

## TECHNICAL MEMORANDUM

**DATE** September 15, 2021

**Project No.** 20138294

**TO** Vanessa Heilman, P.Eng.  
City of Saskatoon

**CC** Hung Vu; Greg Misfeldt

**FROM** Blaise Wilson; Phil Bruch

**EMAIL** [blaise\\_wilson@golder.com](mailto:blaise_wilson@golder.com);  
[phil\\_bruch@golder.com](mailto:phil_bruch@golder.com)

### NUTANA SLOPE INSTABILITY UPDATE – AUGUST 2021

This memorandum presents monitoring data for the slope failures (referred to as the west slide and east slide) at the Nutana Slope Instability site. Locations of survey pins are shown in Figure 1. Locations of slope inclinometers, piezometers, settlement points, crack meters, and tilt plates are shown in Figure 2. Locations of the Saskatoon Light & Power (SL&P) tilt plates and survey pins installed on power poles are shown in Figure 3.

The west slide occurred in June 2012 and impacted a slope area approximately 70 m (230 ft) long and 40 m (130 ft) wide. It is most pronounced in the back yards of 229, 231, 233/235, and 237/239 11<sup>th</sup> Street East, through the back alley, and into the back yard of 222 Saskatchewan Crescent East.

The east slide occurred in June 2013 and impacted a slope area of approximately 50 m (165 ft) long and 30 m (100 ft) wide. It is most pronounced in the back yards of 303, 305, 307, and 309 11<sup>th</sup> Street East, through the back alley, and into the back yard of 306, 310 and 316 Saskatchewan Crescent East.

The monitoring results and photographs from this monitoring period are attached. A summary of the monitoring results is provided below.

#### *Survey Pin Data:*

- Monitoring of the survey pins at the site was not performed during this monitoring period.

#### *Slope Inclinometer Data:*

- Inclinometer COS-13-002 indicated insignificant movement (less than 2 mm or 0.08 in) between May 31, 2021 and August 27, 2021.
- Inclinometer COS-13-004 indicated insignificant movement (less than 2 mm or 0.08 in) between June 3, 2021 and August 27, 2021.
- Inclinometer COS-13-005 indicated between 1.5 mm to 2.5 mm (0.06 in to 0.10 in) between May 31, 2021 and August 27, 2021.
- Inclinometer 20-109 indicated insignificant cumulative surface movement (less than 2 mm or 0.08 in) between May 31, 2021 and August 27, 2021. However, some shifting is noted between 1.0 m and 2.5 m below ground surface (bgs).

- Inclinometer 20-111 indicated approximately 2 mm of movement (0.08 in) along the B axis between May 31, 2021 and August 27, 2021.

#### ***Vibrating Wire (VW) & Standpipe Piezometer Data:***

- Piezometers were monitored by the City of Saskatoon during this period and are not presented in this memorandum.

#### ***Tilt Plate Data:***

- The results of tilt plate monitoring are shown on Figure 4 for the City of Saskatoon tilt plates, and in Figure 5 for the tilt plates installed on SL&P power poles.
- Tilt plates TP4, TP5, TP6, and TP7 indicate insignificant changes in angle of tilt (less than 0.05 degrees) between May 31, 2021 and August 27, 2021.
- Tilt plates SLP4, SLP5, and SLP 6 indicated insignificant changes in angle of tilt (less than 0.05 degrees) between May 31, 2021 and August 27, 2021.
- Tilt plate SLP3 indicated a change in angle of tilt of approximately 0.16 degrees, towards the south, between May 31, 2021 and August 27, 2021.

#### ***Crack Meter Data:***

- Crack meters were not read during this monitoring period.

#### ***Settlement Points:***

- Settlement points were not read during this monitoring period

[https://golderassociates.sharepoint.com/sites/122189/project files/5 technical work/monitoring/reports/4. aug 2021/20138294 - nutana monitoring data update memo\\_aug21.docx](https://golderassociates.sharepoint.com/sites/122189/project%20files/5%20technical%20work/monitoring/reports/4.%20aug%202021/20138294%20-%20nutana%20monitoring%20data%20update%20memo_aug21.docx)

Path: \\golder\gds\gaskatoon\legal\_clients\cityofsaskatoon\saskatoon\09\_PROJECTS\2013\294\Phase\_1\00002\_PRODUCTION\DWG1 - File Name: 20130204-FG003\_MonitoringPins500Series.dwg | Last Edited By: jearthy Date: 2020-06-03 Time: 9:17:31 AM | Printed By: jearthy Date: 2021-06-03 Time: 4:22:24 PM



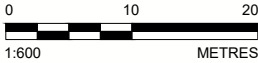
LEGEND

- PIN LOCATION
- 303

LOT NUMBER

REFERENCE(S)

AERIAL PHOTOGRAPH PROVIDED BY CITY OF SASKATOON, MAY 15, 2011  
CITY OF SASKATOON DATUM



CLIENT



PROJECT

NUTANA SLOPE INSTABILITY

TITLE

INSTRUMENTATION PLAN No. 1

CONSULTANT



YYYY-MM-DD 2020-06-02

DESIGNED BW

PREPARED JMC

REVIEWED

APPROVED

PROJECT NO.  
20138294

PHASE  
1000

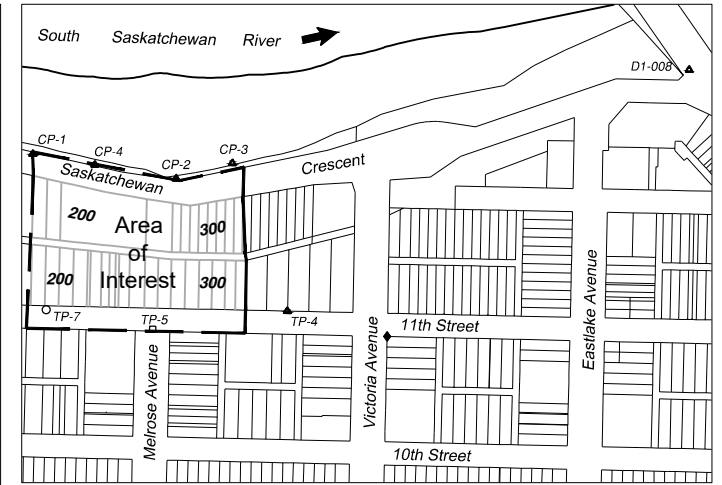
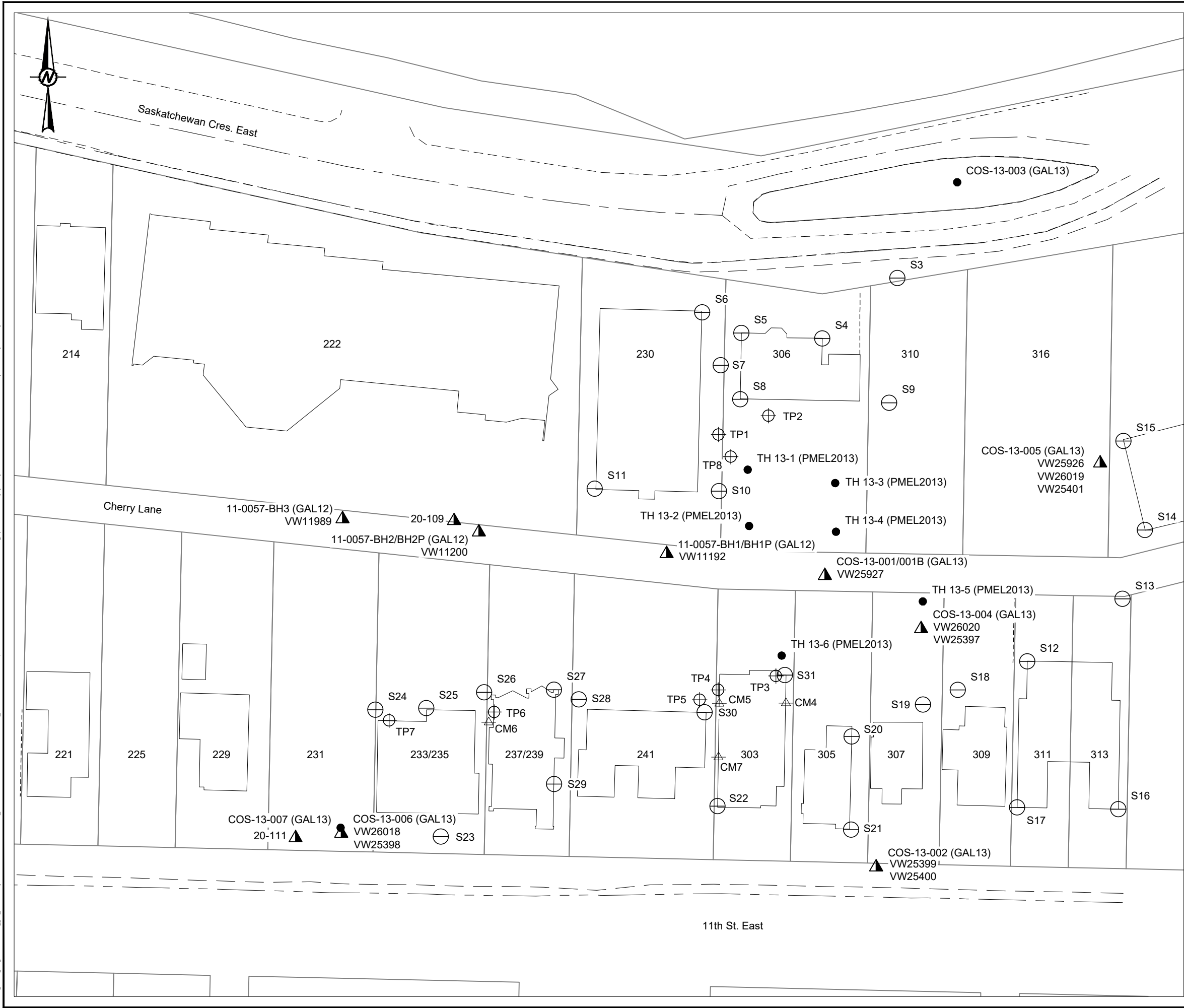
REV.  
A

FIGURE  
1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25 mm

Path: \\golder-g4s-gall-saskatoon\gis\clients\cityofsaskatoon\saskatoon\92\_PROJECTS\2013\24\Phase 1\00002\_PRODUCTION\DWG\_1 File Name: 20130204-FG002 Inst-LocPlan.dwg | Last Edited By: jcarthy Date: 2021-06-03 Time: 4:19:51 PM | Printed By: jcarthy Date: 2021-06-04 Time: 10:02:55 AM



| CONTROL POINTS                 |              |             |                                  |                            |
|--------------------------------|--------------|-------------|----------------------------------|----------------------------|
| COORDINATE TABLE NAD 83 (CSRS) |              |             | UTM ZONE 13                      |                            |
| POINT                          | NORTHING (m) | EASTING (m) | ORTHOMETRIC ELEVATION (m) HTv2.0 | DESCRIPTION                |
| CP-1                           | 5,775,701.84 | 385,897.84  | 477.97                           | 24" REBAR WITH PLASTIC CAP |
| CP-2                           | 5,775,680.32 | 386,022.25  | 478.99                           | 24" REBAR WITH PLASTIC CAP |
| CP-3                           | 5,775,693.72 | 386,071.10  | 479.49                           | 24" REBAR WITH PLASTIC CAP |
| CP-4                           | 5,775,692.40 | 385,951.67  | 477.95                           | GPS CONTROL POINT          |
| TP-4                           | 5,775,565.50 | 386,118.76  | 499.32                           | X IN CONCRETE              |
| TP-5                           | 5,775,549.79 | 386,001.87  | 498.05                           | X IN NORTH RIM CATCH BASIN |
| TP-7                           | 5,775,566.48 | 385,909.52  | 491.32                           | X IN SOUTH RIM MANHOLE     |
| TP-8                           | 5,775,560.37 | 385,809.26  | 484.62                           | X IN WEST RIM MANHOLE      |
| D1-008                         | 5,775,775.85 | 386,467.62  | 499.033                          | CONTROL TABLET             |

| LEGEND |                                         |
|--------|-----------------------------------------|
|        | SETTLEMENT POINT LOCATION               |
|        | TELL-TALE CRACK LOCATION MONITOR        |
|        | TILT PLATE LOCATION                     |
|        | SI & VIBRATING WIRE PIEZOMETER LOCATION |
|        | STANDPIPE PIEZOMETER LOCATION           |
| 303    | LOT NUMBER                              |

