TECHNICAL MEMORANDUM

DATE May 31, 2024 **Reference No.** CA0029692.9234-TM-01-Rev0

TO Vanessa Heilman, P.Eng.
City of Saskatoon

CC Greg Misfeldt (WSP)

FROM Blaise Wilson, Hung Vu **EMAIL blaise.wilson@wsp.com; hung.vu@wsp.com**

NUTANA SLOPE STABILITY UPDATE – MAY 2024

1.0 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the City of Saskatoon (COS) to complete the monitoring of select geotechnical instrumentation and provide the monitoring data results for the slope failures (referred to as the west slide and east slide) at the Nutana Slope Instability site. Locations of the 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.

1.1 Background

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 11th 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 11th Street East, through the back alley, and into the back yard of 306, 310 and 316 Saskatchewan Crescent East.

2.0 FIELD MONITORING RESULTS

Instrumentation monitoring of the slope inclinometers and tilt plates were collected by WSP on May 8, 2024. The monitoring results for this period are summarised below. Photos of the site conditions are attached to this memorandum in Appendix A. The results of the instrumentation monitoring are presented in Appendix B.

2.1 Slope Inclinometer Data

The slope inclinometer monitoring plots are shown in Appendix B.

- Inclinometer COS-13-002 indicated insignificant movement (less than 2 mm or 0.08 in), between August 16, 2023 and May 8, 2024.
- Inclinometer COS-13-004 showed a drift in the displacement plots with approximately 2 mm (0.08 in) of movement, in the upslope direction, between August 16, 2024 and May 8, 2024.

- Inclinometer COS-13-005 indicated approximately 2 mm (0.08 in) of movement, in the upslope direction, between August 16, 2024 and May 8, 2024. This inclinometer plot showed apparent movement in the direction parallel with Cherry Lane.
- Inclinometer 20-109 indicated approximately 2.5 mm (0.10 in) of downslope movement between August 16, 2023 and May 8, 2024. This inclinometer plot showed a drift in the direction parallel with Cherry Lane, similar to what was observed in 2022 and 2023.
- Inclinometer 20-111 indicated insignificant movement (less than 2 mm or 0.08 in), between August 16, 2023 and May 8, 2024.

2.2 Tilt Plate Data

The results of the tilt plate monitoring are shown on Figure B1 for the City of Saskatoon tilt plates, and in Figure B2 for the tilt plates installed on SL&P power poles.

- Tilt plates TP4, TP5, and TP7 indicate insignificant changes in angle of tilt (less than 0.05 degrees) between August 16, 2023 and May 8, 2024.
- Tilt Plate TP6 indicated a change in angle of tile of approximately 0.05 degrees, towards the building, between August 16, 2023 and May 8, 2024.
- Tilt Plate SLP3 indicated a change in angle of tilt of approximately 0.13 degrees, towards the north, between August 16, 2023 and May 8, 2024. However, past readings for SLP3 have been erratic and appear to be affected by seasonal changes.
- Tilt plates SLP4 and SLP5 indicated an insignificant change in angle of tilt (less than 0.05 degrees) between August 16, 2023 and May 8, 2024. However, the tilt monitoring plots indicate a trend of steady tilt of approximately 0.05 degrees/year.
- Tilt plate SLP6 indicated a change in angle of tilt of approximately 0.09 degrees, towards the north, between August 16, 2023 and May 8, 2024.

3.0 CLOSURE

This memorandum provides a factual summary of the instrumentation monitoring results from the May 2024 period. WSP is providing this information for the specific use of the City of Saskatoon. No other party may rely on the information provided herein, or any portion thereof. This memorandum is not intended to serve as a geotechnical assessment and therefore should not be used as the geotechnical basis for any future developments.

We trust that this memorandum provides you with the information you require at this time.

WSP Canada Inc.

Blaise Wilson, P.Eng.
Senior Geotechnical Engineer

Hung Vu, Ph.D., P.Eng.
Senior Principal Geotechnical Engineer

BW/HV/tt

Distribution: Greg Misfeldt (WSP)

Attachments: Figure 1: Instrumentation Plan No. 1
Figure 2: Instrumentation Location Plan No. 2
Figure 3: Instrumentation Location Plan No. 3
Appendix A: Site Photographs
Appendix B: Instrumentation Monitoring Results

https://wsponlinecan.sharepoint.com/sites/ca-ca00296929234/shared documents/06. deliverables/01 may2024/ca0029692.9234-tm-01-rev0 - cos nutana monitoring update_may2024.docx

APPENDIX A

Figures

LEGEND

● PIN LOCATION

303 LOT NUMBER

REFERENCE(S)

