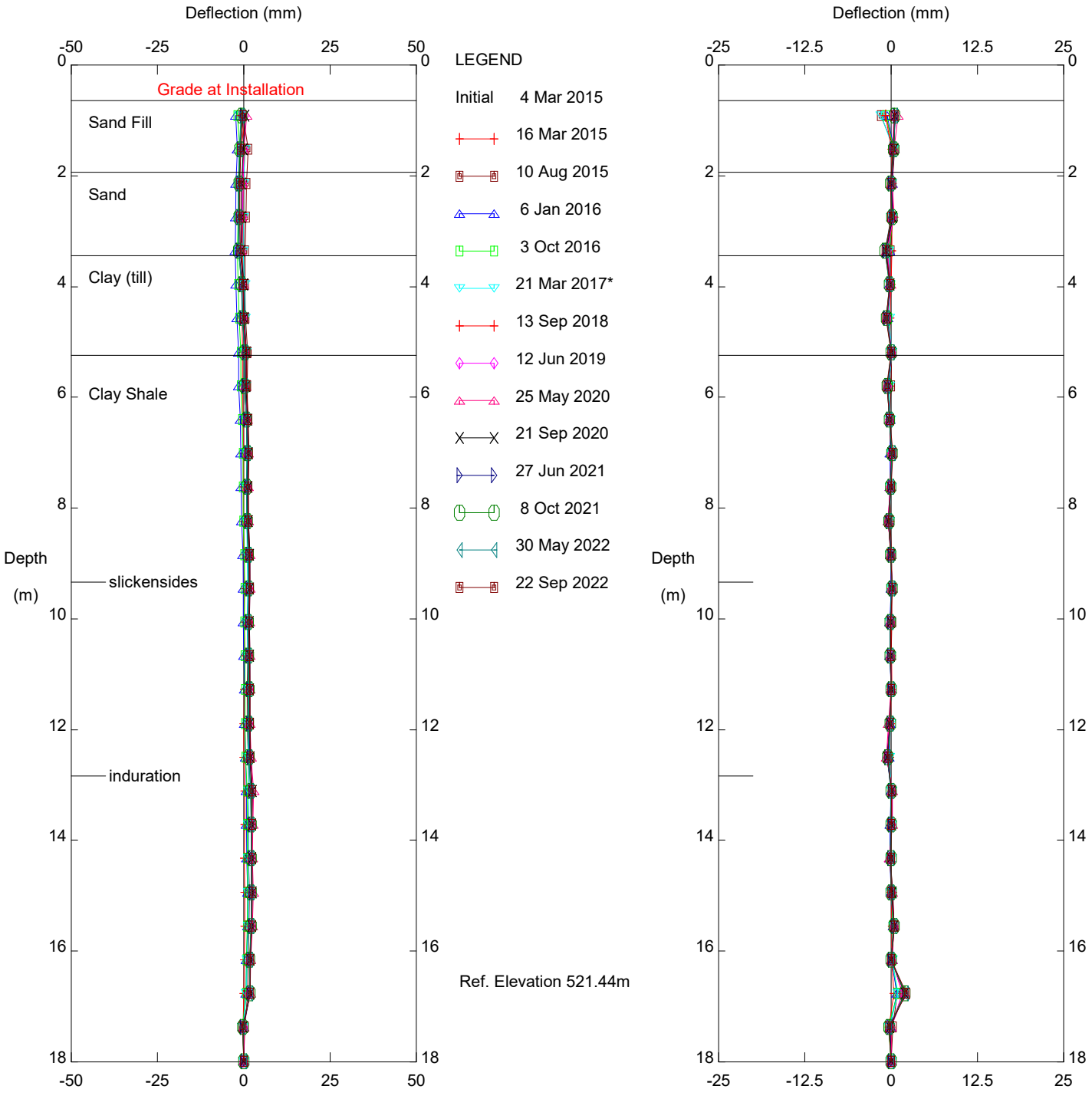
Thurber Engineering Ltd.




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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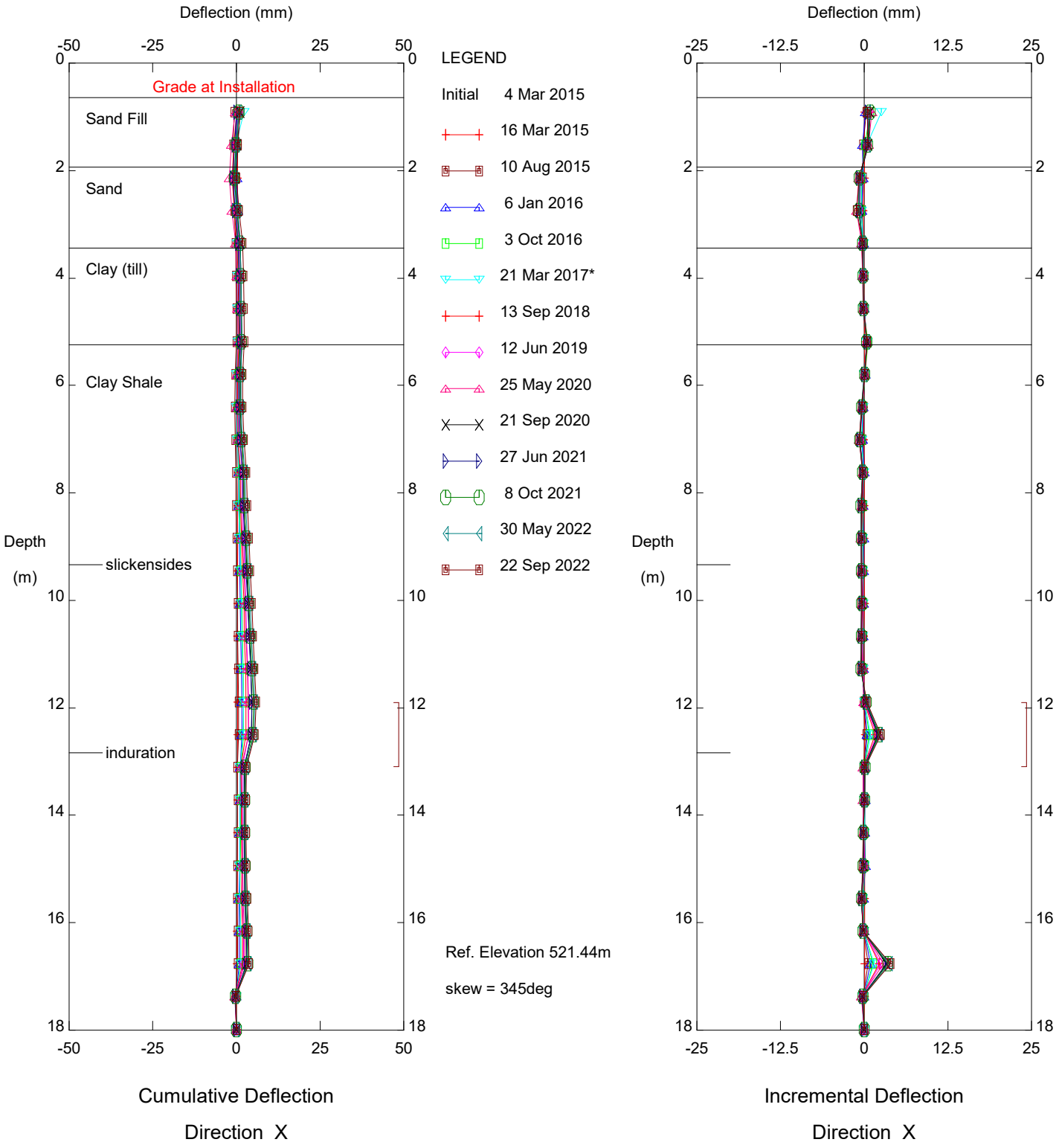


Cumulative Deflection

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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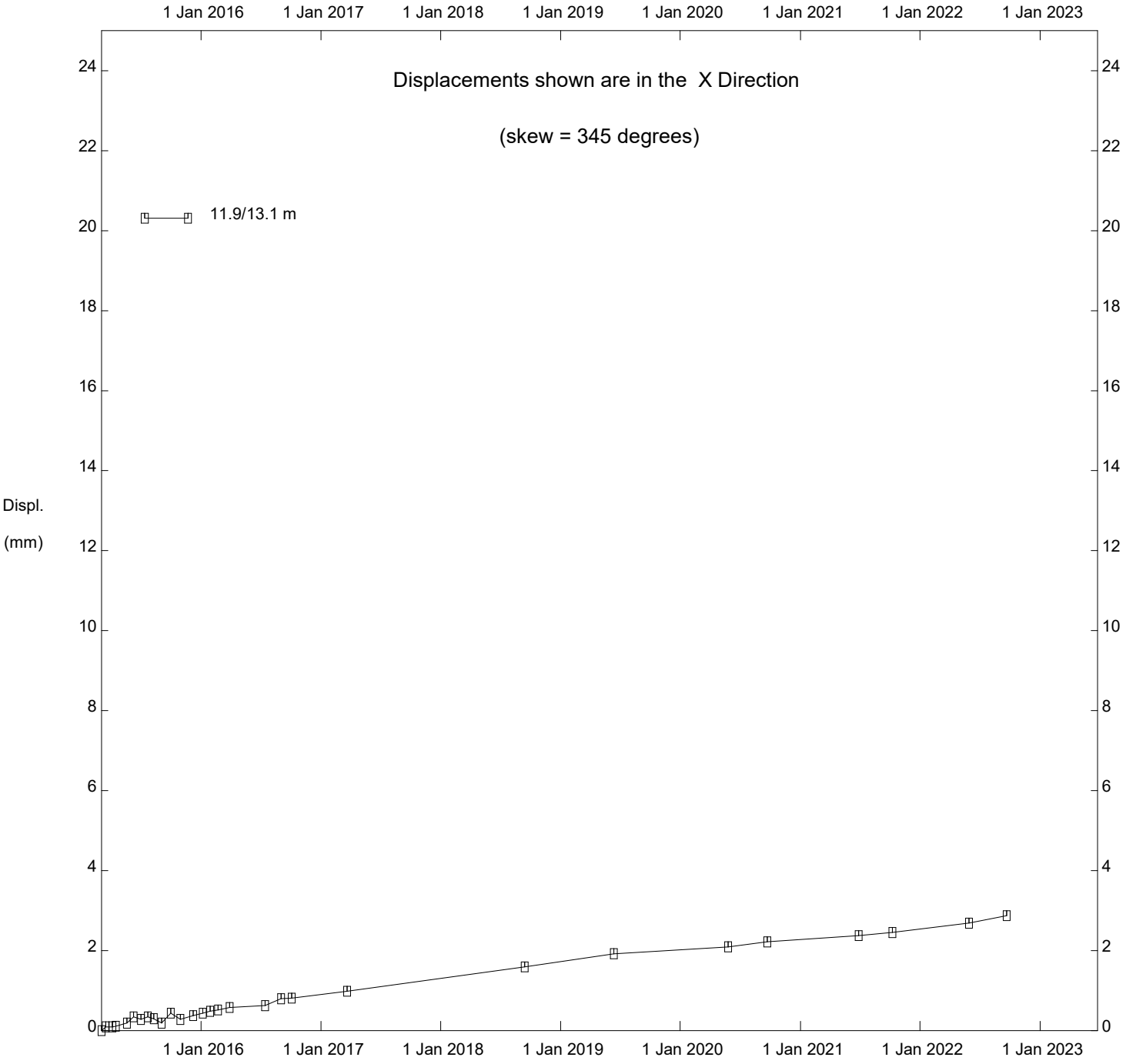