**REFERENCE(S)**  
LOT LOCATIONS PROVIDED BY CITY OF SASKATOON  
CITY OF SASKATOON DATUM

CLIENT

PROJECT

NUTANA SLOPE INSTABILITY

TITLE

INSTRUMENTATION LOCATION PLAN No. 2

CONSULTANT

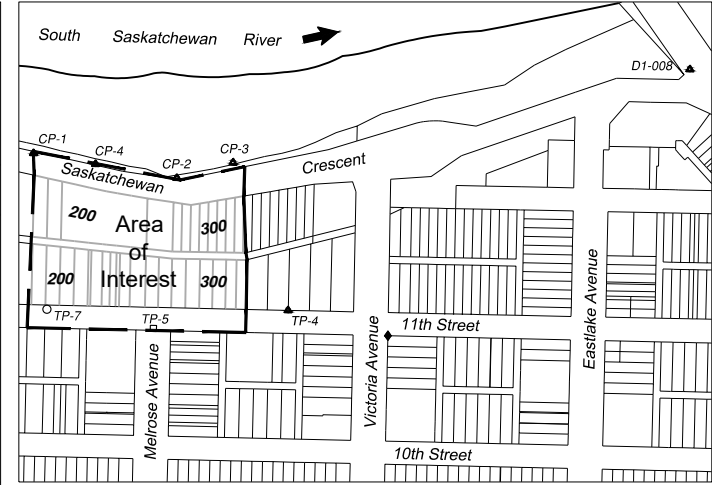
**GOLDER**  
MEMBER OF WSP

|            |            |
|------------|------------|
| YYYY-MM-DD | 2020-06-02 |
| DESIGNED   | BW         |
| PREPARED   | JMC        |
| REVIEWED   |            |
| APPROVED   |            |

|             |       |      |        |
|-------------|-------|------|--------|
| PROJECT NO. | PHASE | REV. | FIGURE |
| 20138294    | 1000  | A    | 2      |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI 'B' 25 mm

Path: \\golder-gfsgal\saskatoon\gis\clients\cityofsaskatoon\saskatoon\09\_PROJECTS\20138294\Phase\_100002\_PRODUCTION\DWG\_1 File Name: 20138294-FG001\_MonitorPlan.dwg | Last Edited By: jcarthy Date: 2020-06-03 Time: 9:17:21 AM | Printed By: jcarthy Date: 2021-06-03 Time: 4:22:51 PM



| CONTROL POINTS                 |              |             |                                  |                            |
|--------------------------------|--------------|-------------|----------------------------------|----------------------------|
| COORDINATE TABLE NAD 83 (CSRS) |              |             | UTM ZONE 13                      |                            |
| POINT                          | NORTHING (m) | EASTING (m) | ORTHOMETRIC ELEVATION (m) HTv2.0 | DESCRIPTION                |
| CP-1                           | 5,775,701.84 | 385,897.84  | 477.97                           | 24" REBAR WITH PLASTIC CAP |
| CP-2                           | 5,775,680.32 | 386,022.25  | 478.99                           | 24" REBAR WITH PLASTIC CAP |
| CP-3                           | 5,775,693.72 | 386,071.10  | 479.49                           | 24" REBAR WITH PLASTIC CAP |
| CP-4                           | 5,775,692.40 | 385,951.67  | 477.95                           | GPS CONTROL POINT          |
| TP-4                           | 5,775,565.50 | 386,118.76  | 499.32                           | X IN CONCRETE              |
| TP-5                           | 5,775,549.79 | 386,001.87  | 498.05                           | X IN NORTH RIM CATCH BASIN |
| TP-7                           | 5,775,566.48 | 385,909.52  | 491.32                           | X IN SOUTH RIM MANHOLE     |
| TP-8                           | 5,775,560.37 | 385,809.26  | 484.62                           | X IN WEST RIM MANHOLE      |
| D1-008                         | 5,775,775.85 | 386,467.62  | 499.033                          | CONTROL TABLET             |

**LEGEND**

- TILT PLATE LOCATION
- POWER POLE LOCATION
- LOT NUMBER
- VECTOR OF TILT OF POLES (MAY 5, 2015)

**REFERENCE(S)**

LOT LOCATIONS PROVIDED BY CITY OF SASKATOON  
CITY OF SASKATOON DATUM

CLIENT

PROJECT

NUTANA SLOPE INSTABILITY

TITLE

INSTRUMENTATION LOCATION PLAN No. 3

CONSULTANT

**GOLDER**  
MEMBER OF WSP

|            |            |
|------------|------------|
| YYYY-MM-DD | 2020-06-02 |
| DESIGNED   | BW         |
| PREPARED   | JMC        |
| REVIEWED   |            |
| APPROVED   |            |

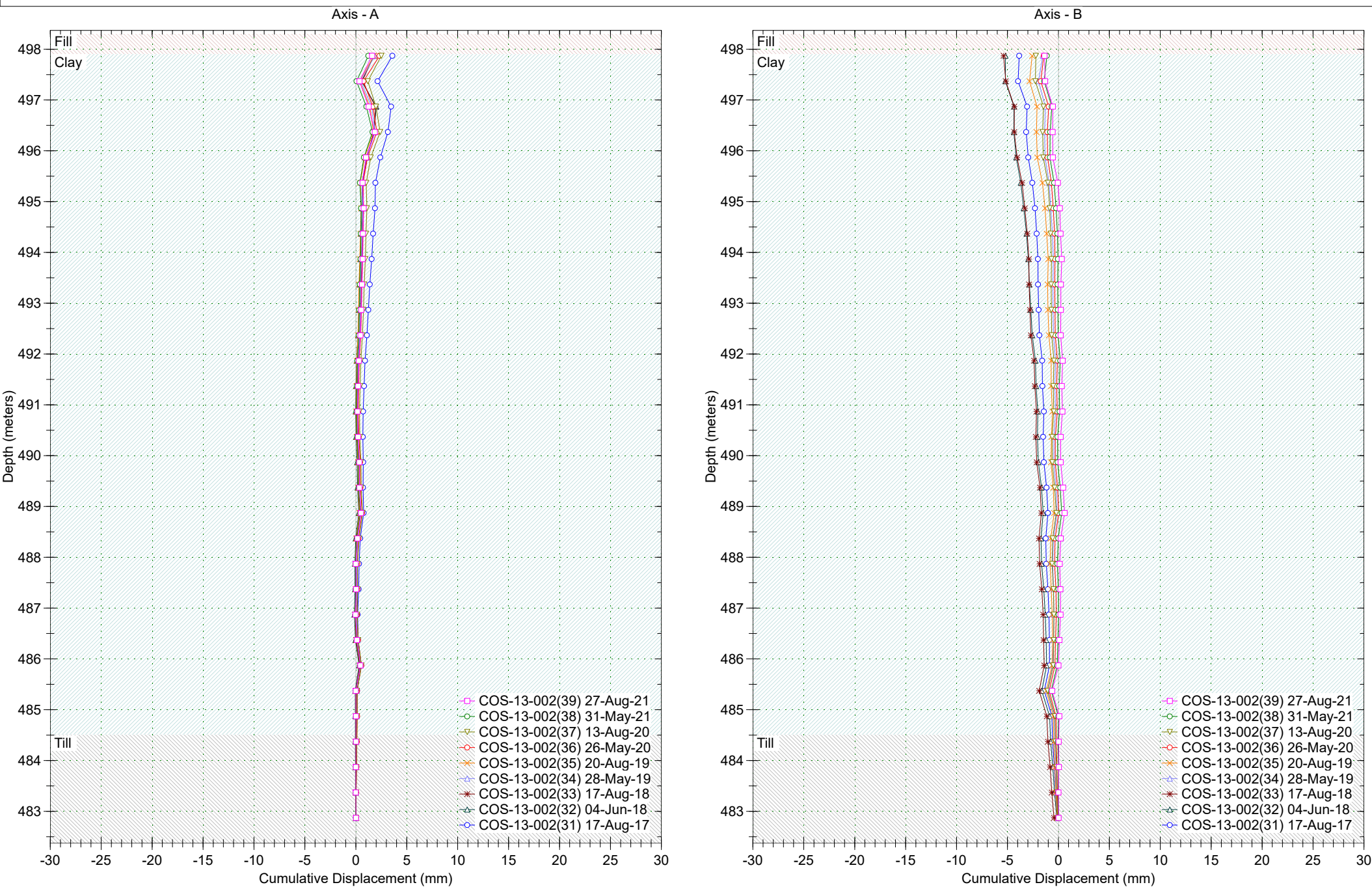
|             |       |      |        |
|-------------|-------|------|--------|
| PROJECT NO. | PHASE | REV. | FIGURE |
| 20138294    | 1000  | A    | 3      |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