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

0 10 20

1:600 METRES

CLIENT

City of Saskatoon

PROJECT

NUTANA SLOPE INSTABILITY

TITLE

INSTRUMENTATION PLAN No. 1

CONSULTANT

wsp

YYYY-MM-DD	2024-05-22
DESIGNED	BW
PREPARED	JMC
REVIEWED	BW
APPROVED	HV

PROJECT NO.	PHASE	REV.	FIGURE
CA0029692.9234	1000	0	1

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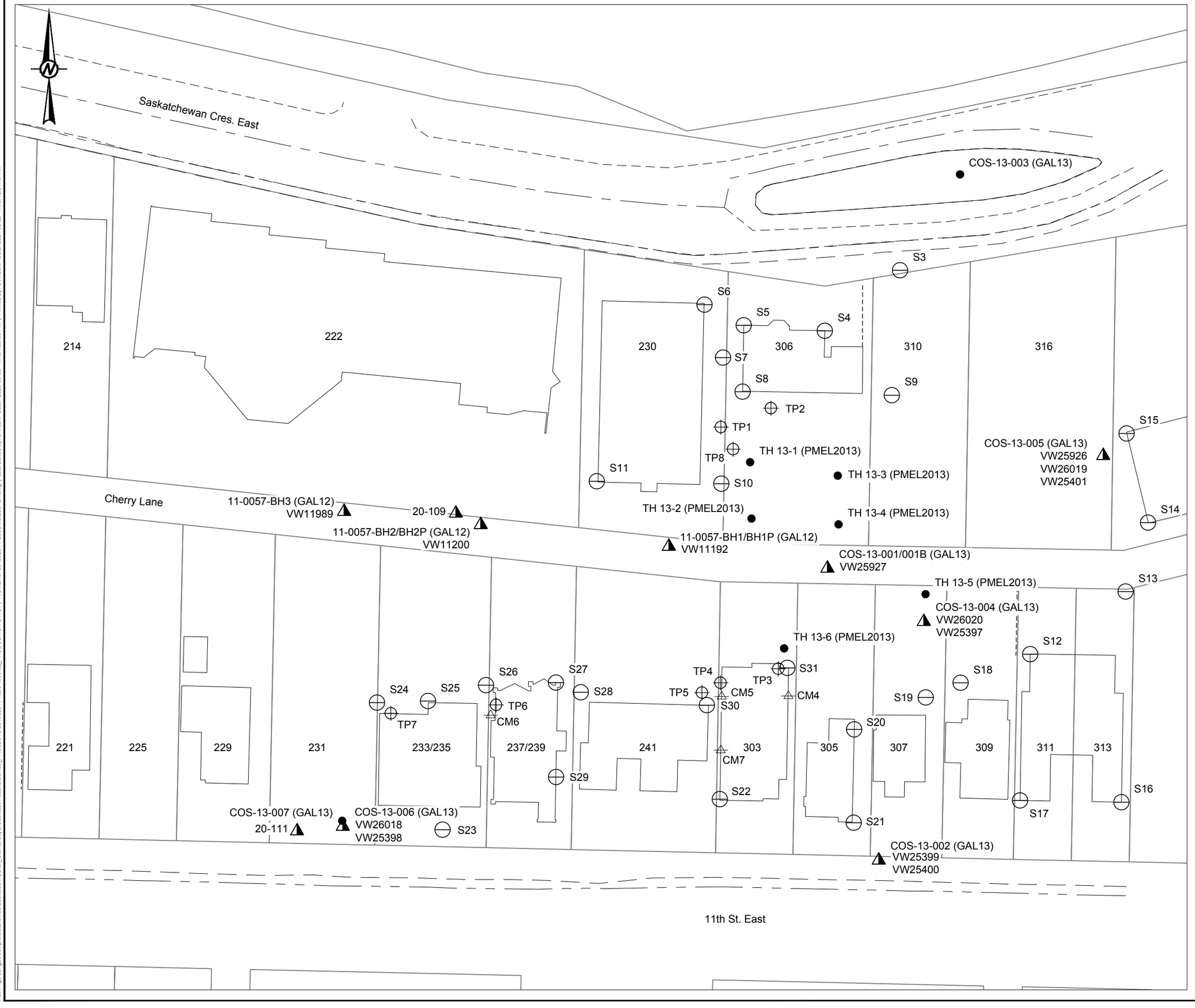
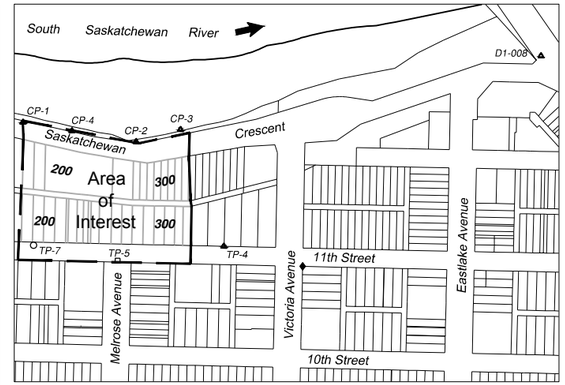
0 25mm





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

0 10 20
1:600 METRES

CLIENT
City of Saskatoon

PROJECT
NUTANA SLOPE INSTABILITY

TITLE
INSTRUMENTATION LOCATION PLAN No. 2

CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
DESIGNED	BW
PREPARED	JMC
REVIEWED	BW
APPROVED	HV

PROJECT NO.	PHASE	REV.	FIGURE
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0 25 mm

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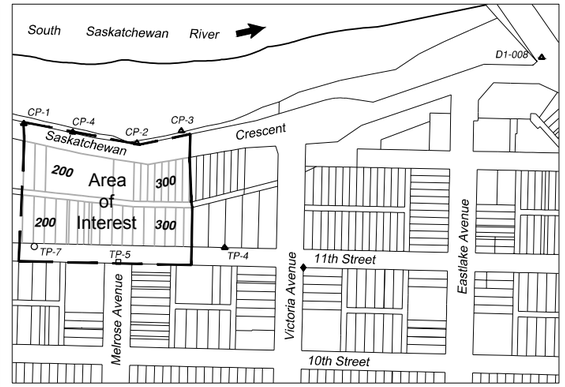