NC099 Cut Slope - Bench 1, Inclinometer 15-10

Alberta Transportation

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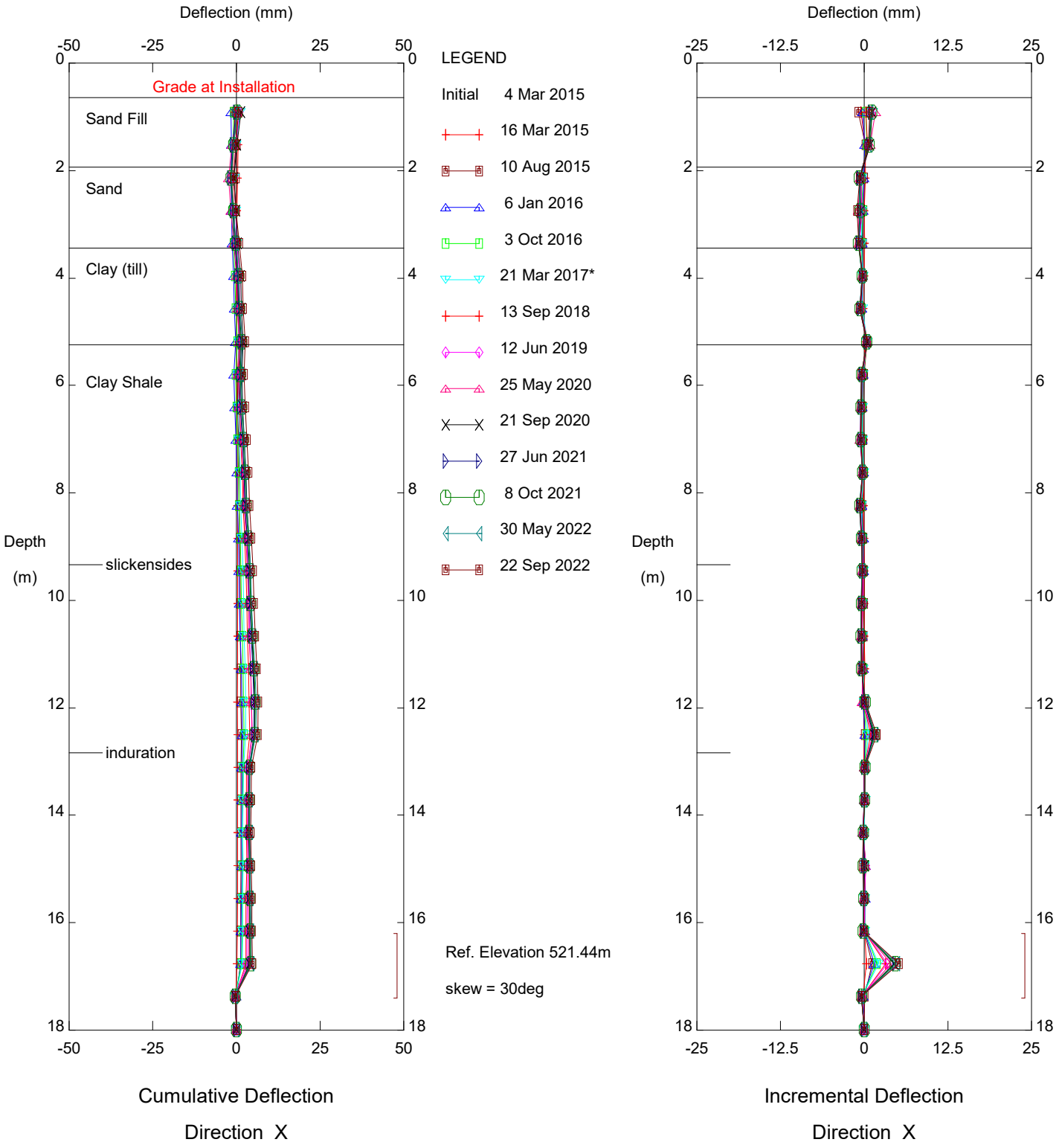


Cumulative Deflection

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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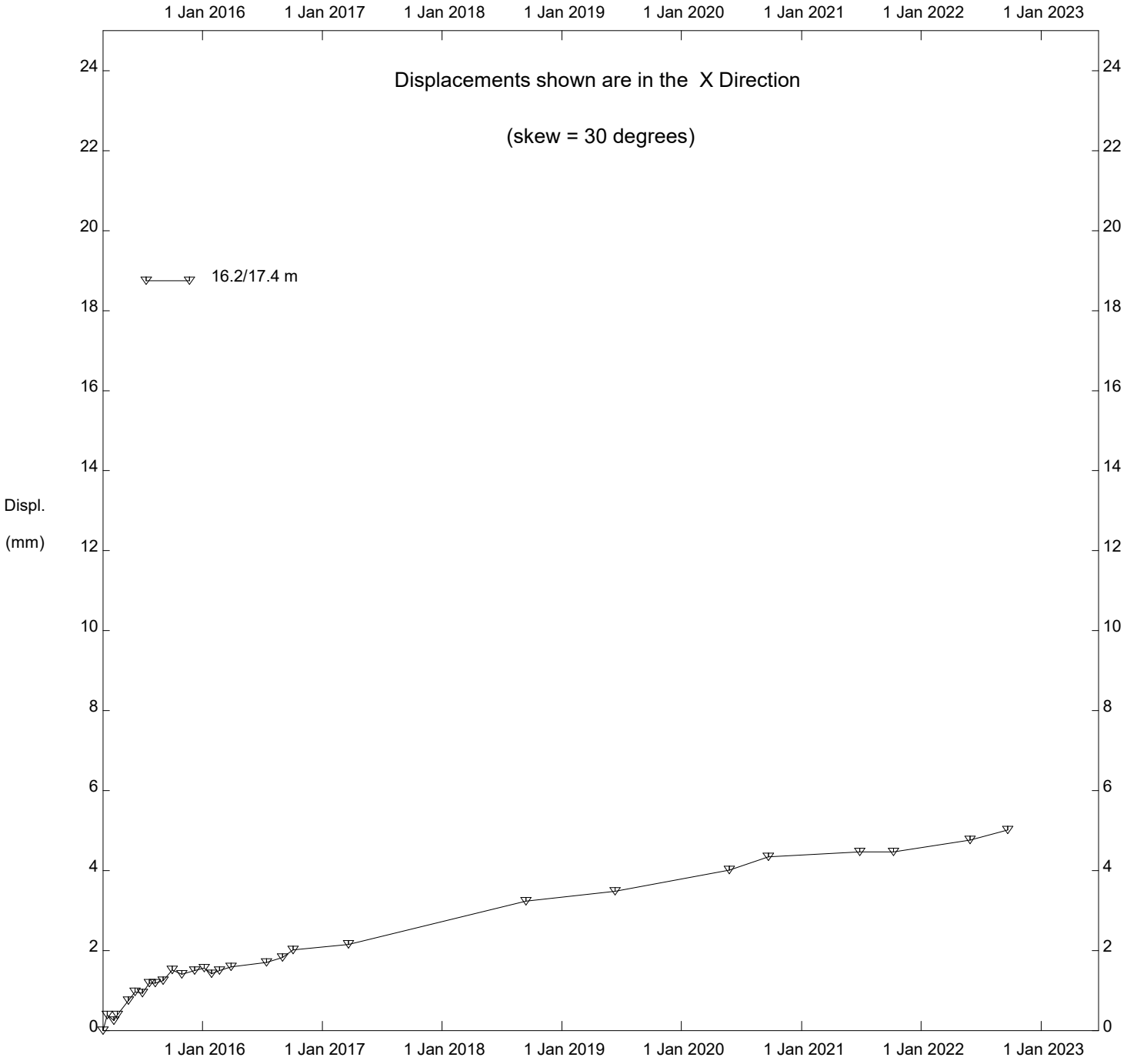
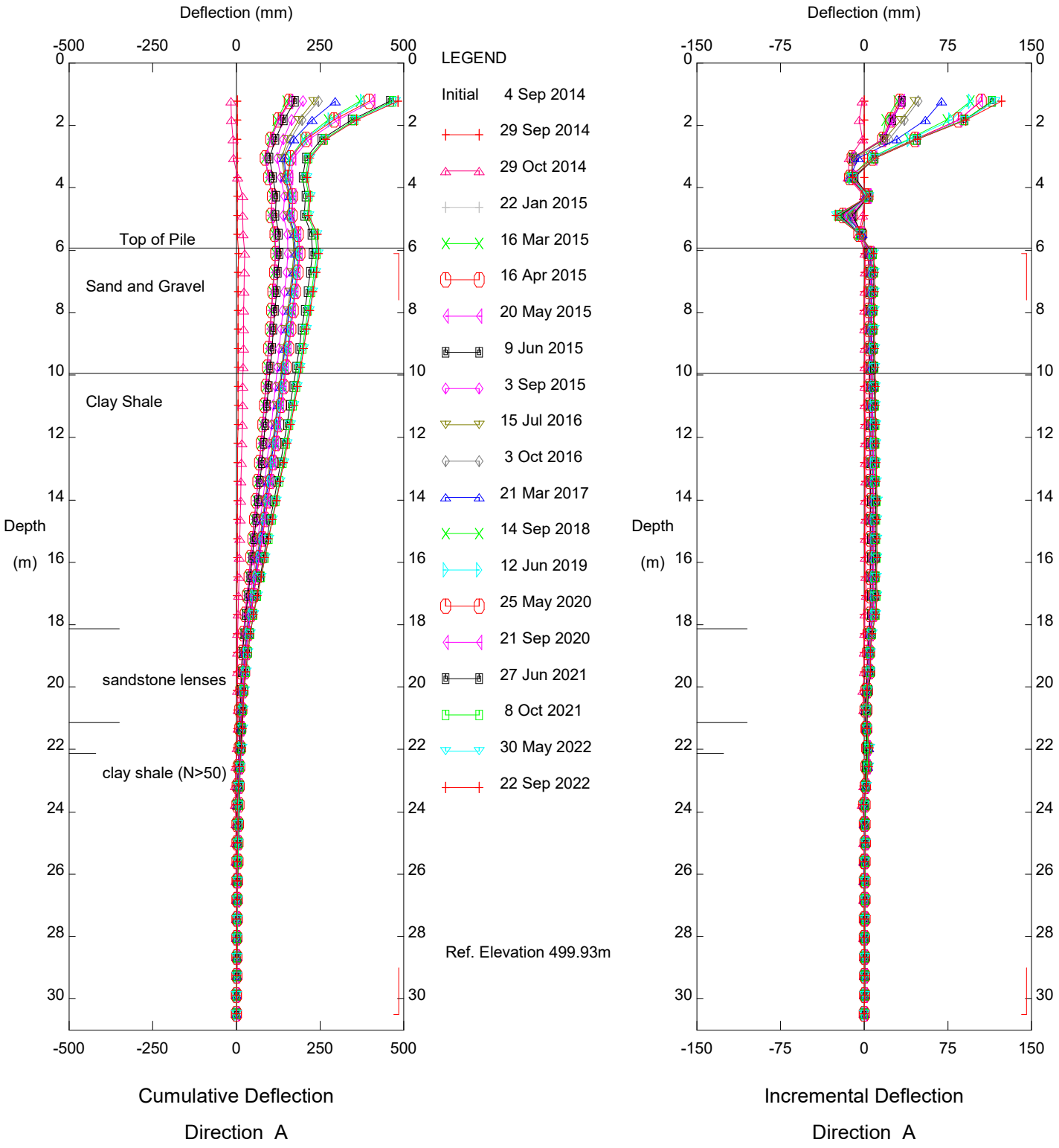



NC099 Cut Slope - Bench 1, Inclinometer 15-10

Alberta Transportation

Thurber Engineering Ltd.