## **SLOPE INCLINOMETERS**

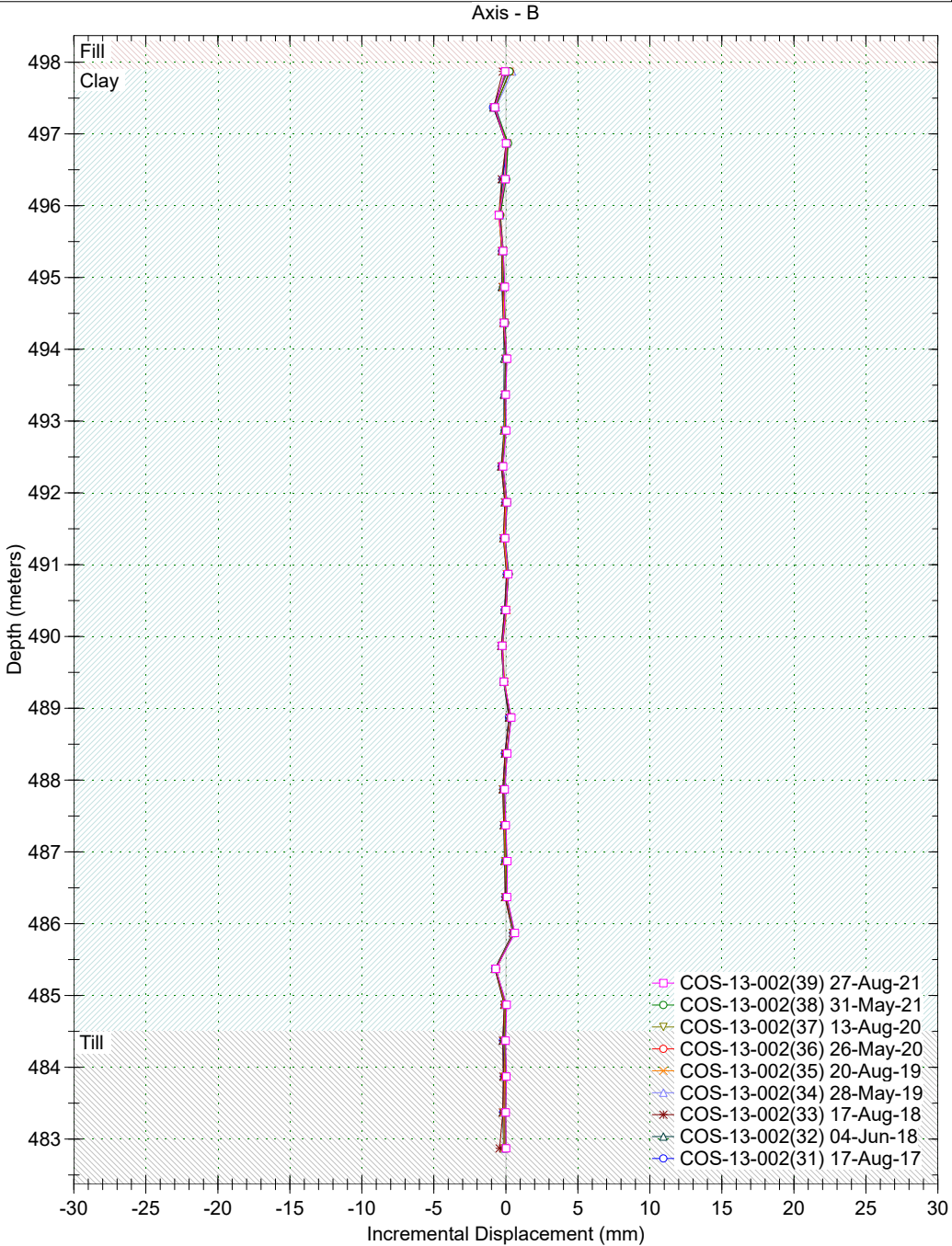
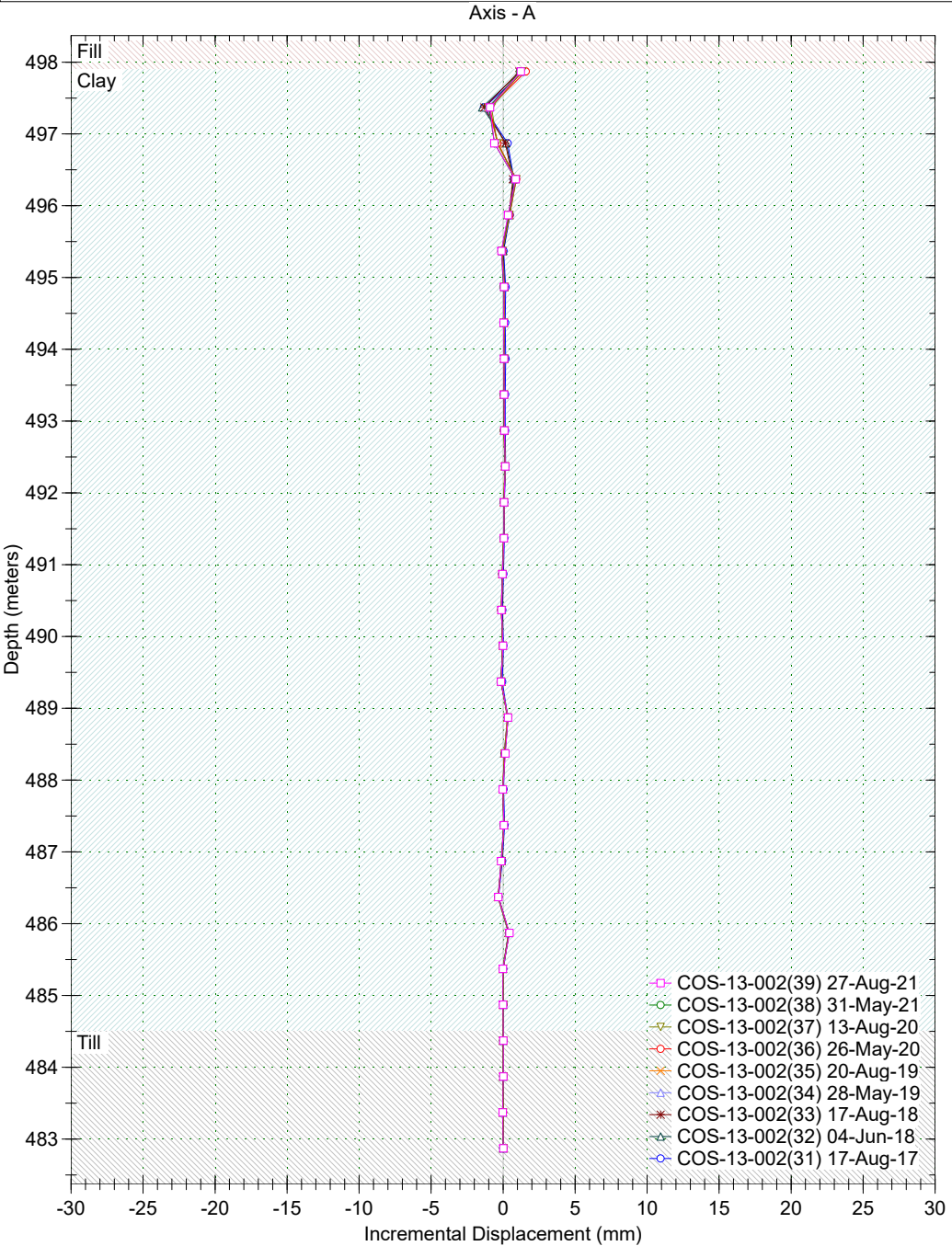
Borehole : COS-13-002  
Project : Nutana Slope  
Location : 307 11th St. E. (Front)  
Northing : 5775567.41  
Easting : 386043.54  
Collar : -0.113

Spiral Correction : N/A  
Collar Elevation : :498.37 meters  
Reading Depth : 15.5 meters  
A+ Groove Azimuth :  
Base Reading : 2013 Jul 30 16:18  
Applied Azimuth : 0.0 degrees



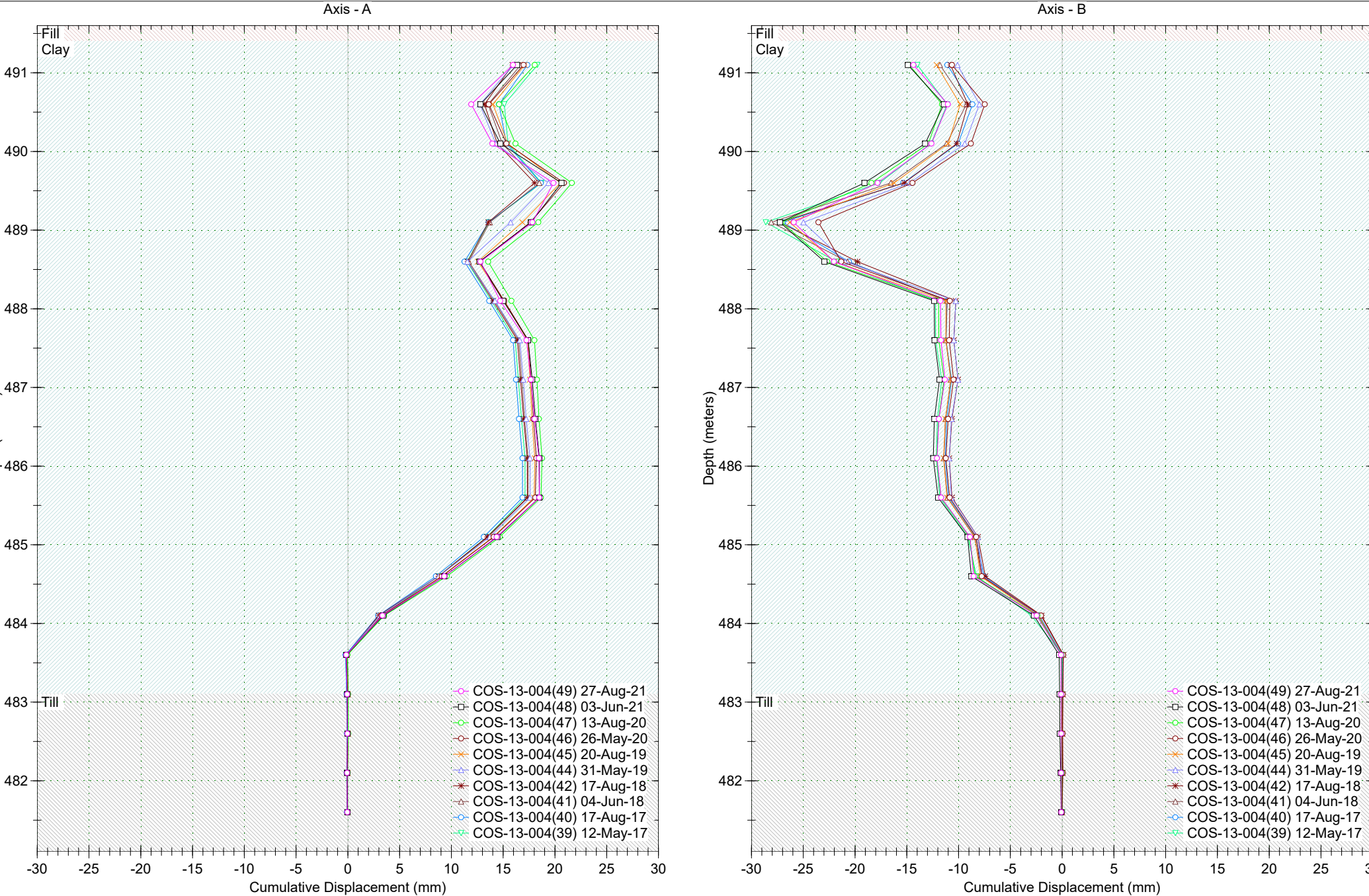
Borehole : COS-13-002  
Project : Nutana Slope  
Location : 307 11th St. E. (Front)  
Northing : 5775567.41  
Easting : 386043.54  
Collar : -0.113

Spiral Correction : N/A  
Collar Elevation : :498.37 meters  
Reading Depth : 15.5 meters  
A+ Groove Azimuth :  
Base Reading : 2013 Jul 30 16:18  
Applied Azimuth : 0.0 degrees



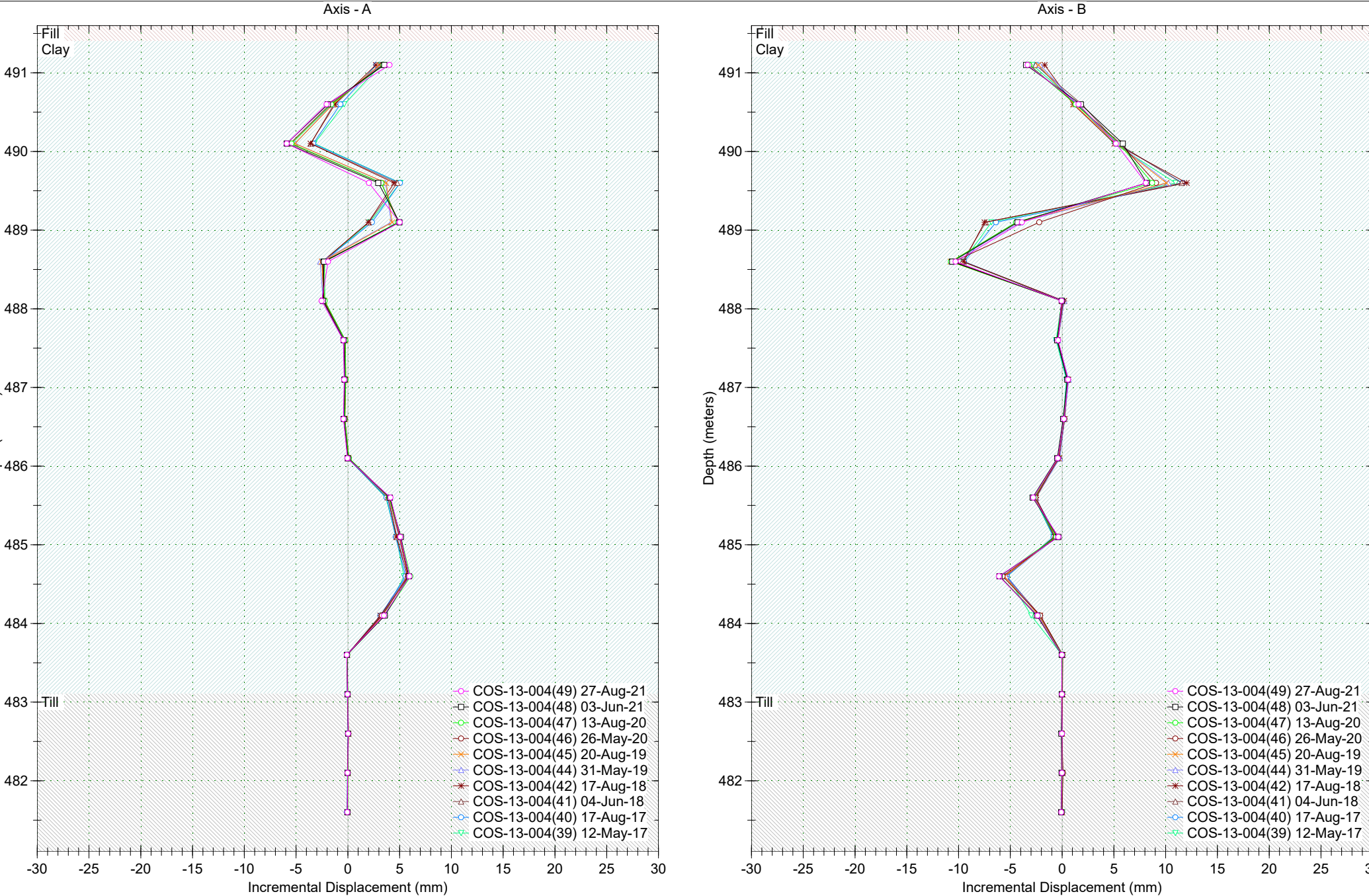
Borehole : COS-13-004  
Project : Nutana Slope  
Location : 307 11th. St. E. (back)  
Northing : 5775604.97  
Easting : 386050.63  
Collar : -0.677