CONTROL POINTS

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D1-008	5,775,775.85	386,467.62	499.033	CONTROL TABLET

LEGEND

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

REFERENCE(S)

LOT LOCATIONS PROVIDED BY CITY OF SASKATOON
CITY OF SASKATOON DATUM

0 12.5 25
1:750 METRES

CLIENT

City of Saskatoon

PROJECT

NUTANA SLOPE INSTABILITY

TITLE

INSTRUMENTATION LOCATION PLAN No. 3

CONSULTANT

wsp

YYYY-MM-DD	2024-05-22
DESIGNED	BW
PREPARED	JMC
REVIEWED	BW
APPROVED	HV

PROJECT NO.	PHASE	REV.	FIGURE
CA0029692.9234	1000	0	3

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

0 25 mm

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APPENDIX B

Site Photographs

Photograph 1: Looking west down the back alley at the East Failure (May 8, 2024)

Photograph 2: Looking west down the back alley at the West Failure (May 8, 2024)

APPENDIX C

Instrumentation Monitoring Results

SLOPE INCLINOMETERS

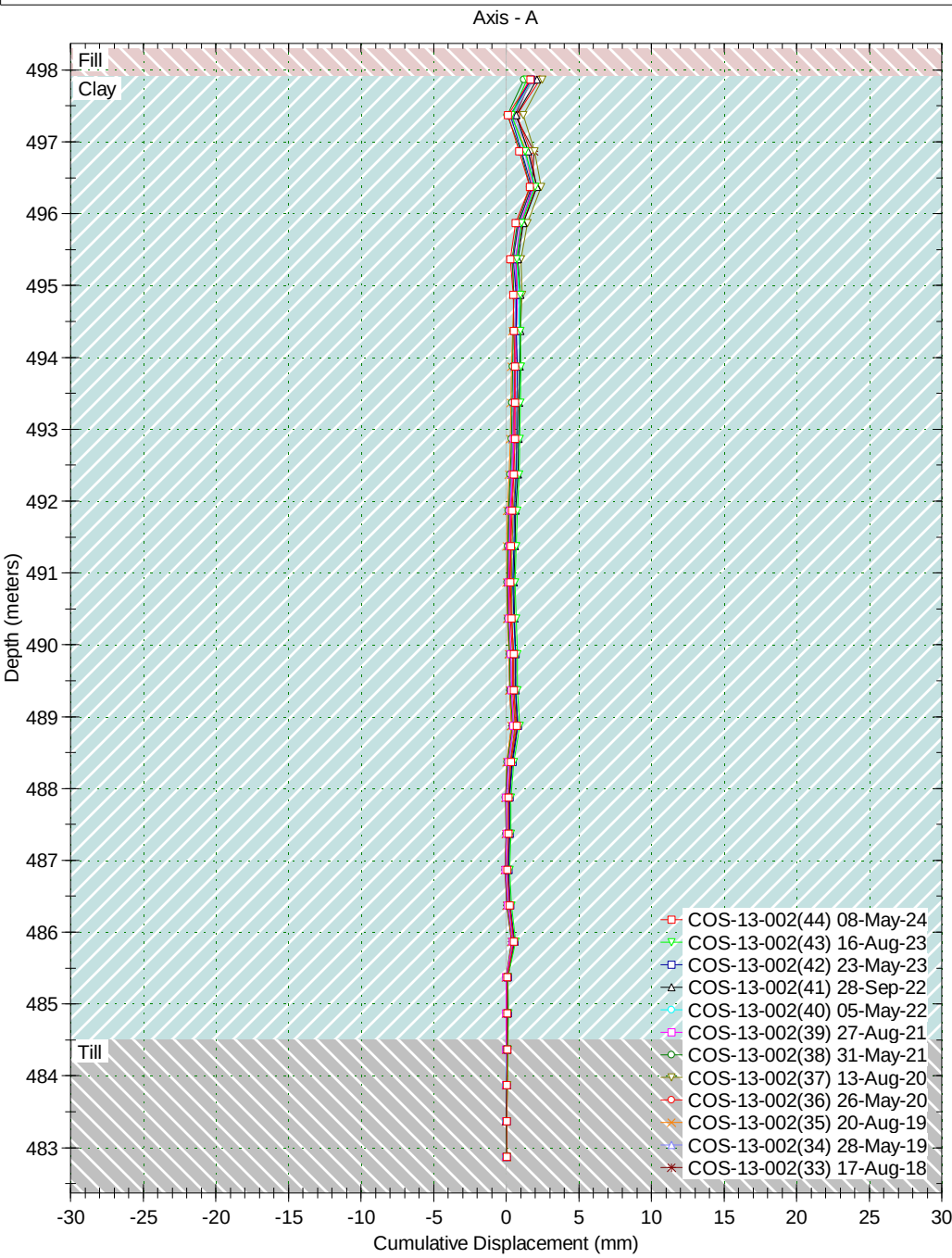
RST Instruments Ltd.