Cumulative Deflection

Direction A

Incremental Deflection

Direction A

NC099 North Slope Stability Pile Wall, Inclinometer 14-01

Alberta Transportation

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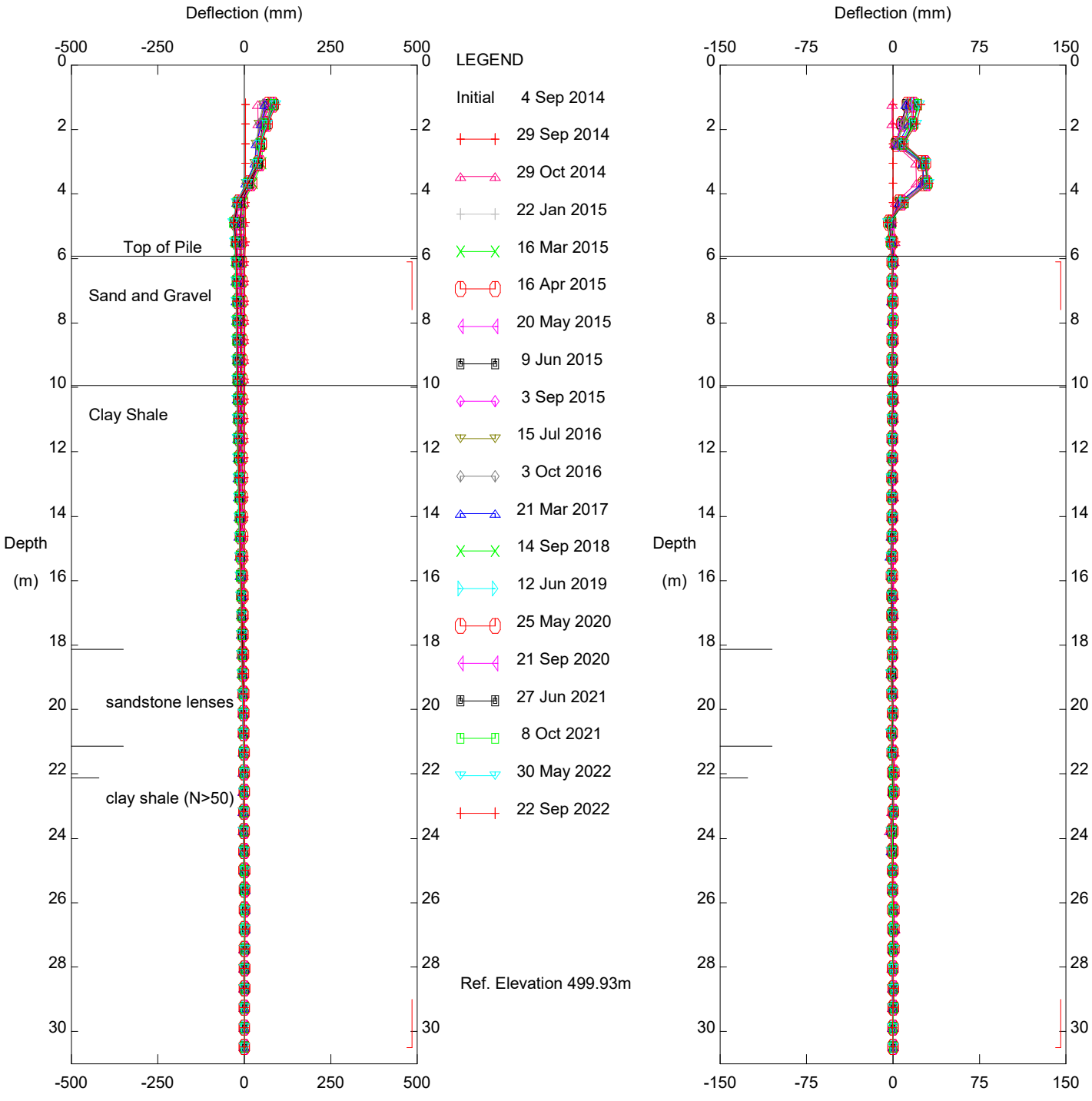


Cumulative Deflection

Direction B

Incremental Deflection

Direction B

NC099 North Slope Stability Pile Wall, Inclinometer 14-01

Alberta Transportation

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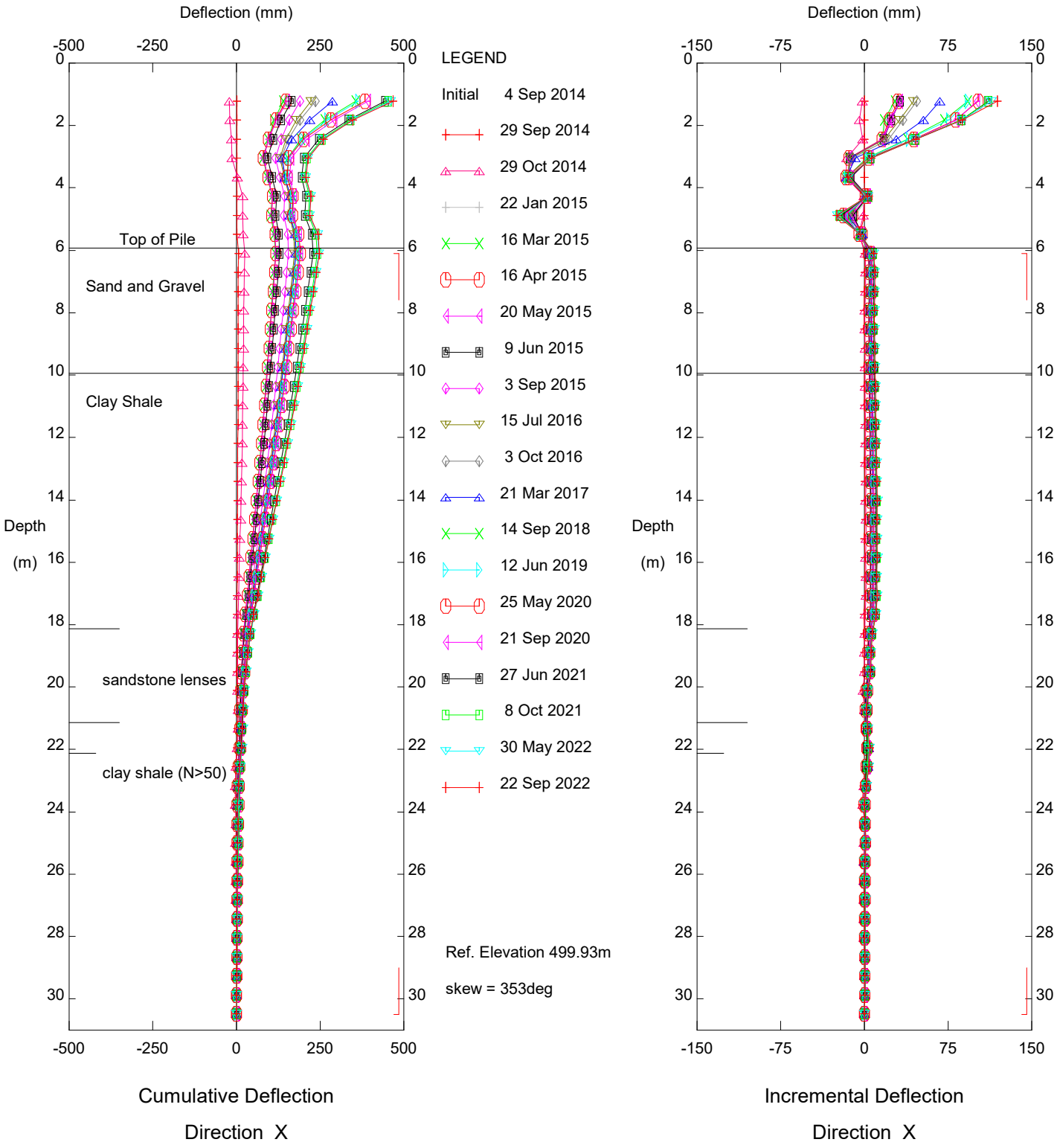


Cumulative Deflection

Direction X

Incremental Deflection

Direction X

NC099 North Slope Stability Pile Wall, Inclinometer 14-01

Alberta Transportation

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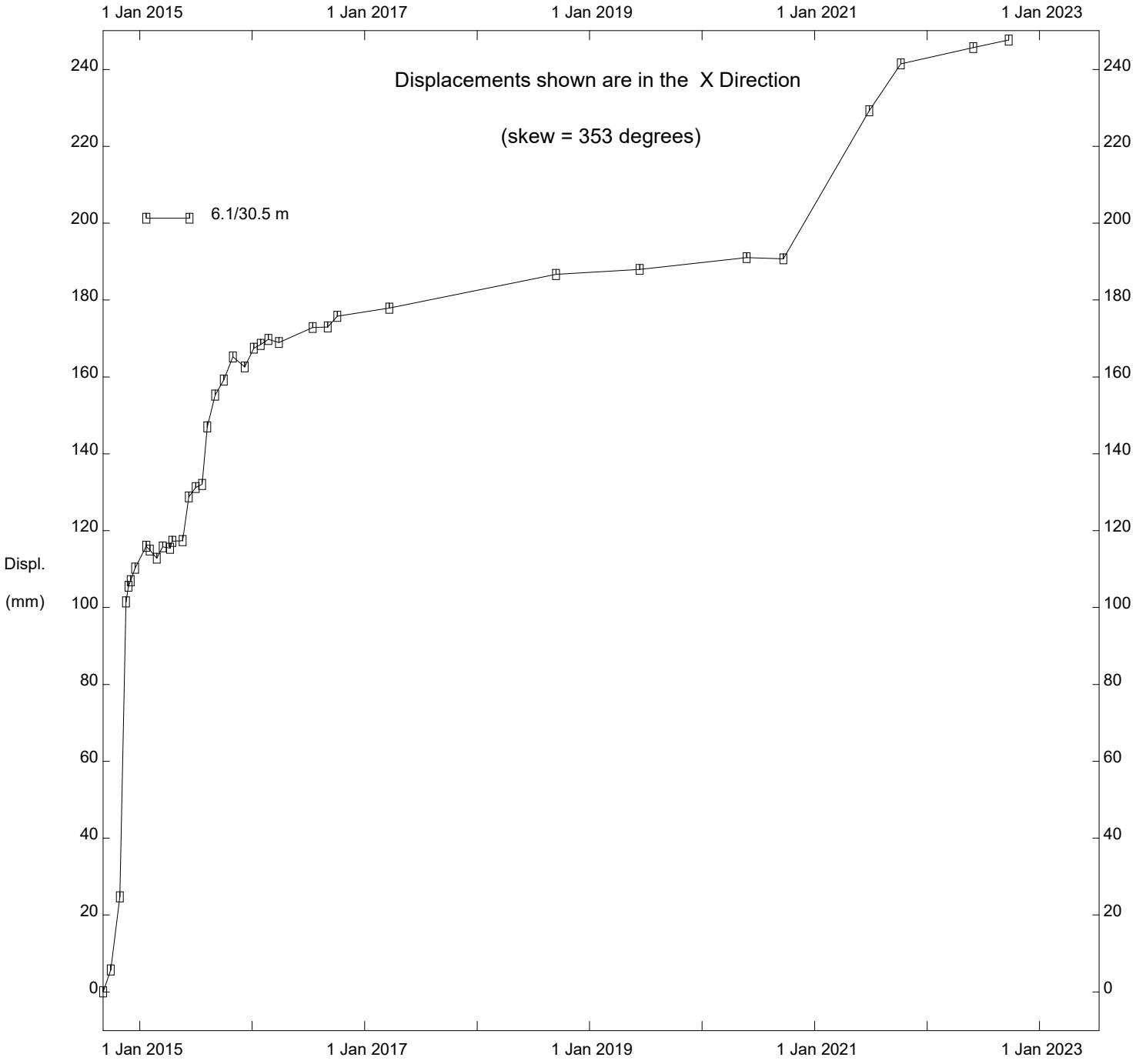