Spiral Correction : N/A  
Collar Elevation : :491.60 meters  
Reading Depth : 10.0 meters  
A+ Groove Azimuth :  
Base Reading : 2013 Aug 28 08:30  
Applied Azimuth : 0.0 degrees



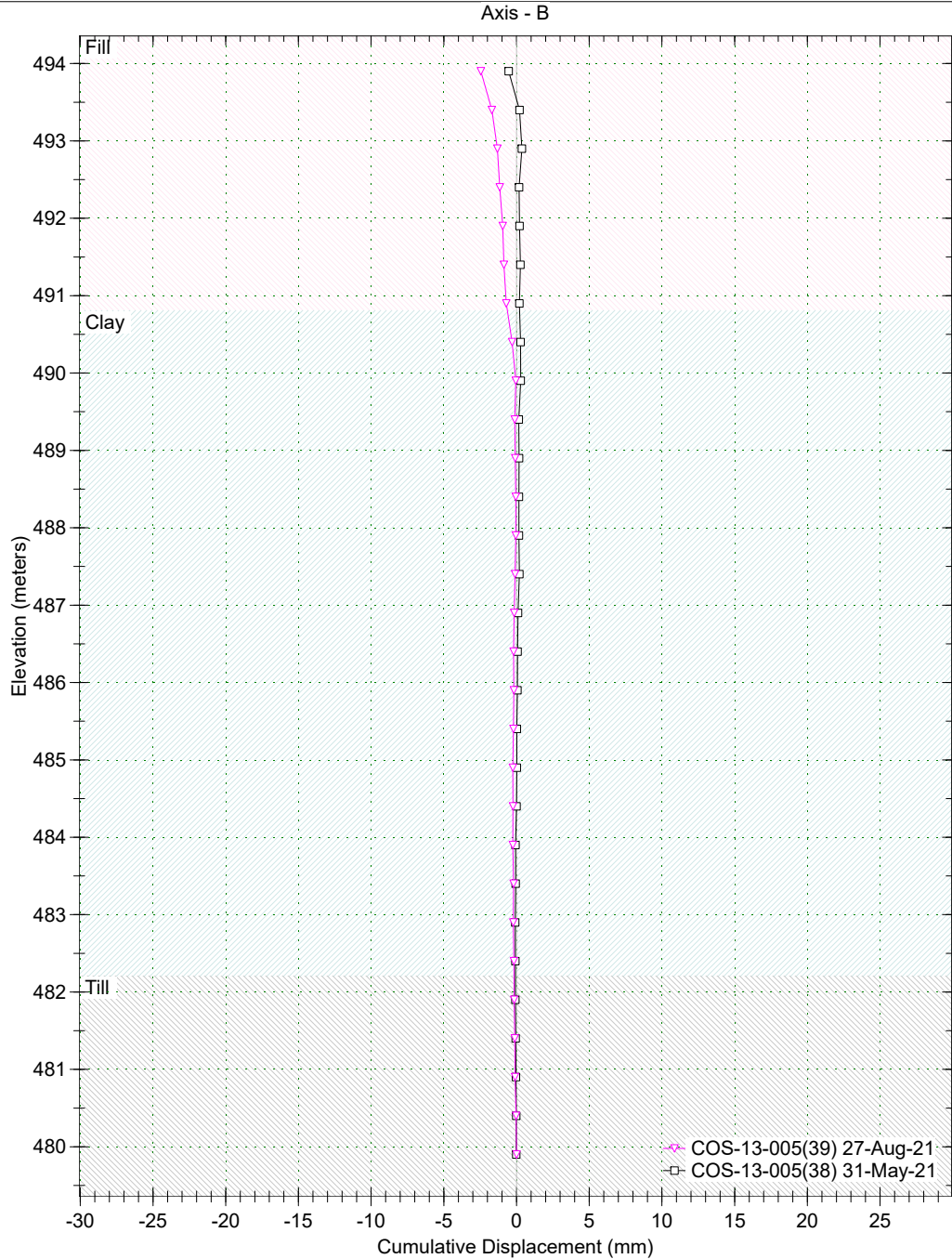
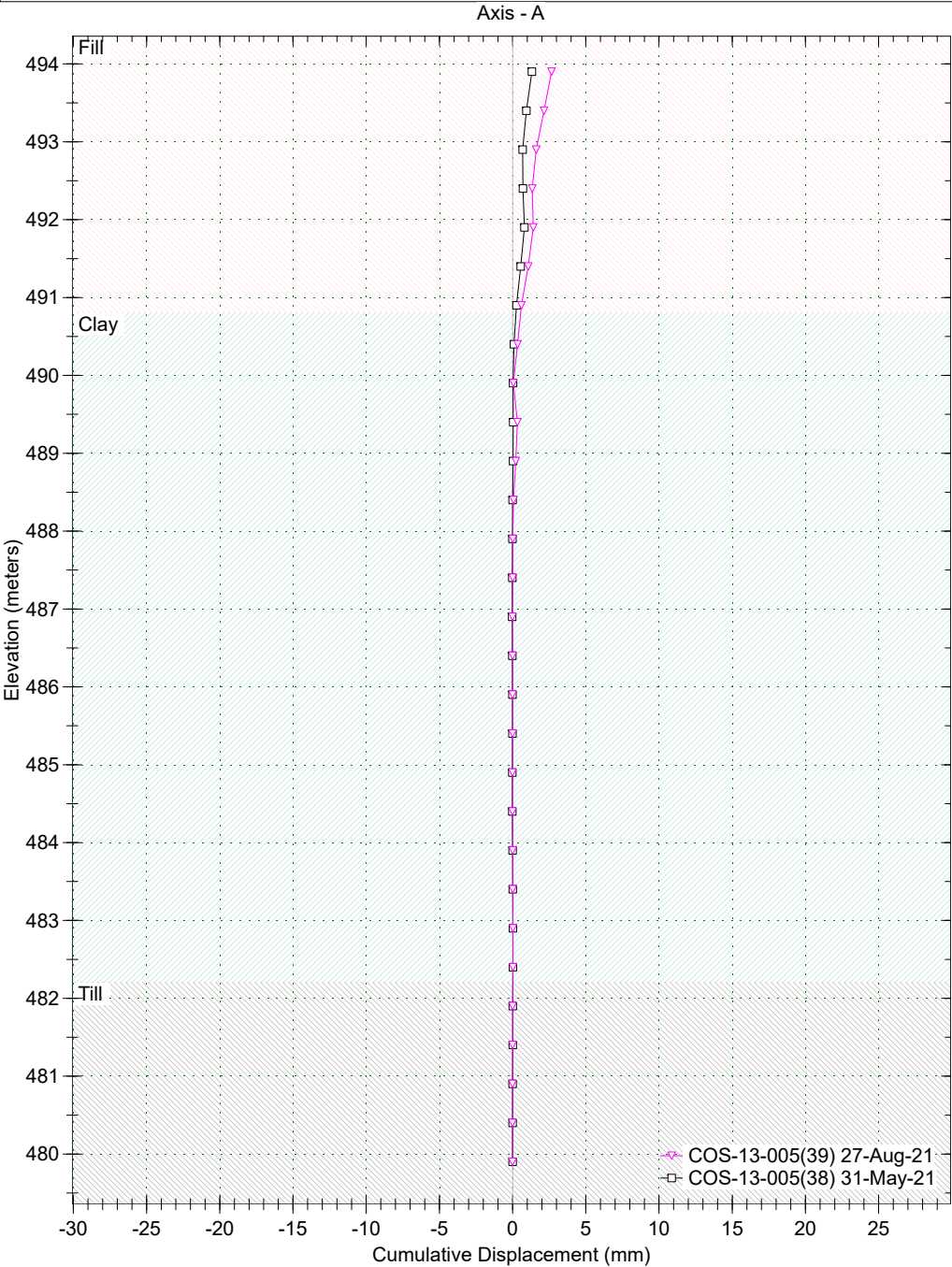
Borehole : COS-13-004  
Project : Nutana Slope  
Location : 307 11th. St. E. (back)  
Northing : 5775604.97  
Easting : 386050.63  
Collar : -0.677

Spiral Correction : N/A  
Collar Elevation : :491.60 meters  
Reading Depth : 10.0 meters  
A+ Groove Azimuth :  
Base Reading : 2013 Aug 28 08:30  
Applied Azimuth : 0.0 degrees