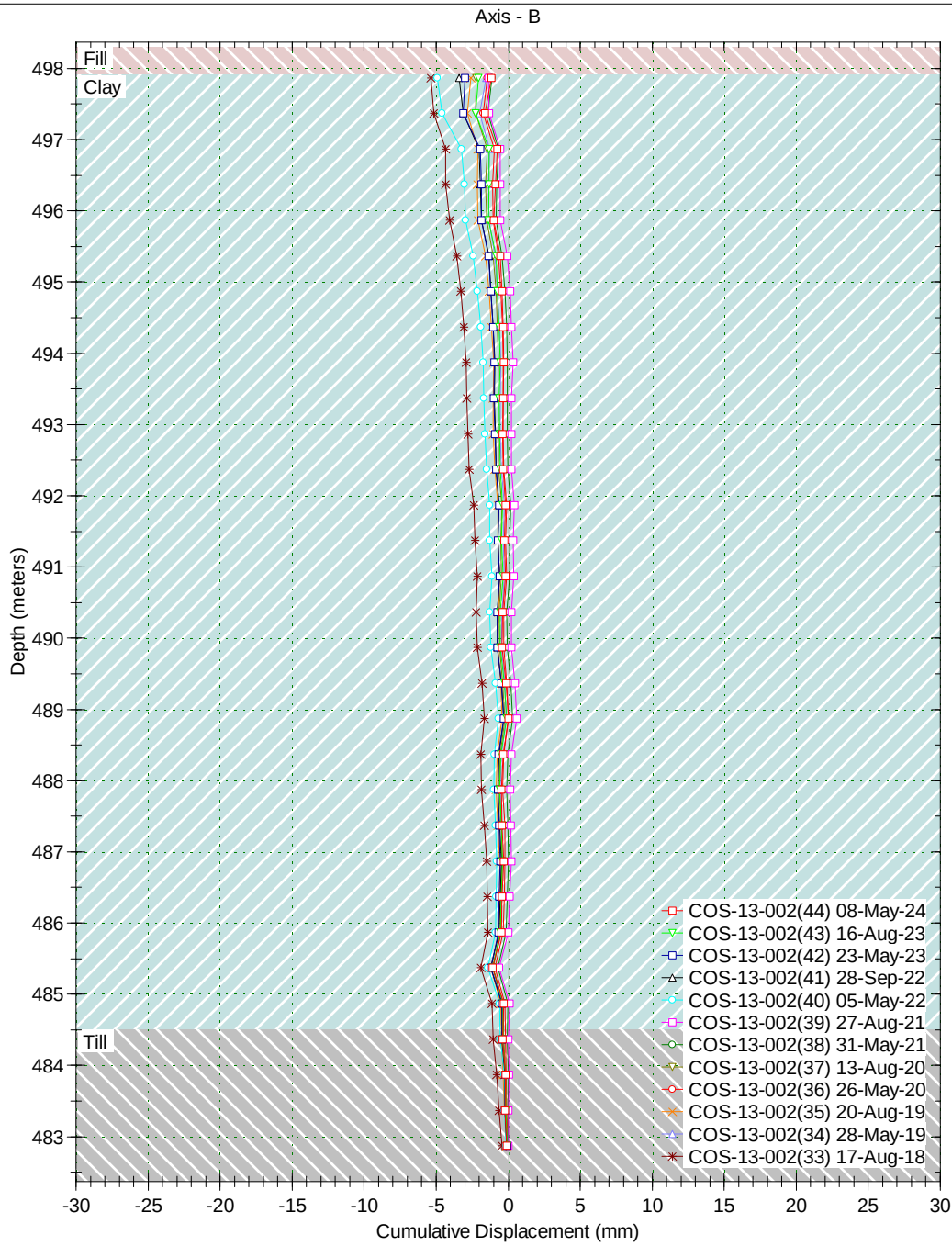
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.49.0

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





RST Instruments Ltd.