NC099 North Slope Stability Pile Wall, Inclinometer 14-01

Alberta Transportation

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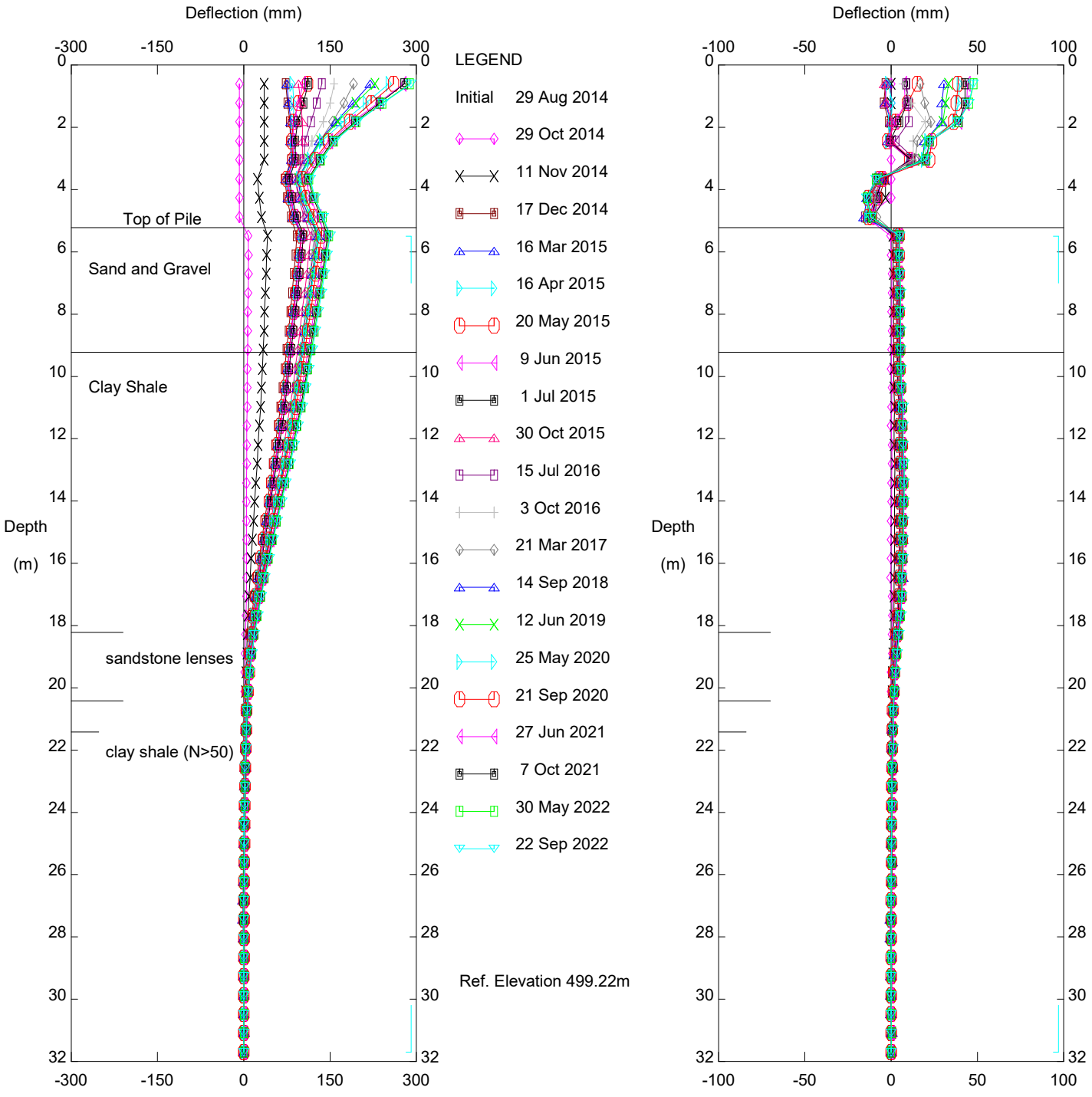


Cumulative Deflection

Direction A

Incremental Deflection

Direction A

NC099 South Slope Stability Pile Wall, Inclinometer 14-02

Alberta Transportation

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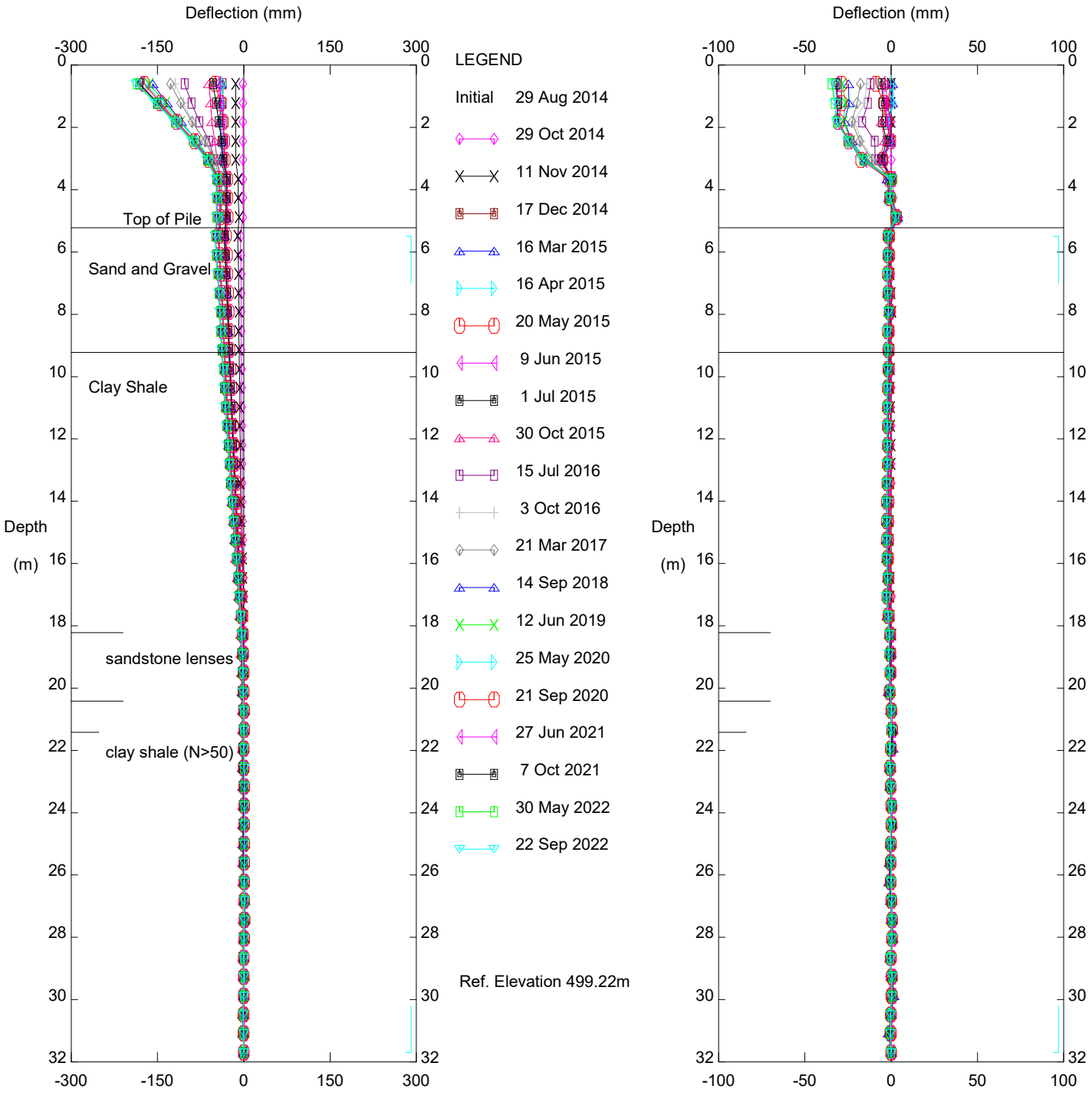


Cumulative Deflection

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\2022B-Fall\SI Readings\NC99\14-02.gtl