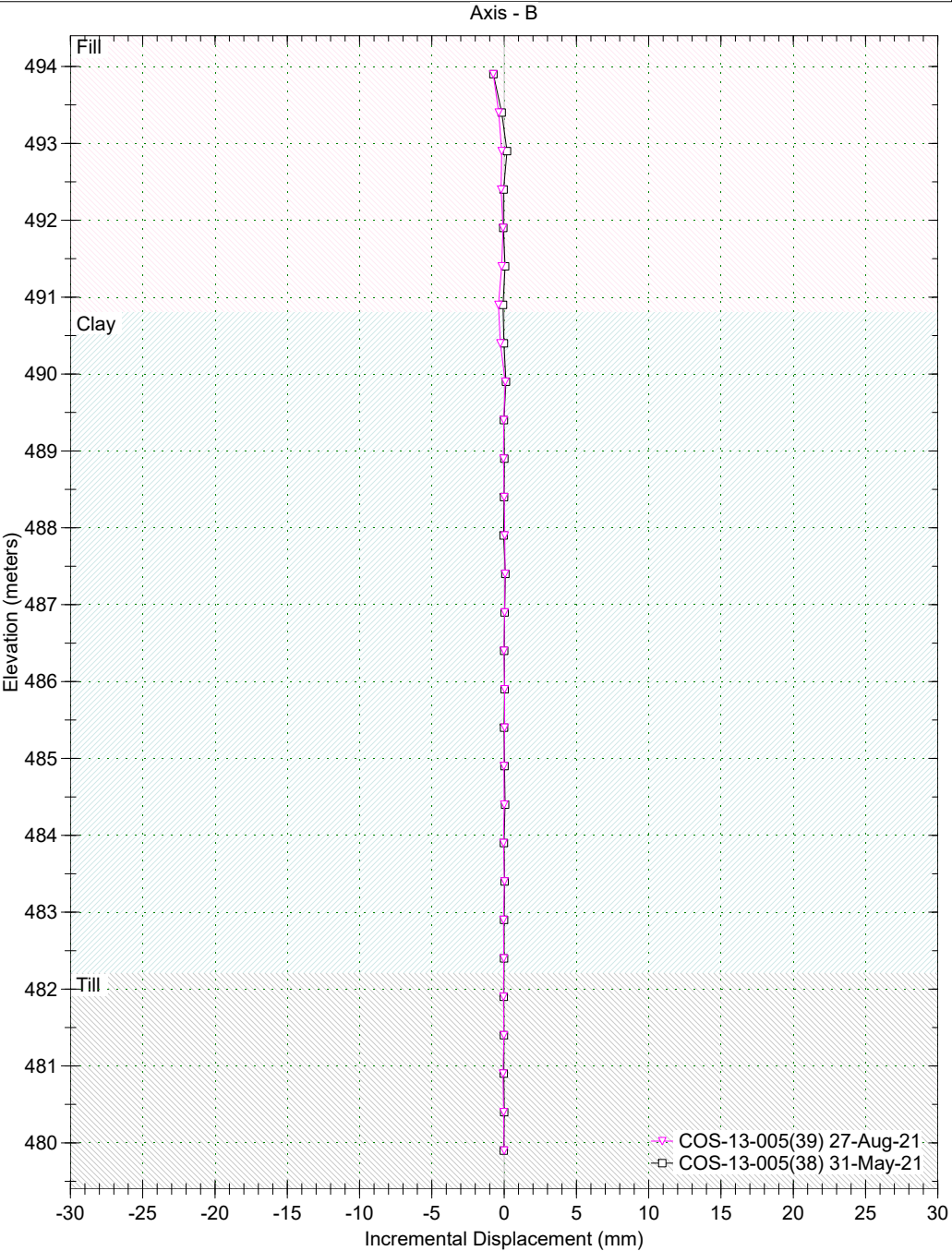
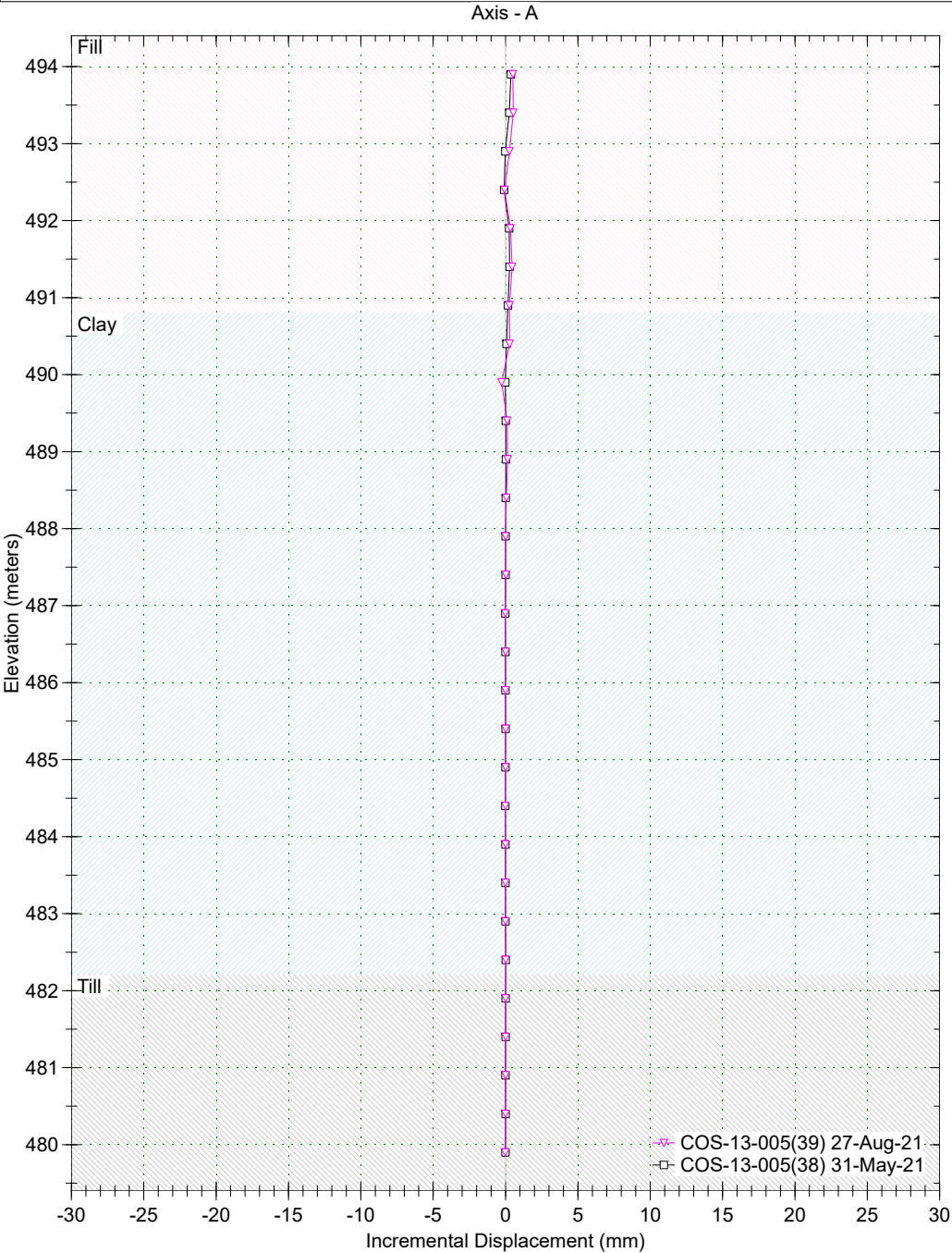
Borehole : COS-13-005 (Aug 13 2020 Baseline)  
Project : Nutana Slope  
Location : 316 Sask. Cres. E.  
Northing : 5775631.299  
Easting : 386078.8467  
Collar : -0.1

Spiral Correction : N/A  
Collar Elevation : :494.40 meters  
Reading Depth : 14.5 meters  
A+ Groove Azimuth :  
Base Reading : 2020 Aug 13 12:59  
Applied Azimuth : 0.0 degrees



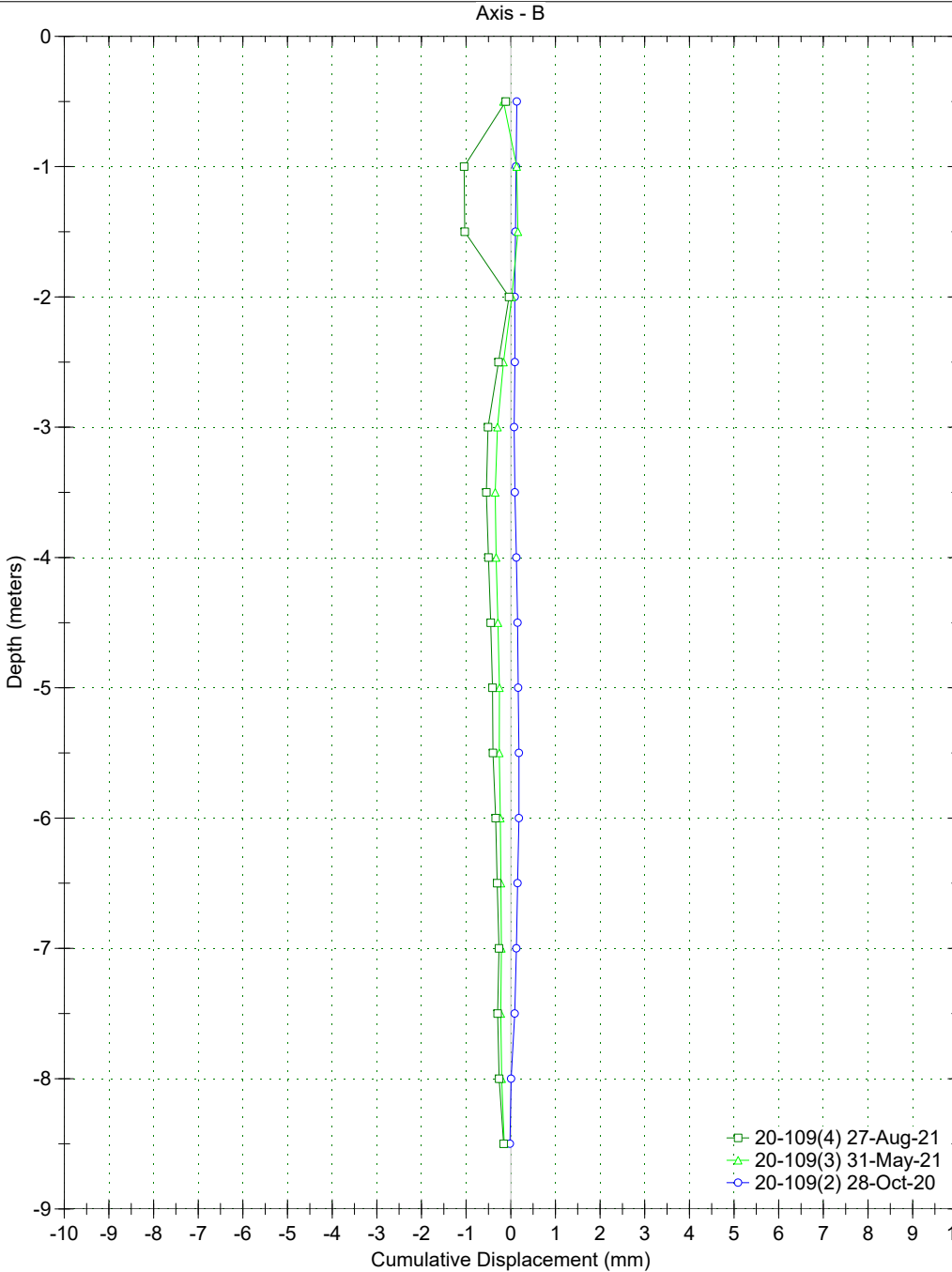
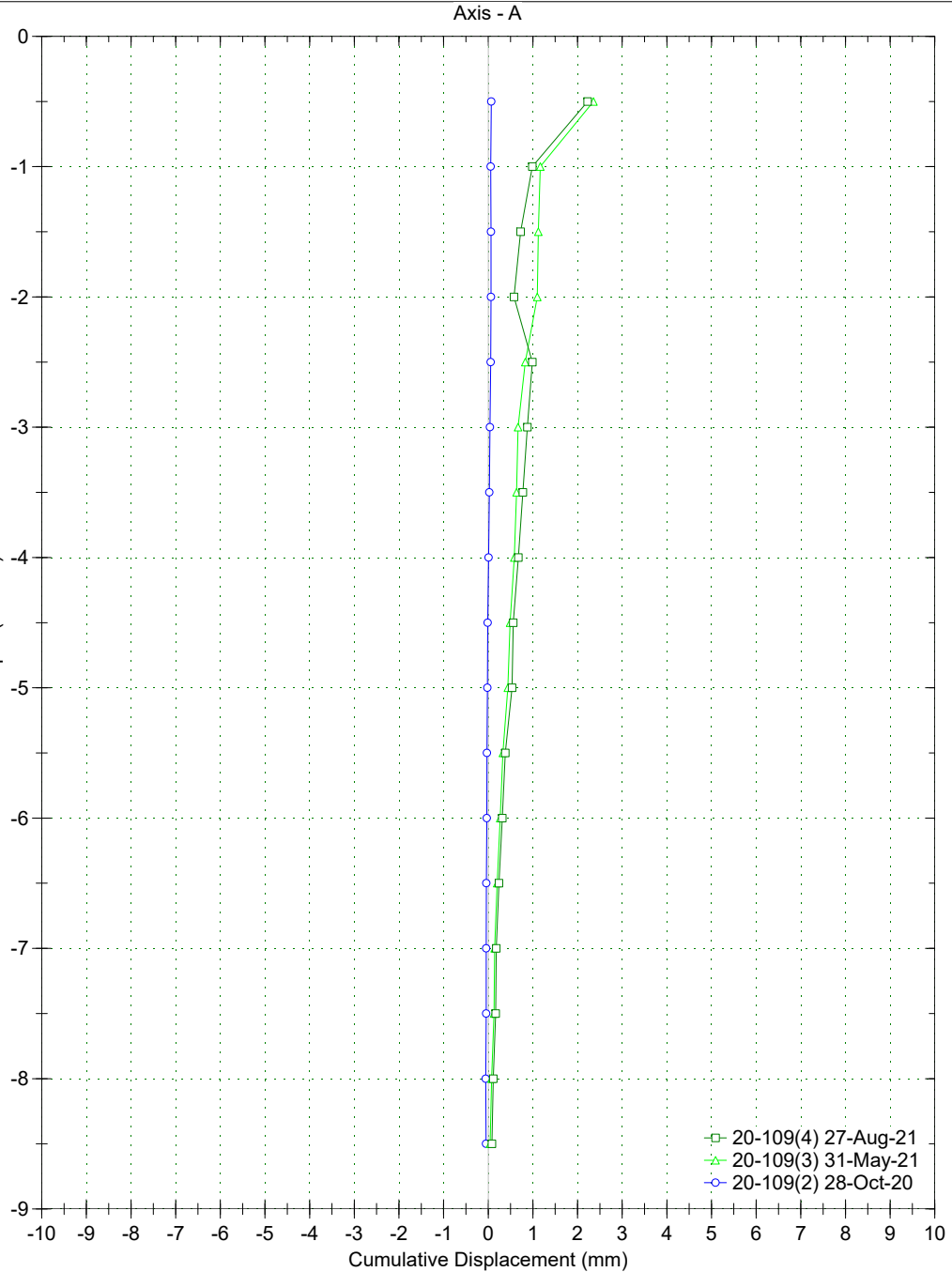
Borehole : COS-13-005 (Aug 13 2020 Baseline)  
Project : Nutana Slope  
Location : 316 Sask. Cres. E.  
Northing : 5775631.299  
Easting : 386078.8467  
Collar : -0.1