INCREMENTAL DISPLACEMENT

Inclinalysis v. 2.49.0

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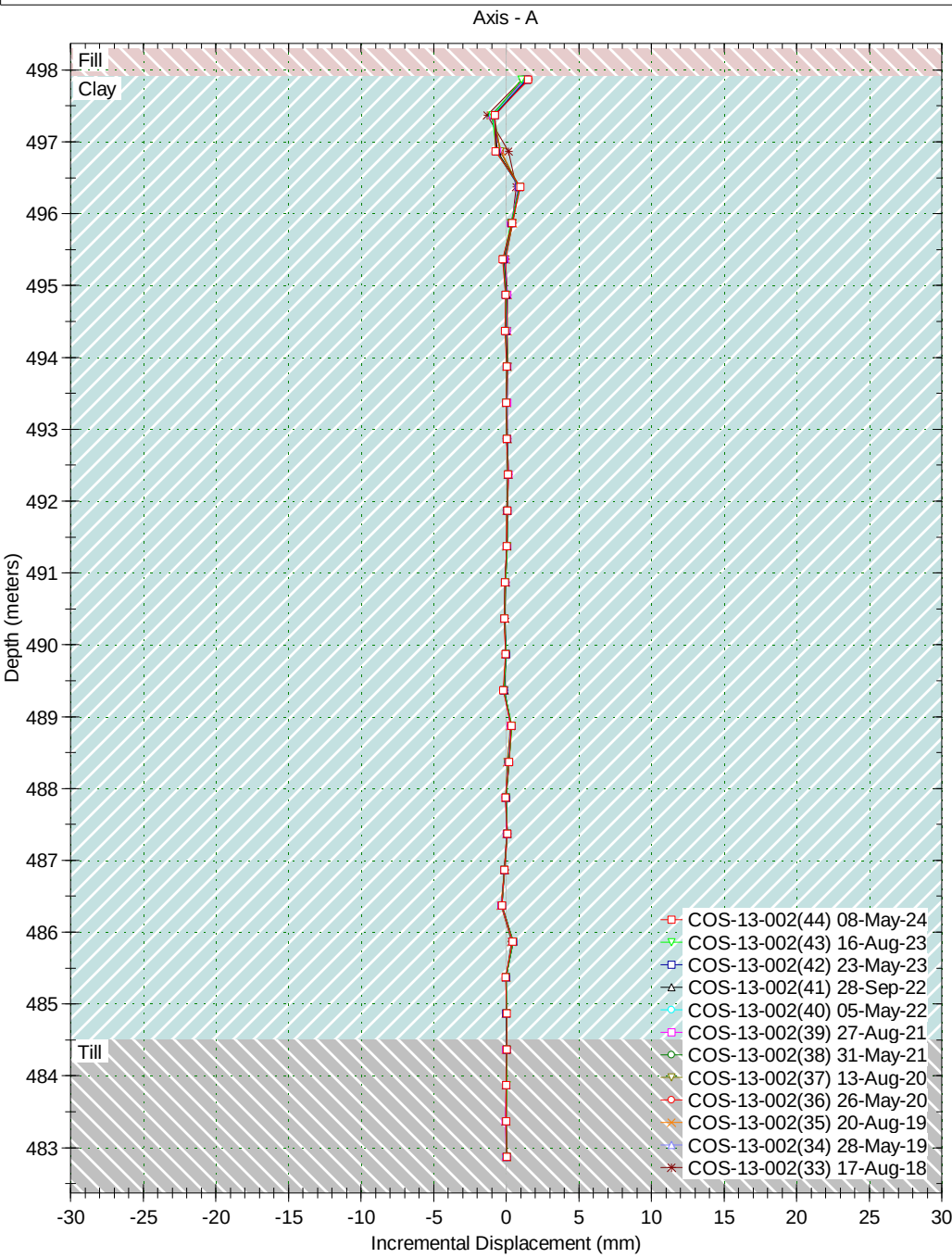
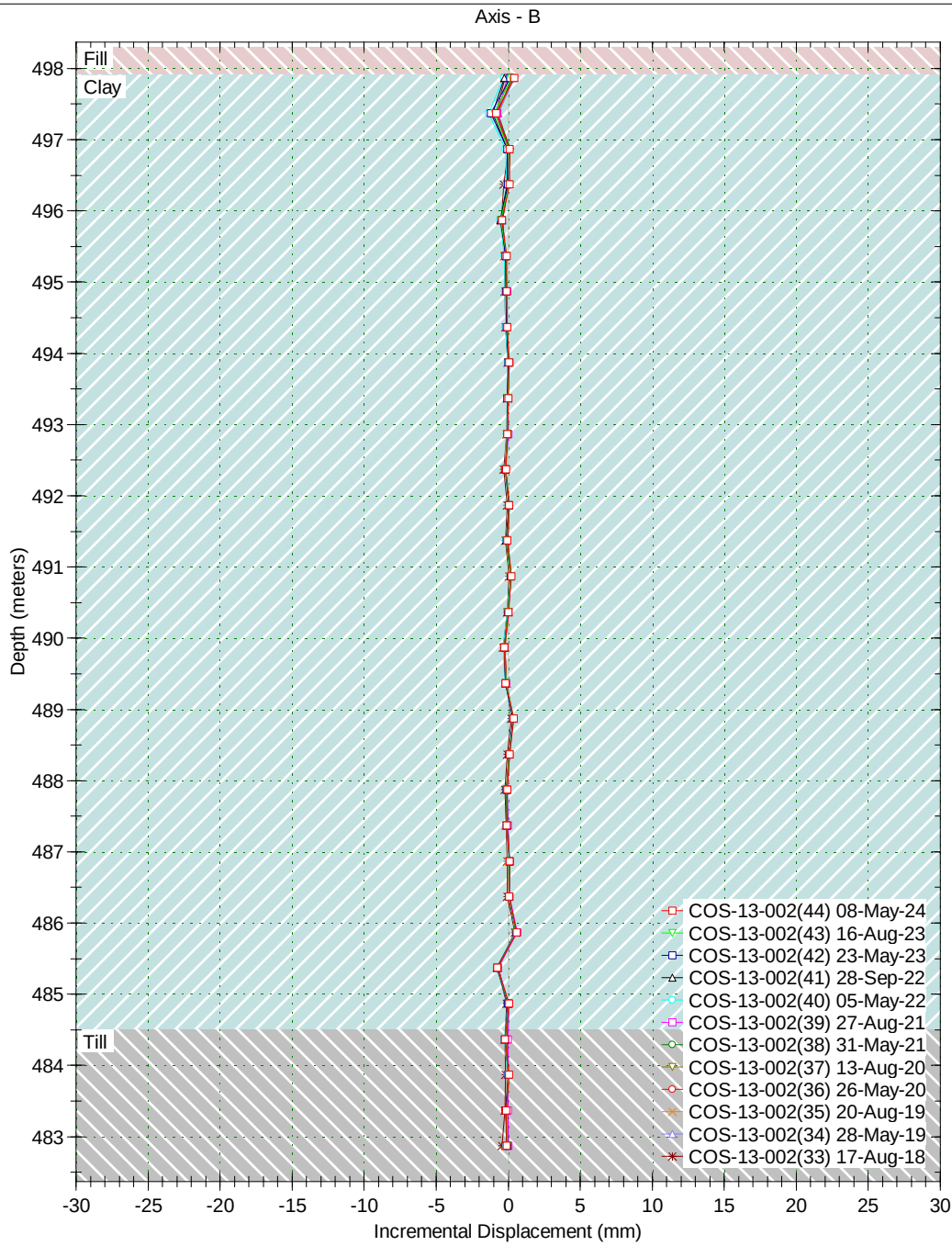