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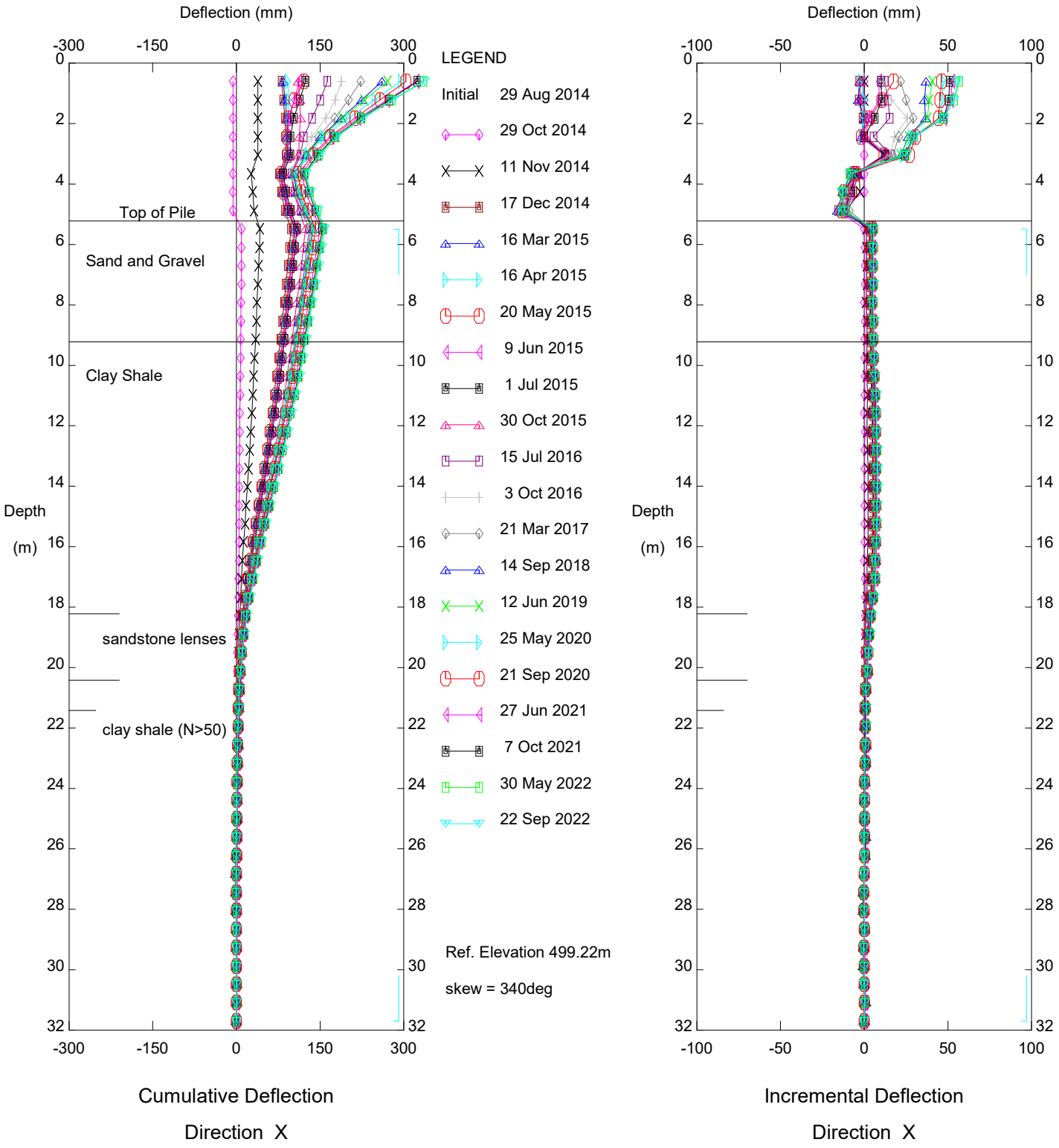


Cumulative Deflection

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\2022B-Fall\SI Readings\NC99\14-02.gtl

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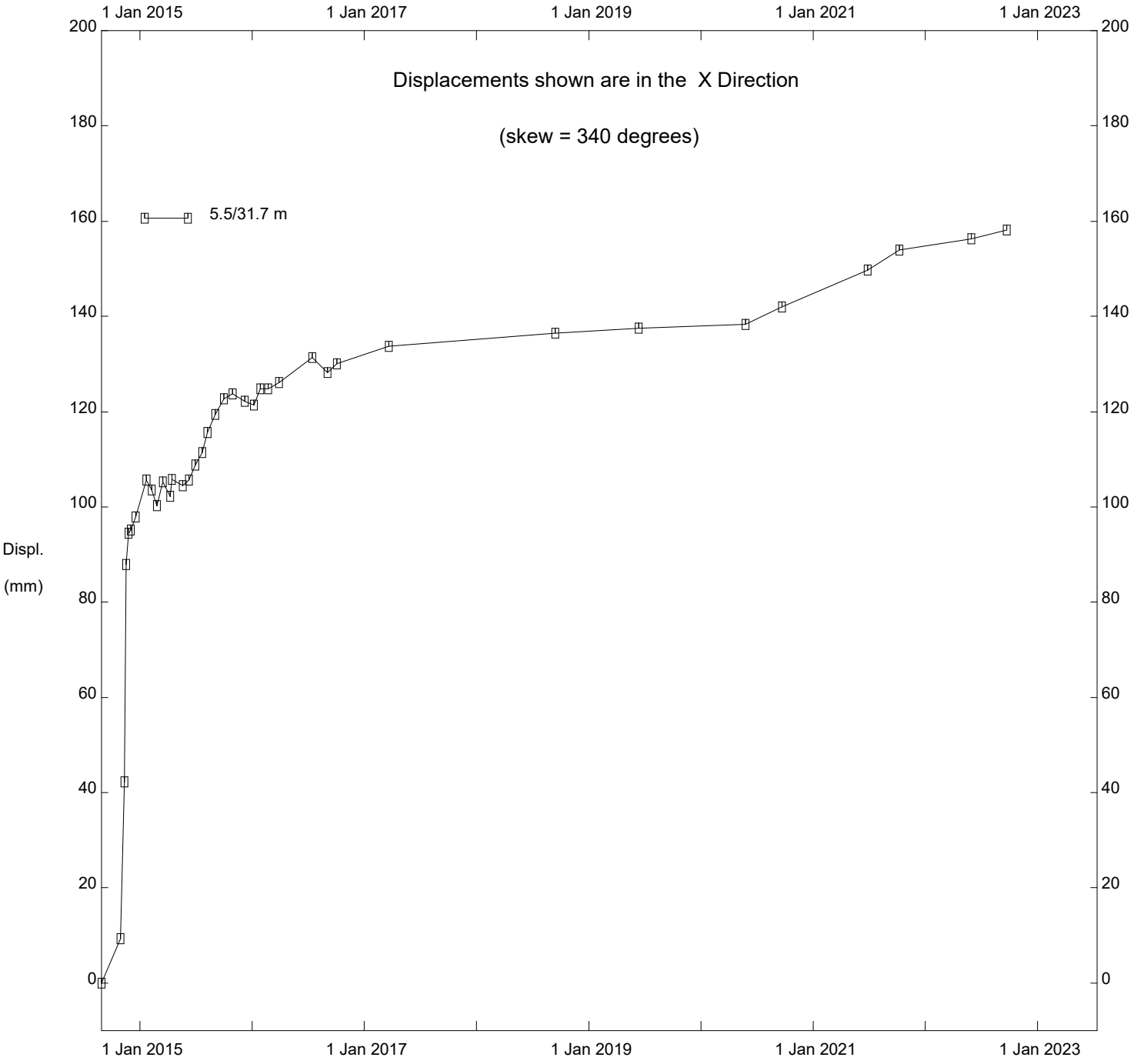