Spiral Correction : N/A  
Collar Elevation : :494.40 meters  
Reading Depth : 14.5 meters  
A+ Groove Azimuth :  
Base Reading : 2020 Aug 13 12:59  
Applied Azimuth : 0.0 degrees



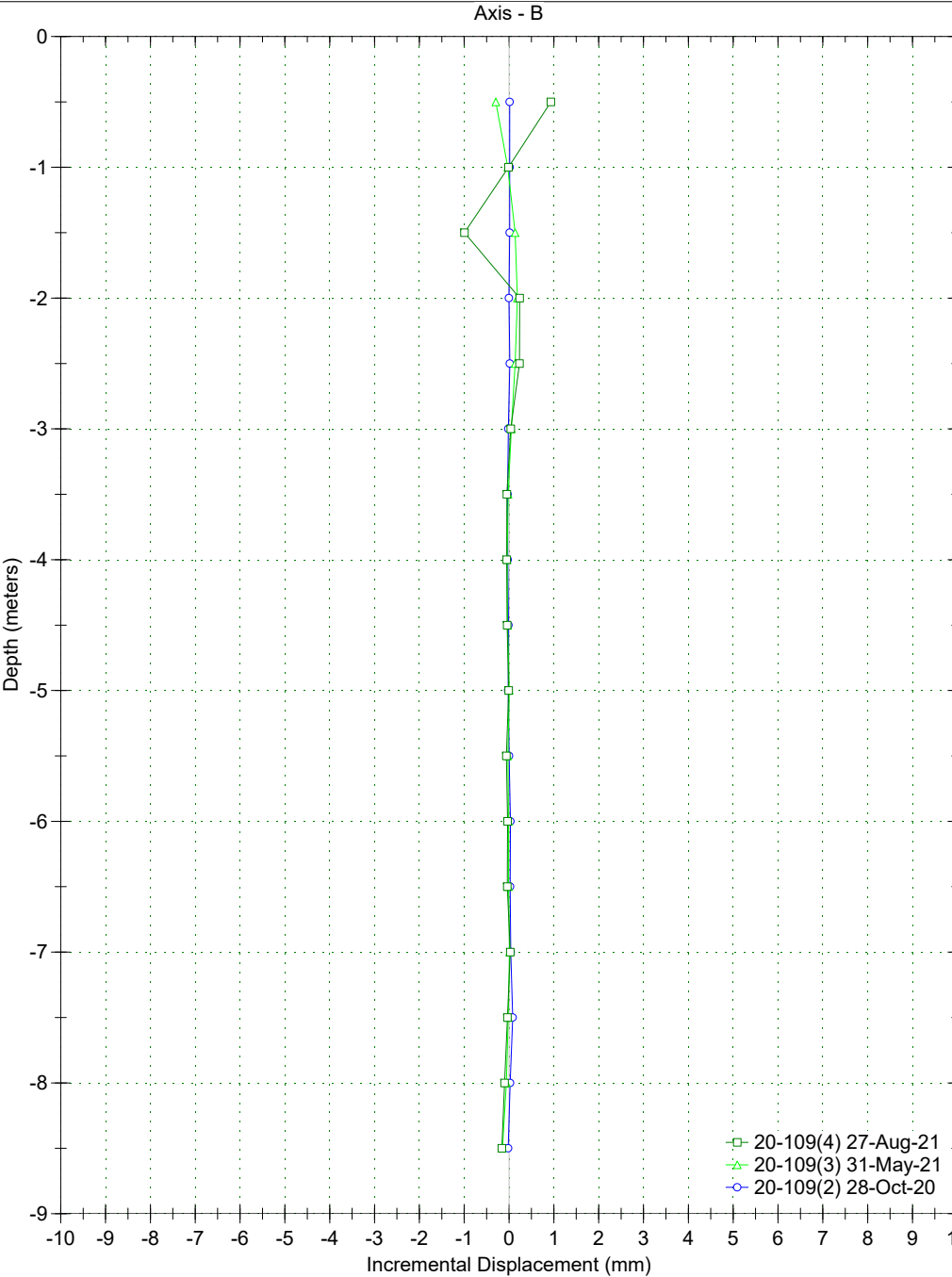
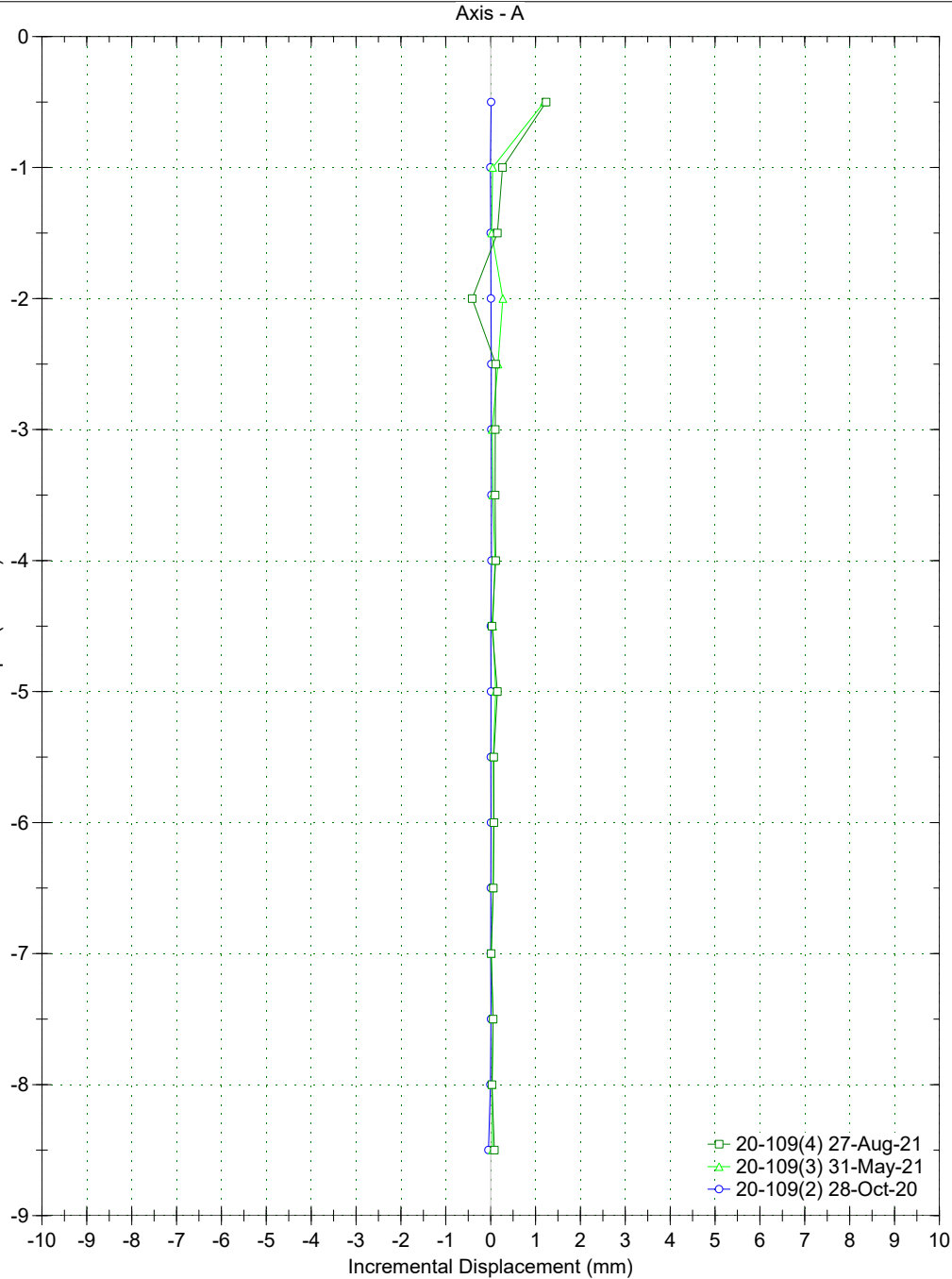
Borehole : 20-109  
Project : Nutana Slope  
Location :  
Northing : 5775622  
Easting : 385977  
Collar :

Spiral Correction : N/A  
Collar Elevation : 0.00 meters  
Reading Depth : 8.5 meters  
A+ Groove Azimuth :  
Base Reading : 2020 Oct 28 16:29  
Applied Azimuth : 0.0 degrees