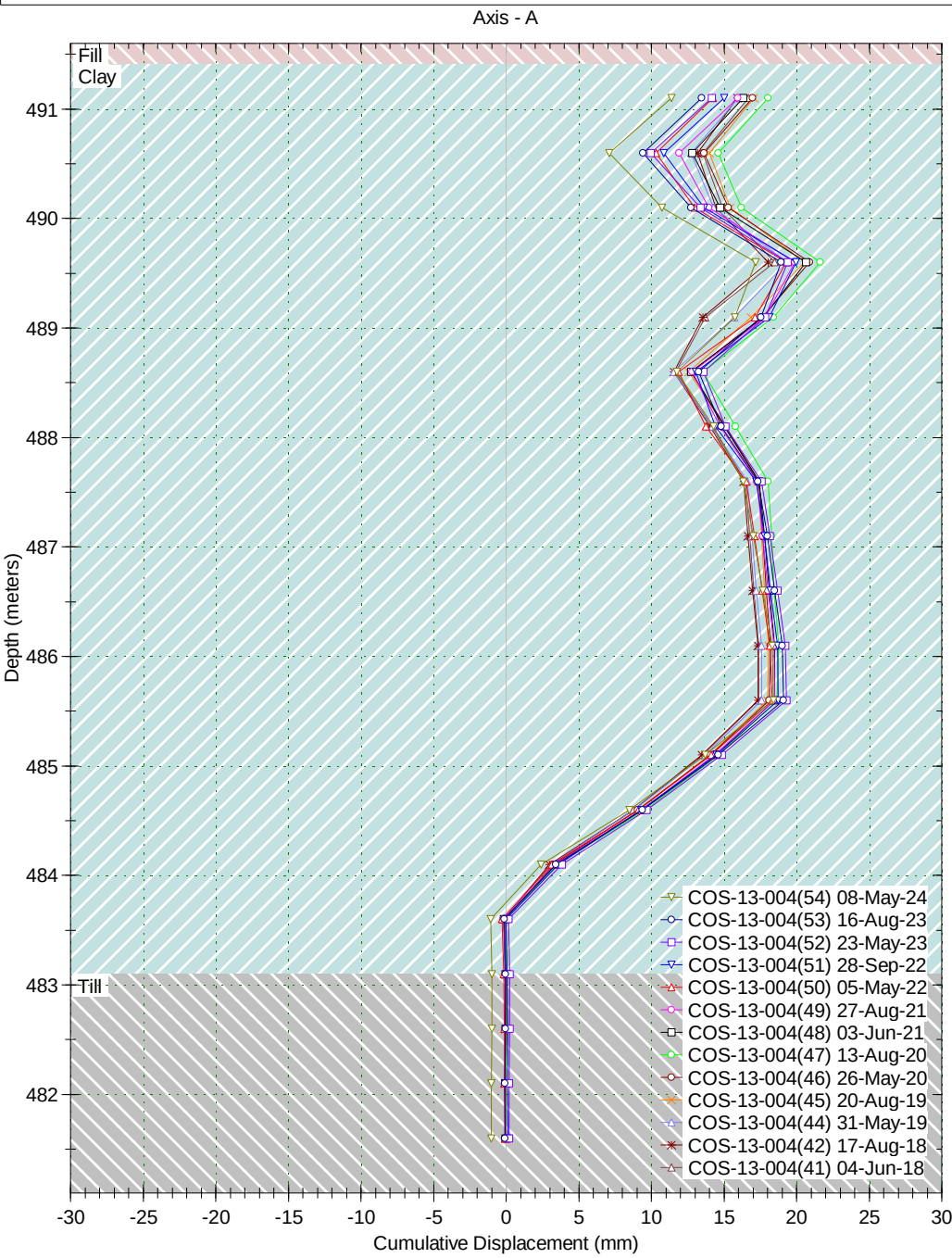
RST Instruments Ltd.