NC099 South Slope Stability Pile Wall, Inclinometer 14-02

Alberta Transportation

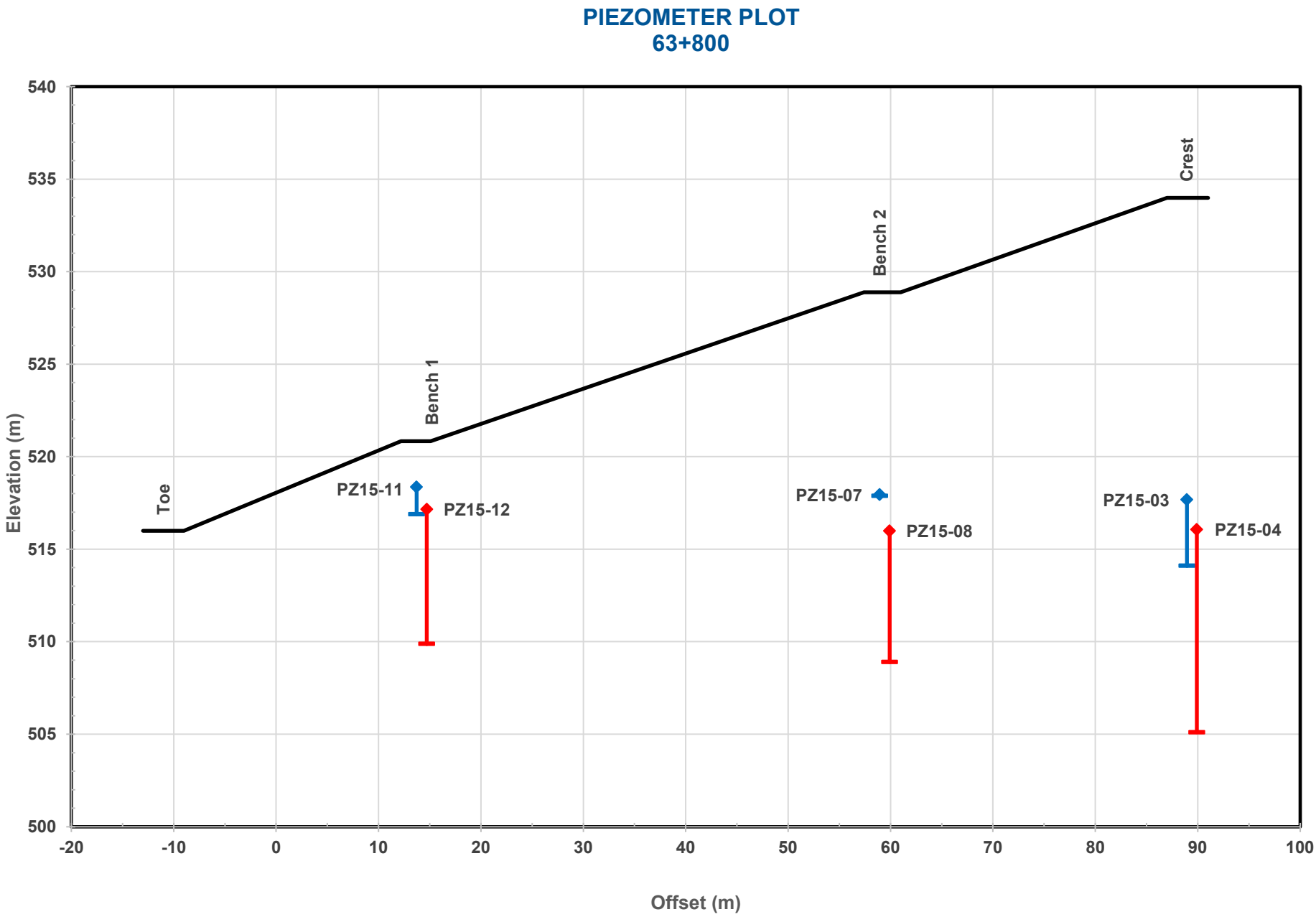


Figure NC099-1

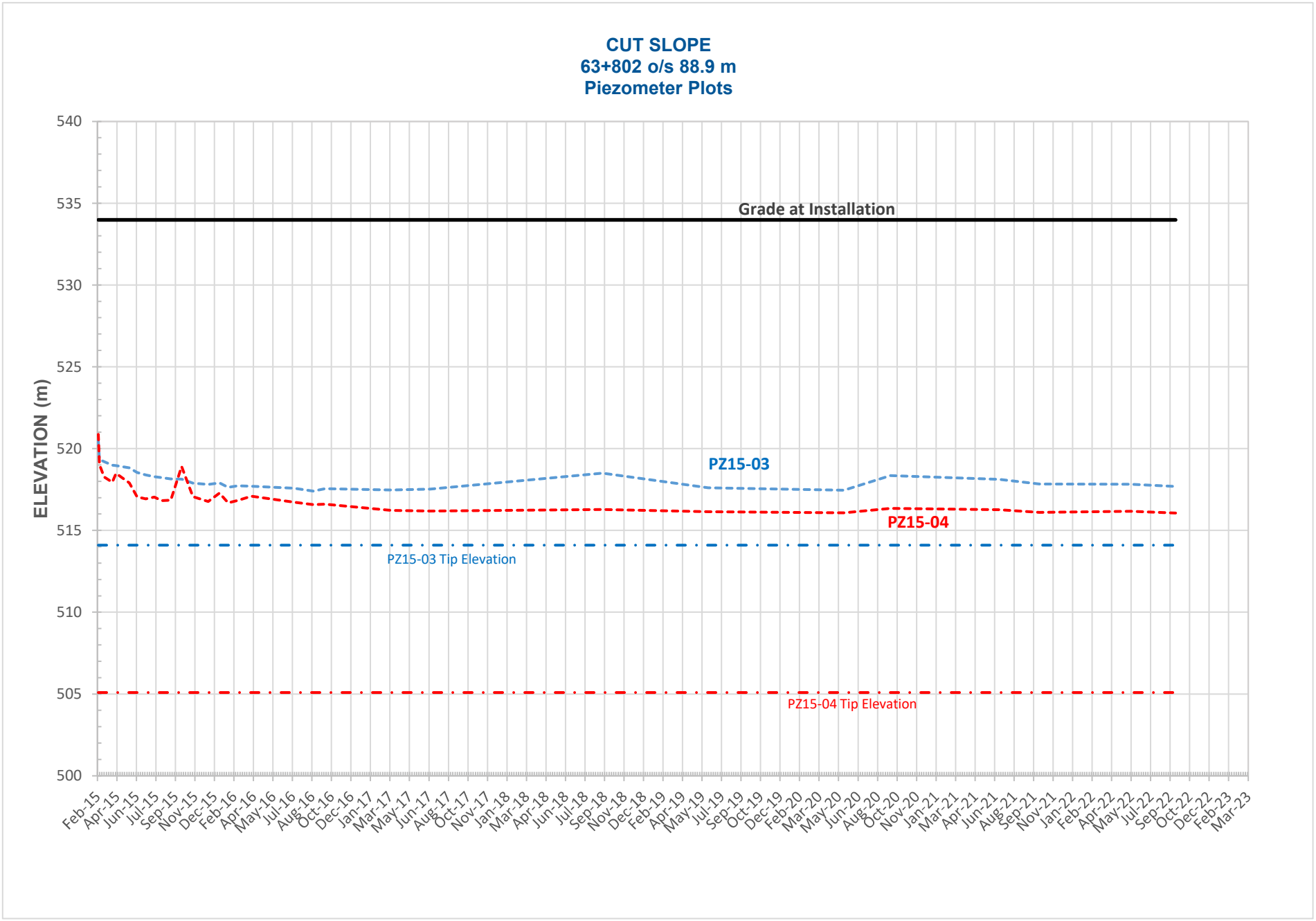


Figure NC099-2

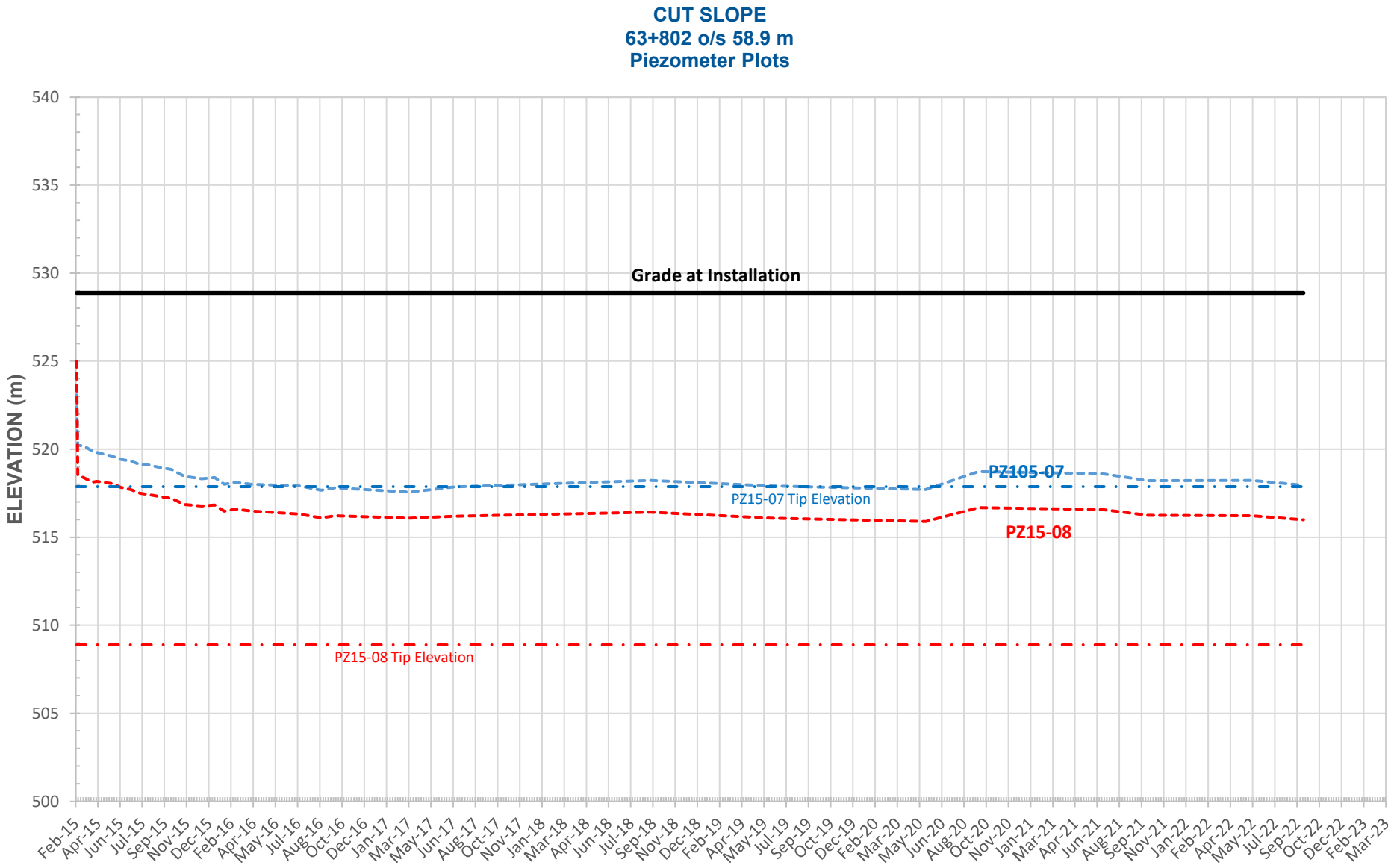