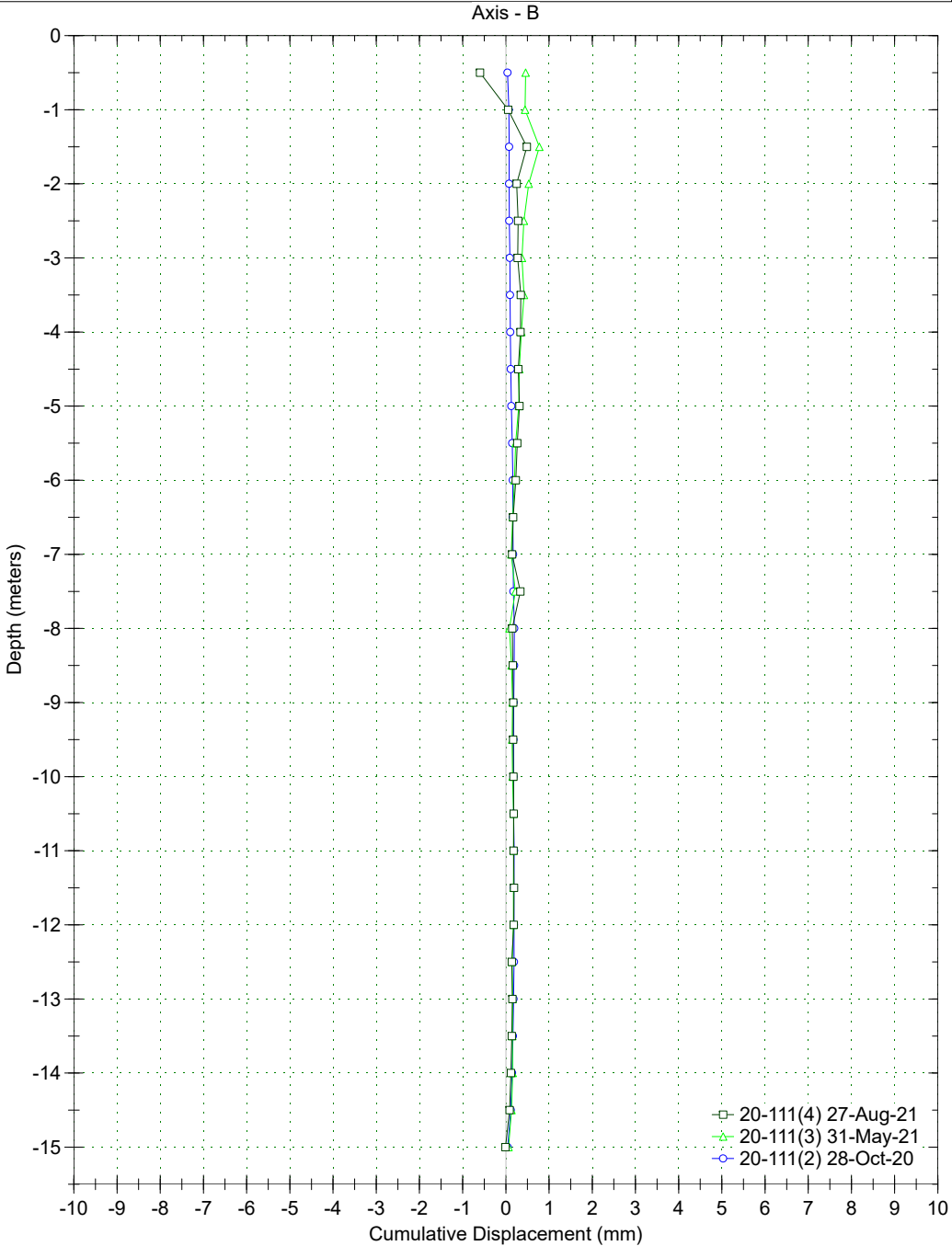
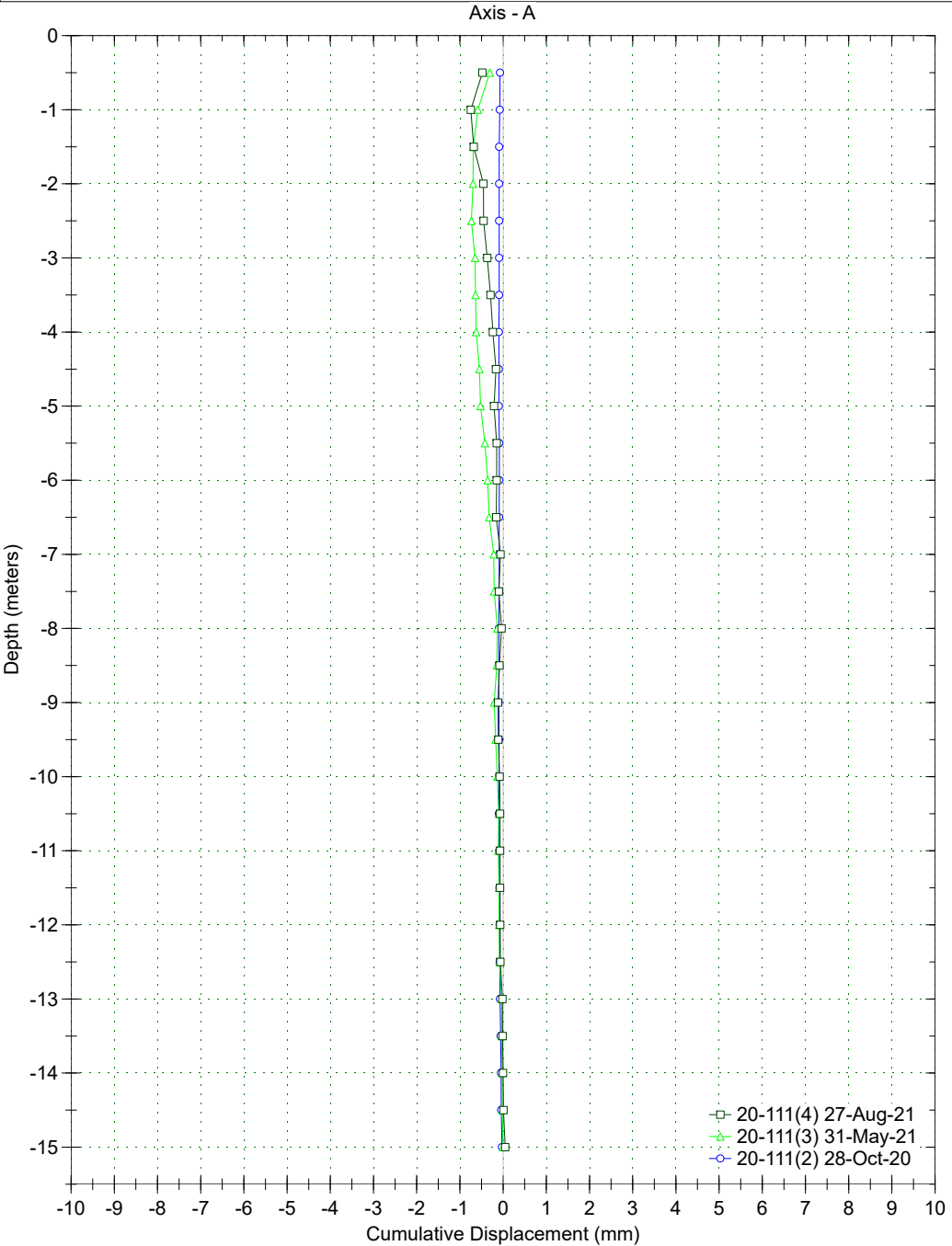
Borehole : 20-109  
Project : Nutana Slope  
Location :  
Northing : 5775622  
Easting : 385977  
Collar :

Spiral Correction : N/A  
Collar Elevation : 0.00 meters  
Reading Depth : 8.5 meters  
A+ Groove Azimuth :  
Base Reading : 2020 Oct 28 16:29  
Applied Azimuth : 0.0 degrees



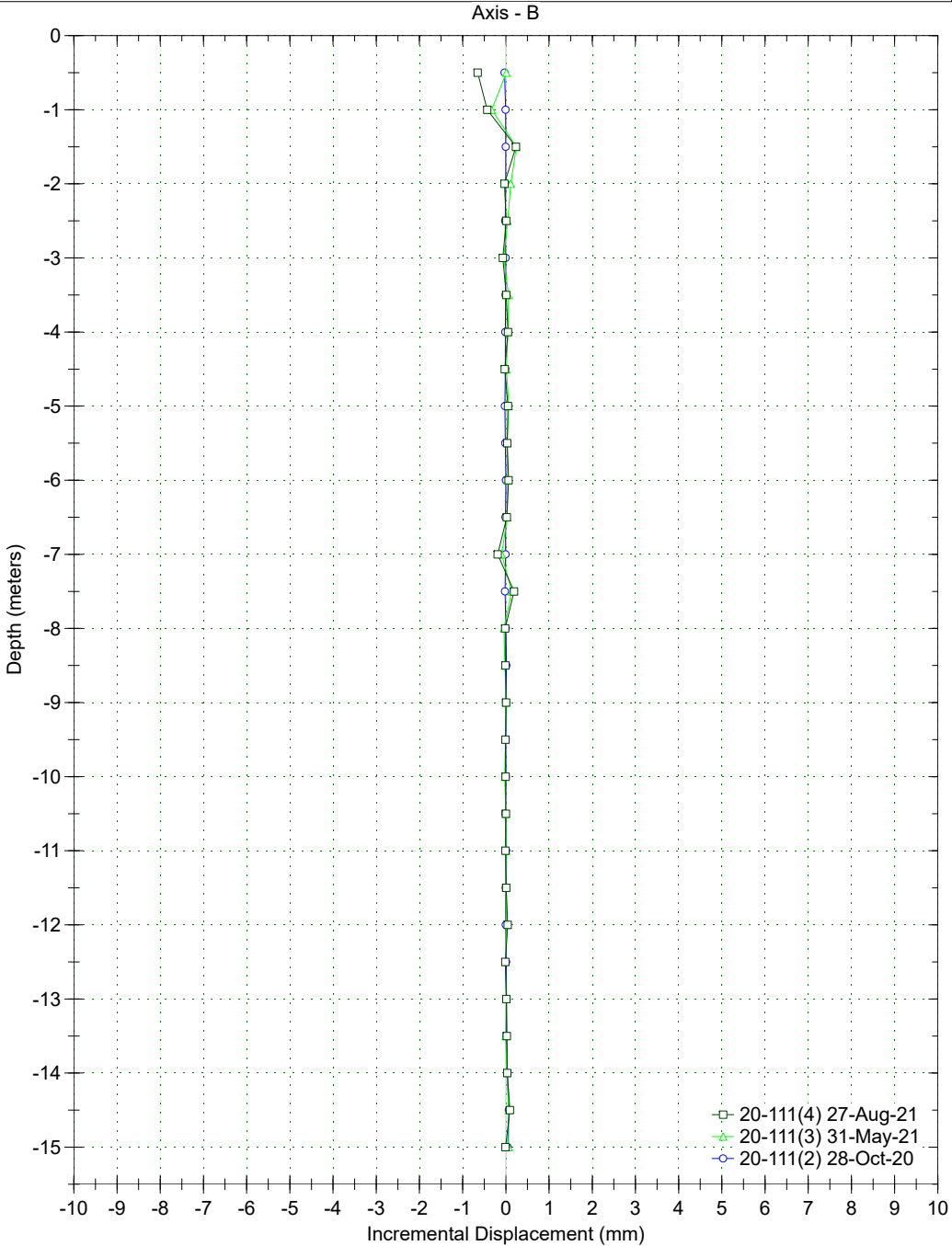
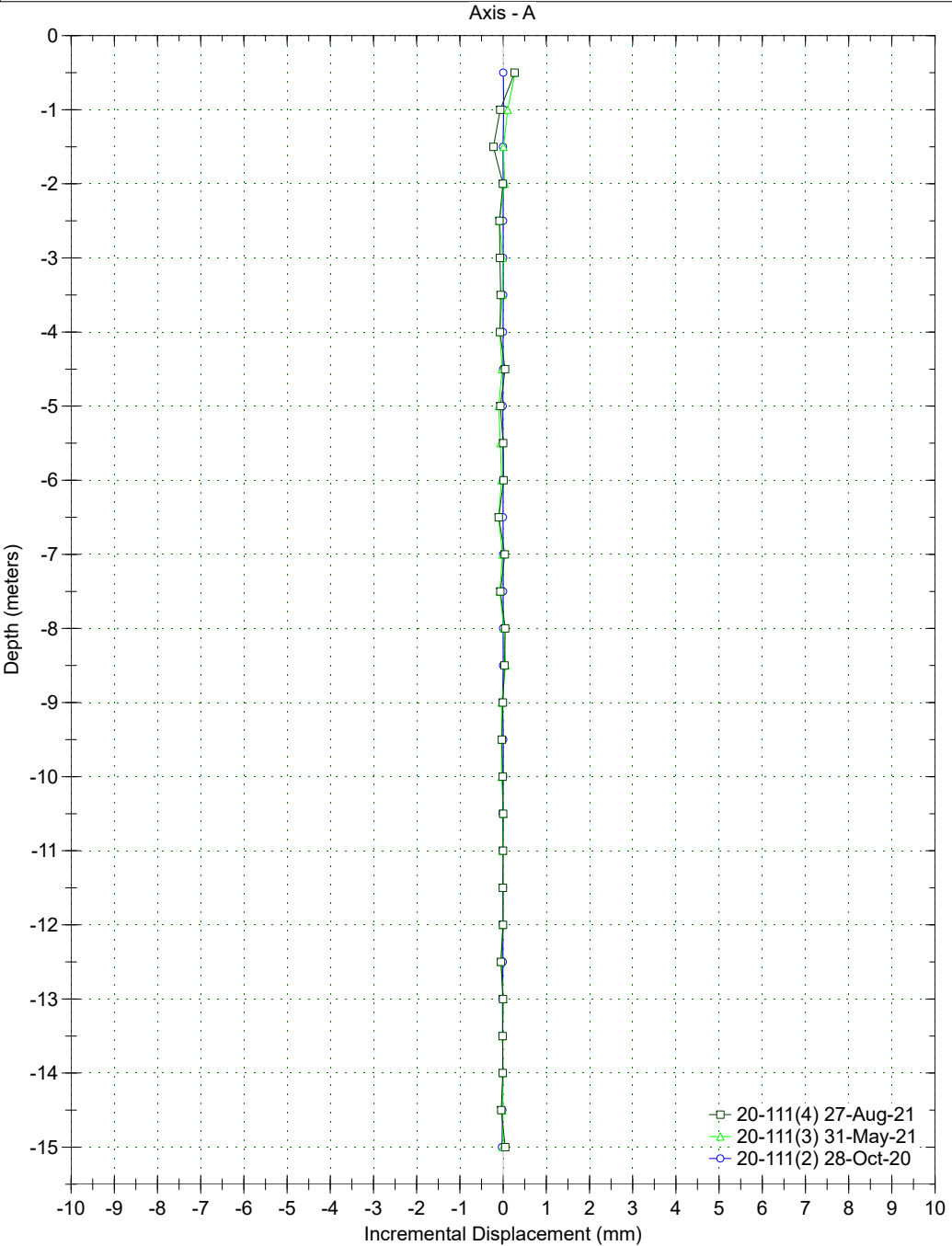
Borehole : 20-111  
Project : Nutana Slope  
Location :  
Northing : 5775568  
Easting : 385953  
Collar :