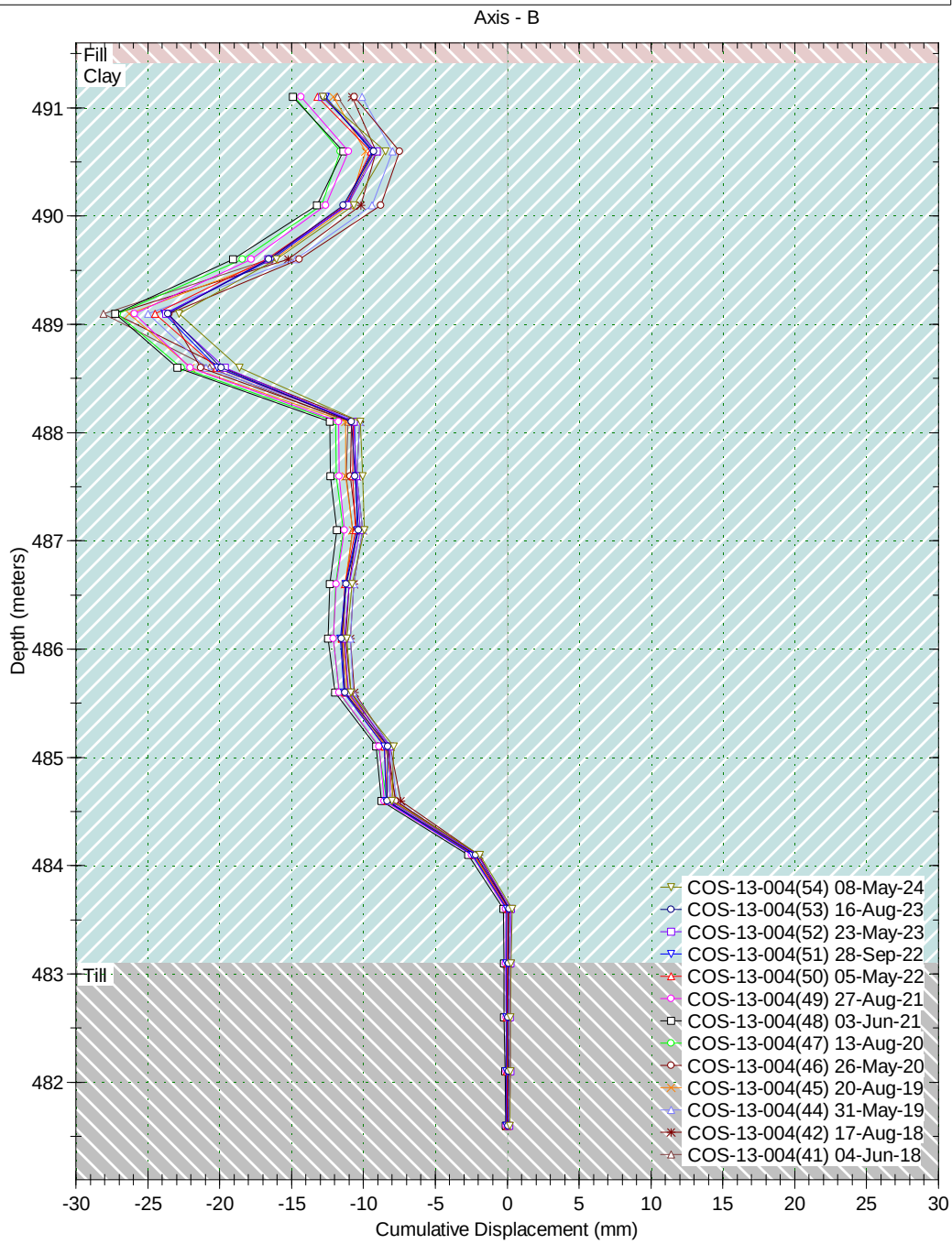
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.49.0

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





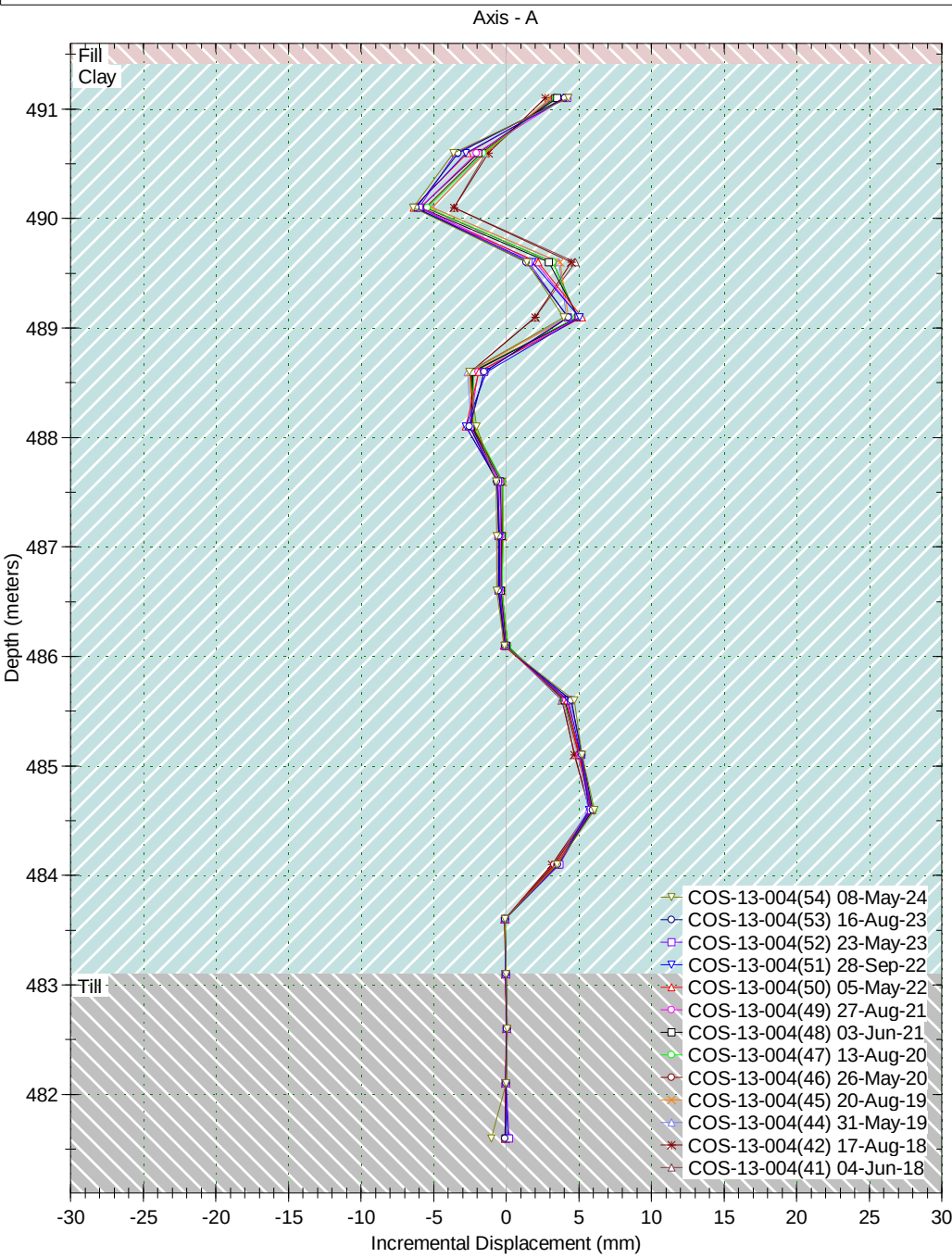
RST Instruments Ltd.