Figure NC099-3

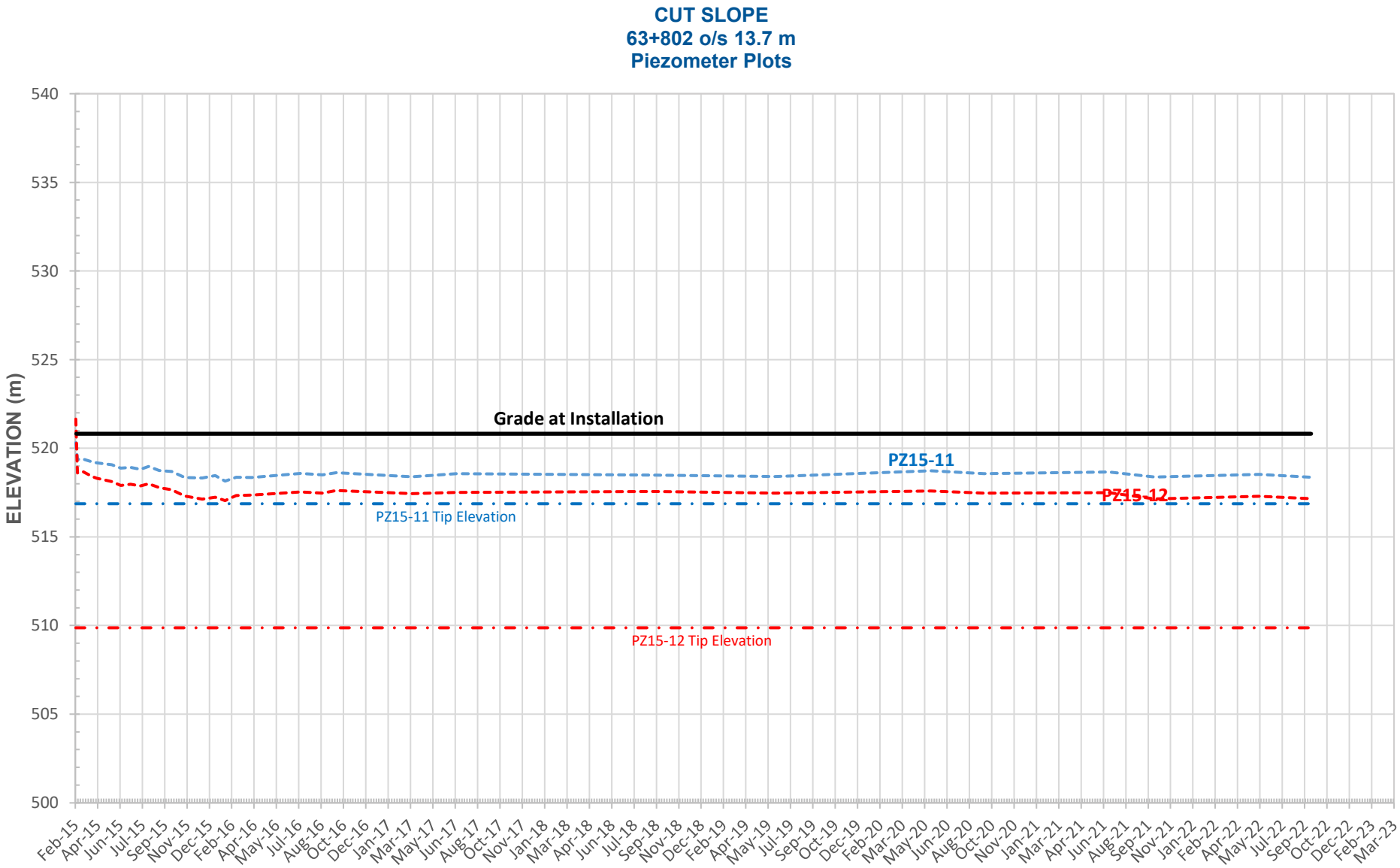


Figure NC099-4

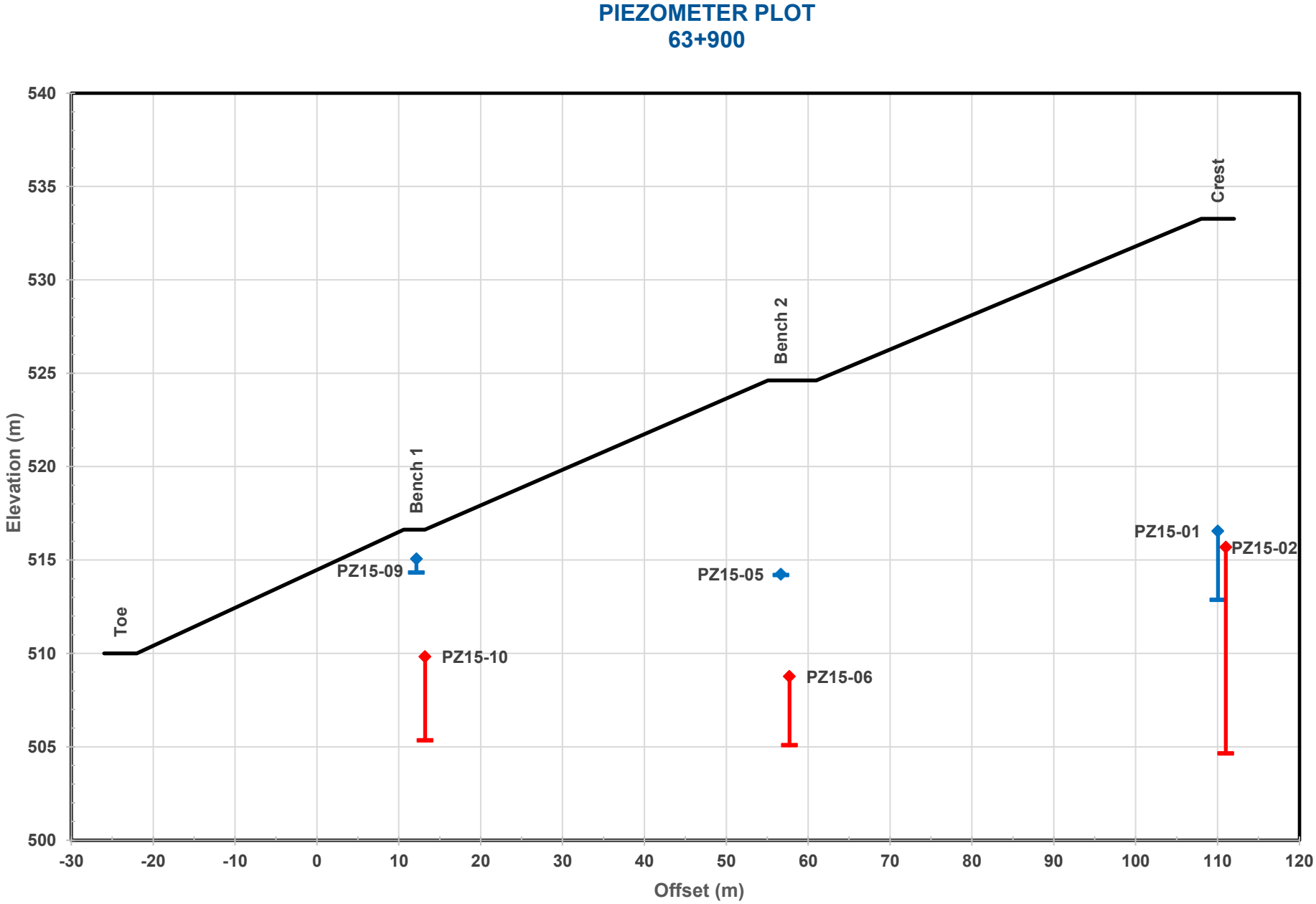


Figure NC099-5

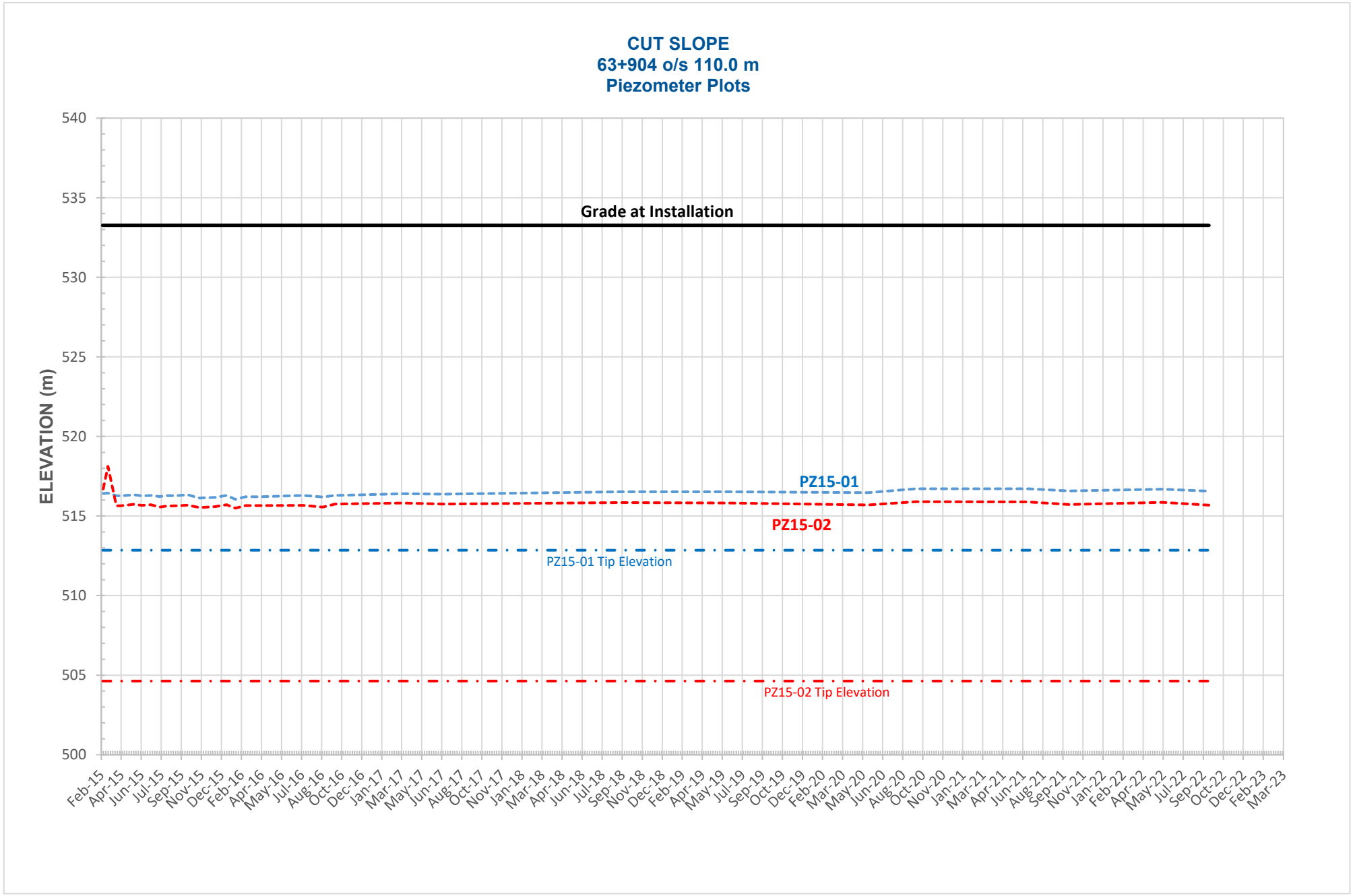


Figure NC099-6