Spiral Correction : N/A  
Collar Elevation : 0.00 meters  
Reading Depth : 15.0 meters  
A+ Groove Azimuth :  
Base Reading : 2020 Oct 28 15:01  
Applied Azimuth : 0.0 degrees

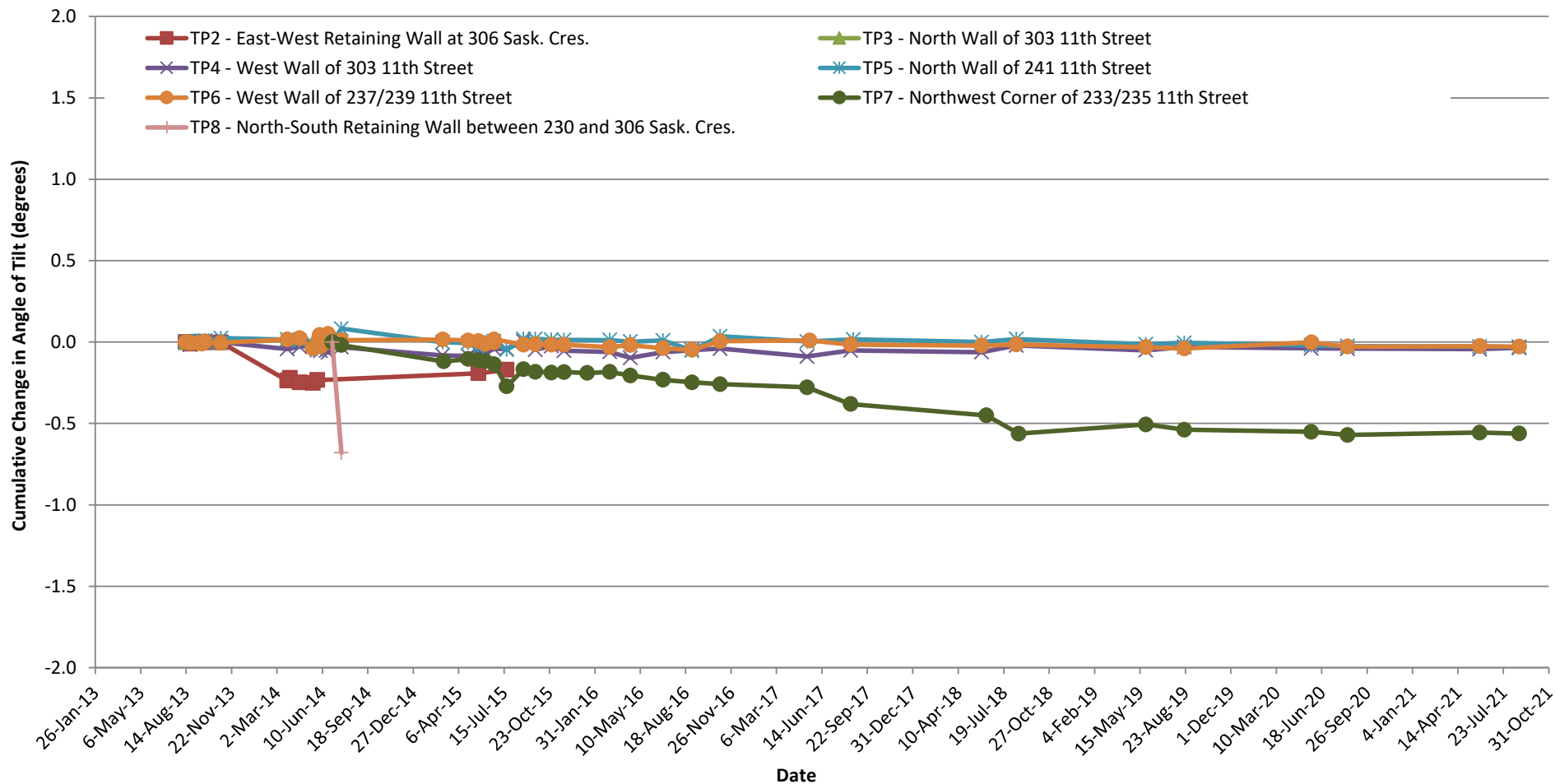


Borehole : 20-111  
Project : Nutana Slope  
Location :  
Northing : 5775568  
Easting : 385953  
Collar :

Spiral Correction : N/A  
Collar Elevation : 0.00 meters  
Reading Depth : 15.0 meters  
A+ Groove Azimuth :  
Base Reading : 2020 Oct 28 15:01  
Applied Azimuth : 0.0 degrees



## TILT PLATES



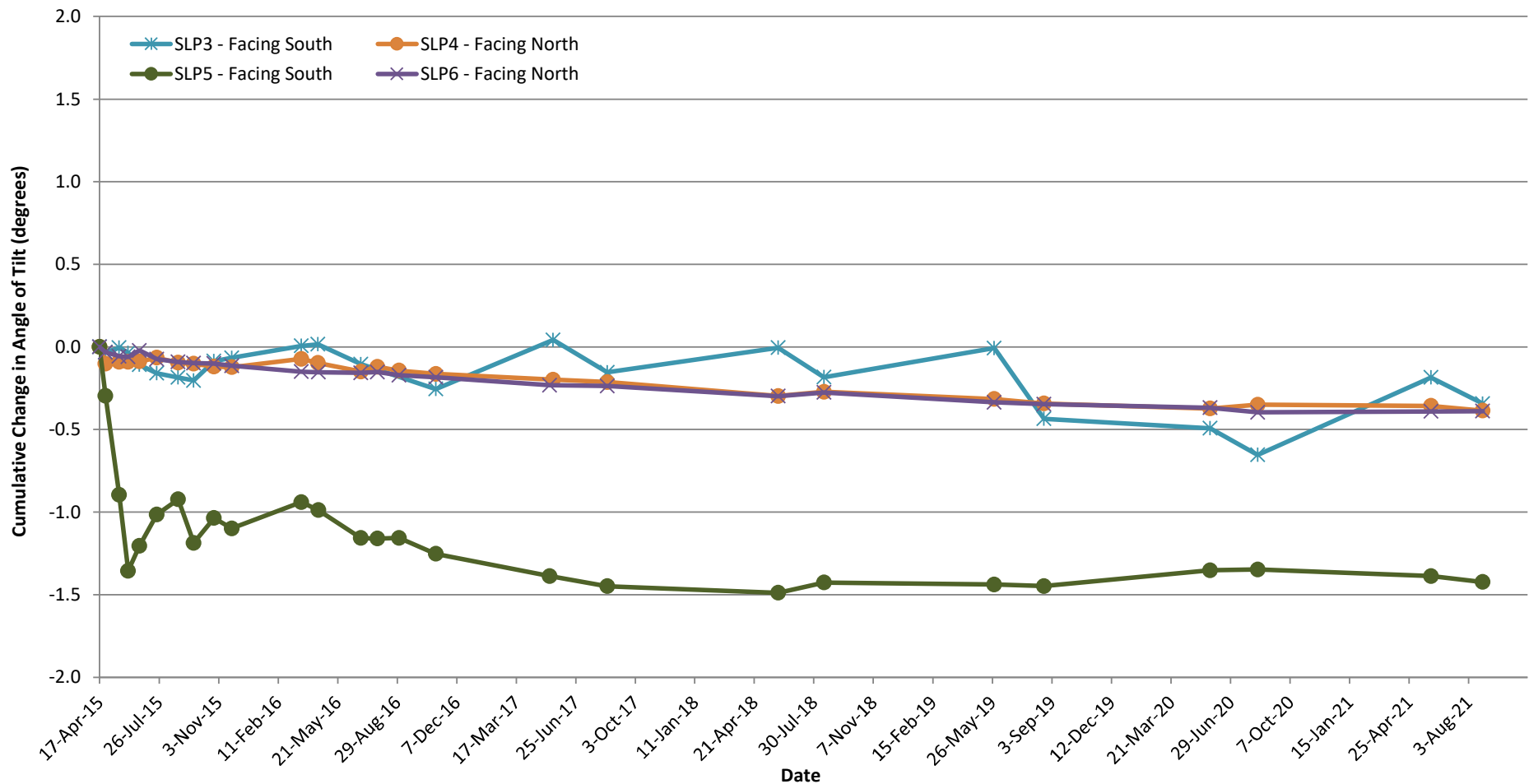
**Notes:**

- 1) Positive changes in tilt indicate tilting toward the monitoring structure.
- 2) TP1, located on the retaining wall between 230 and 306 Sask. Cres., is not monitored for health and safety reasons; monitoring results for this tilt plate show a change in angle of tilt of approximately 9 degrees between August 2013 and June 2014.
- 3) TP3 and TP8 are destroyed, and TP2 is buried.

**DRAFT**

|                                                                                                               |  |                                                                                                            |  |                             |  |           |  |     |      |
|---------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------|--|-----------------------------|--|-----------|--|-----|------|
| PROJECT                                                                                                       |  |  City of<br>Saskatoon |  | NUTANA<br>SLOPE INSTABILITY |  |           |  |     |      |
| TITLE                                                                                                         |  |                                                                                                            |  |                             |  |           |  |     |      |
| RESULTS OF TILT MONITORING                                                                                    |  |                                                                                                            |  |                             |  |           |  |     |      |
| August 2021 Monitoring                                                                                        |  |                                                                                                            |  |                             |  |           |  |     |      |
|  GOLDER<br>MEMBER OF WSP |  | PROJECT                                                                                                    |  | 20138294                    |  | FILE No.  |  |     |      |
|                                                                                                               |  | DESIGN                                                                                                     |  |                             |  | SCALE     |  | N/A | REV. |
|                                                                                                               |  | CADD                                                                                                       |  |                             |  |           |  |     |      |
|                                                                                                               |  | CHECK                                                                                                      |  |                             |  |           |  |     |      |
|                                                                                                               |  | REVIEW                                                                                                     |  |                             |  |           |  |     |      |
|                                                                                                               |  |                                                                                                            |  |                             |  | FIGURE: 4 |  |     |      |





Notes:  
1) Positive changes in tilt indicate tilting toward the monitoring structure.

**DRAFT**

|                                                                                                                      |  |                                                                                                                |     |                                 |  |
|----------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------|-----|---------------------------------|--|
| PROJECT                                                                                                              |  |  <b>City of Saskatoon</b> |     | <b>NUTANA SLOPE INSTABILITY</b> |  |
| TITLE                                                                                                                |  |                                                                                                                |     |                                 |  |
| <b>RESULTS OF TILT MONITORING</b><br>August 2021 Monitoring                                                          |  |                                                                                                                |     |                                 |  |
| PROJECT                                                                                                              |  | 20138294                                                                                                       |     | FILE No.                        |  |
| DESIGN                                                                                                               |  | SCALE                                                                                                          | N/A | REV.                            |  |
| CADD                                                                                                                 |  | <b>FIGURE: 5</b>                                                                                               |     |                                 |  |
| CHECK                                                                                                                |  |                                                                                                                |     |                                 |  |
| REVIEW                                                                                                               |  |                                                                                                                |     |                                 |  |
|  <b>GOLDER</b><br>MEMBER OF WSP |  |                                                                                                                |     |                                 |  |

## SITE PHOTOGRAPHS



**Photograph 1: Looking west down the back alley at the East Failure (August 27, 2021)**



**Photograph 2: Looking west down the back alley at the West Failure (August 27, 2021)**