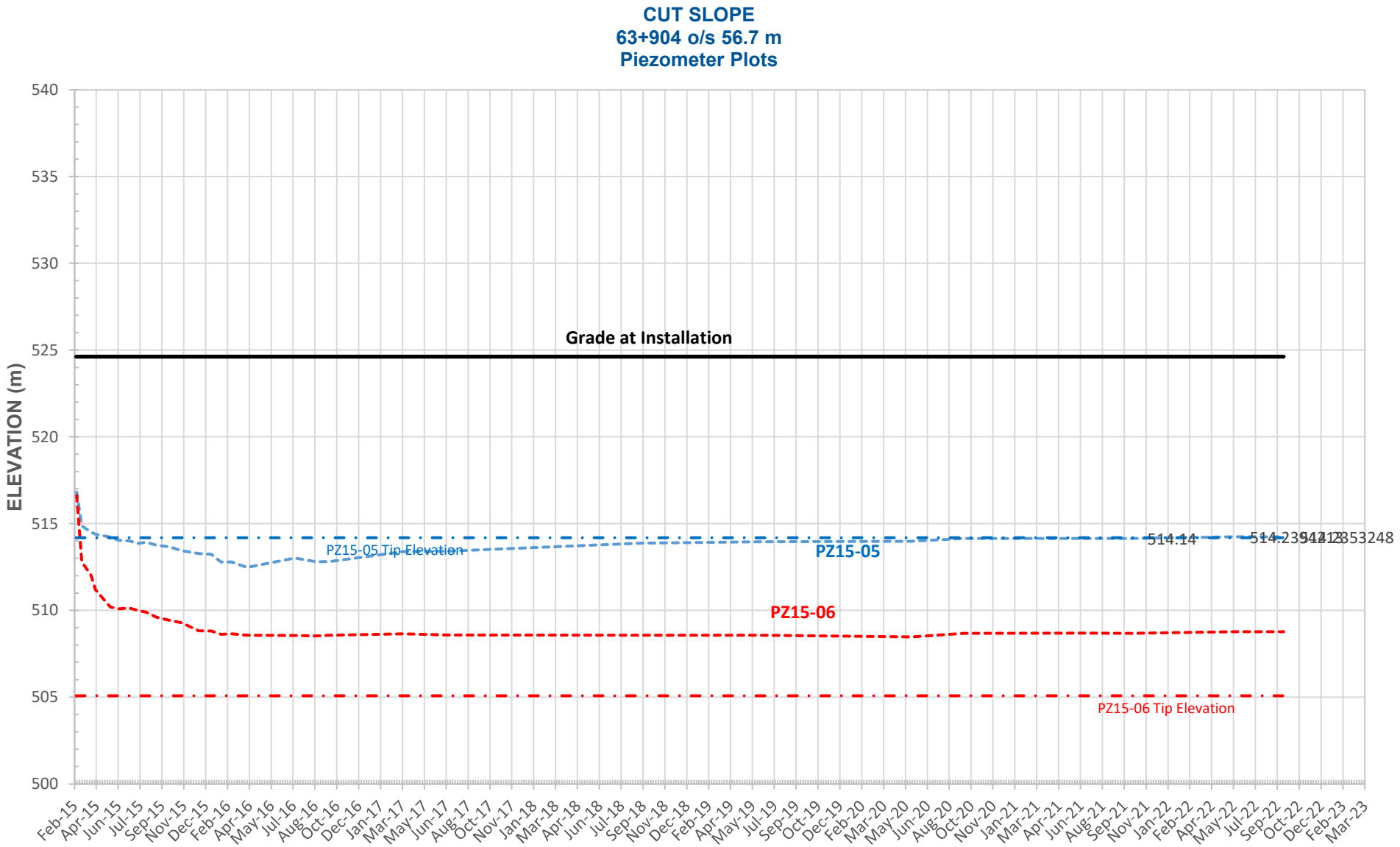


Figure NC099-7

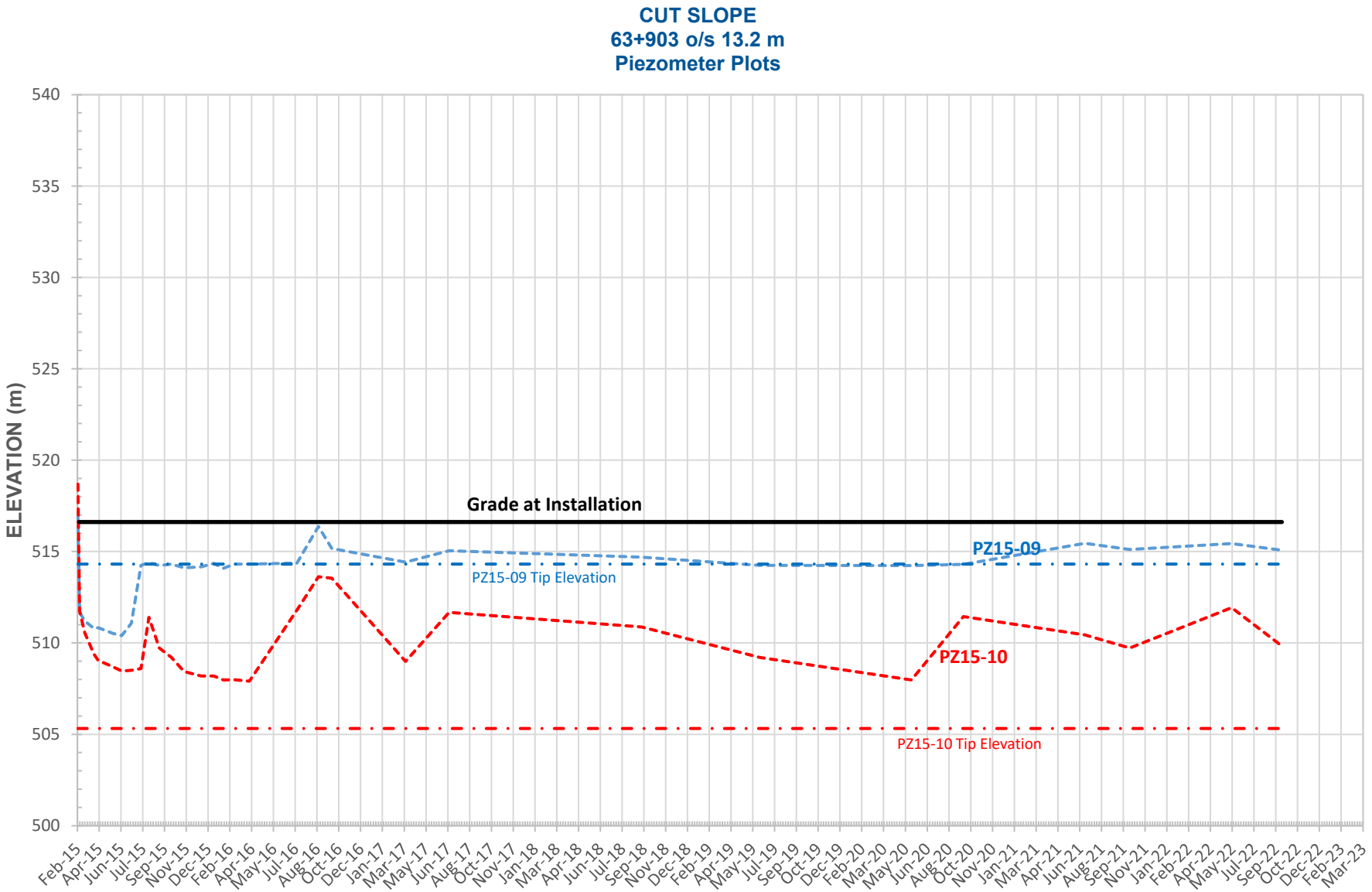


Figure NC099-8

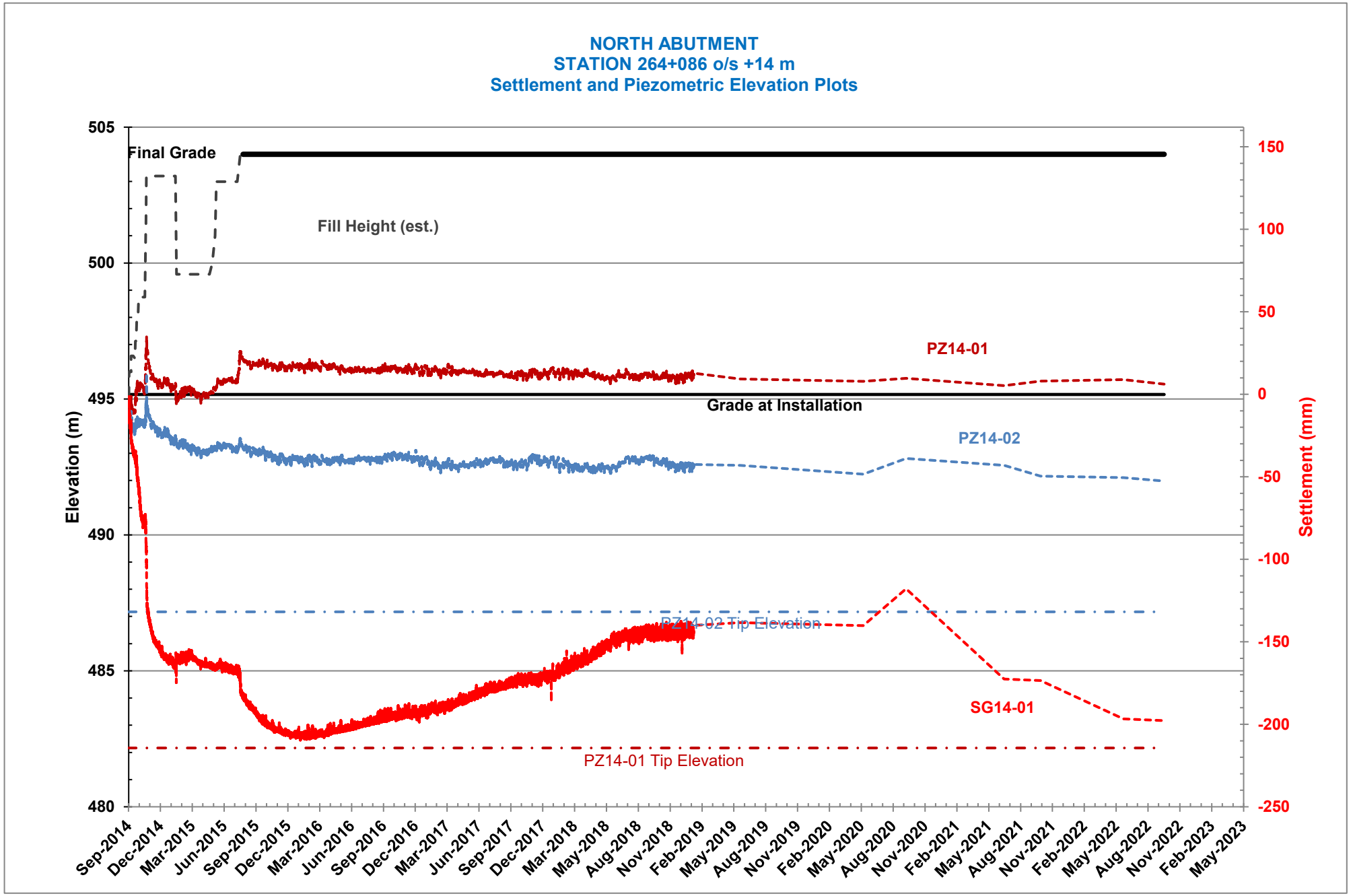


Figure NC099-9

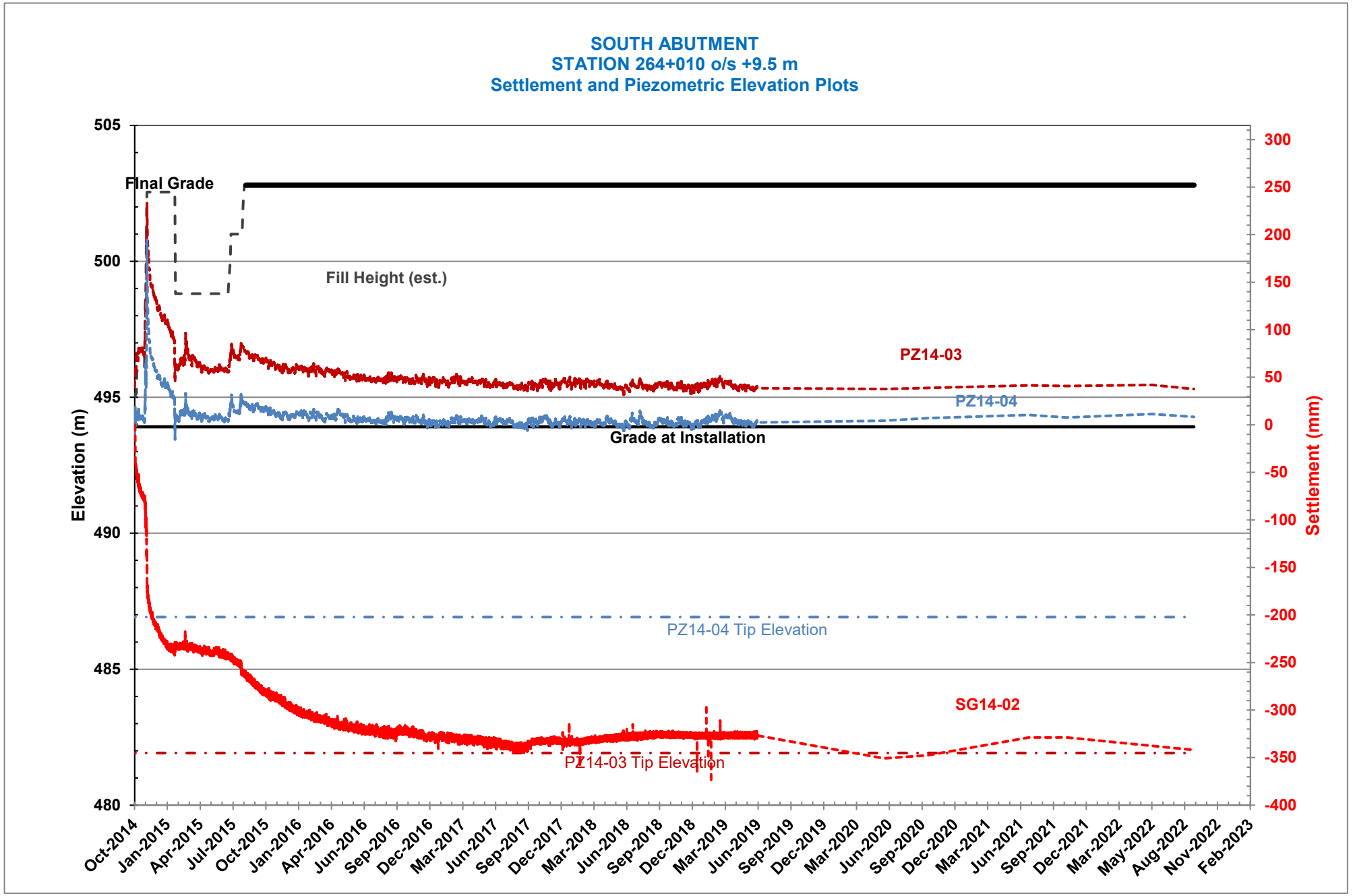


Figure NC099-10