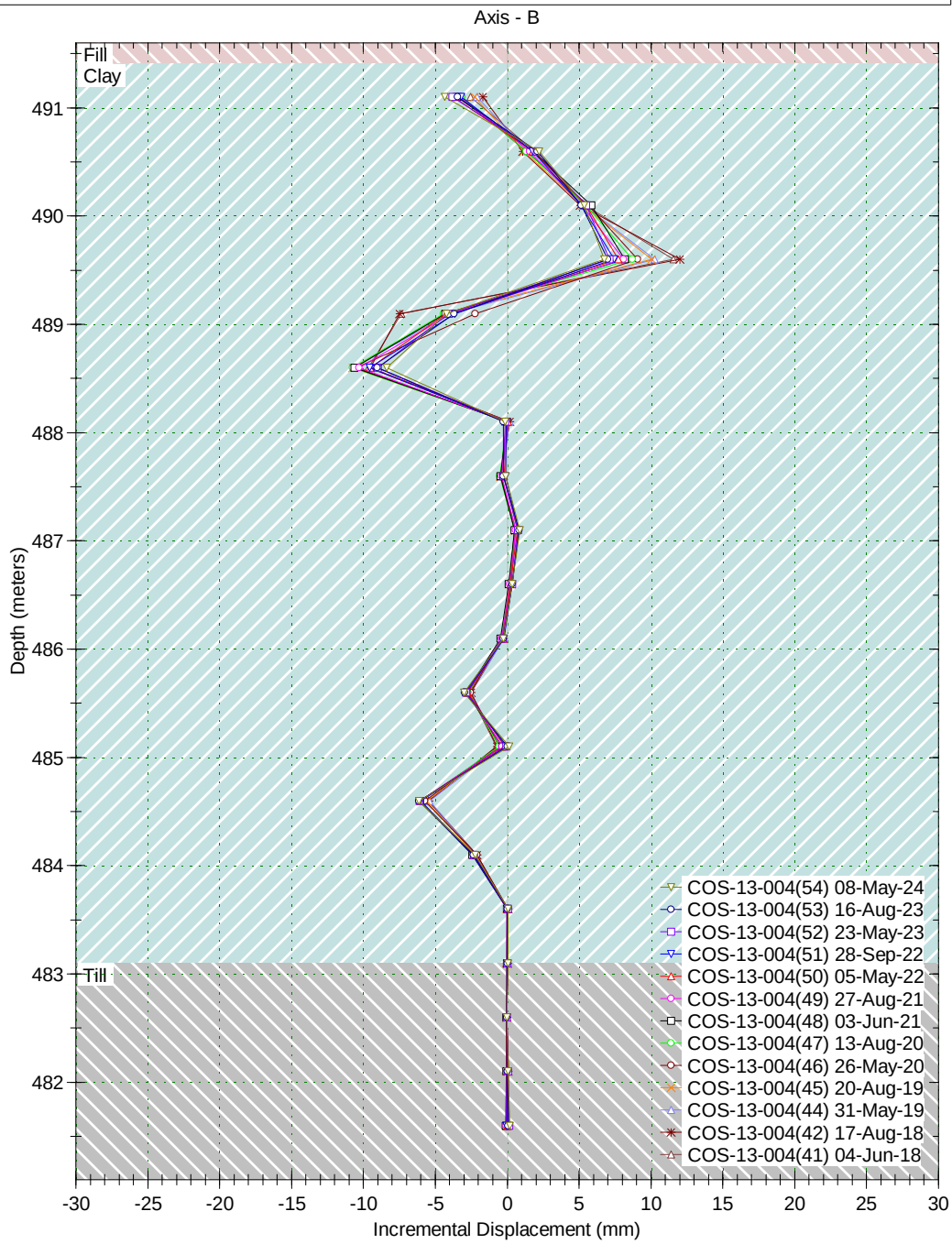
INCREMENTAL DISPLACEMENT

Inclinalysis v. 2.49.0

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





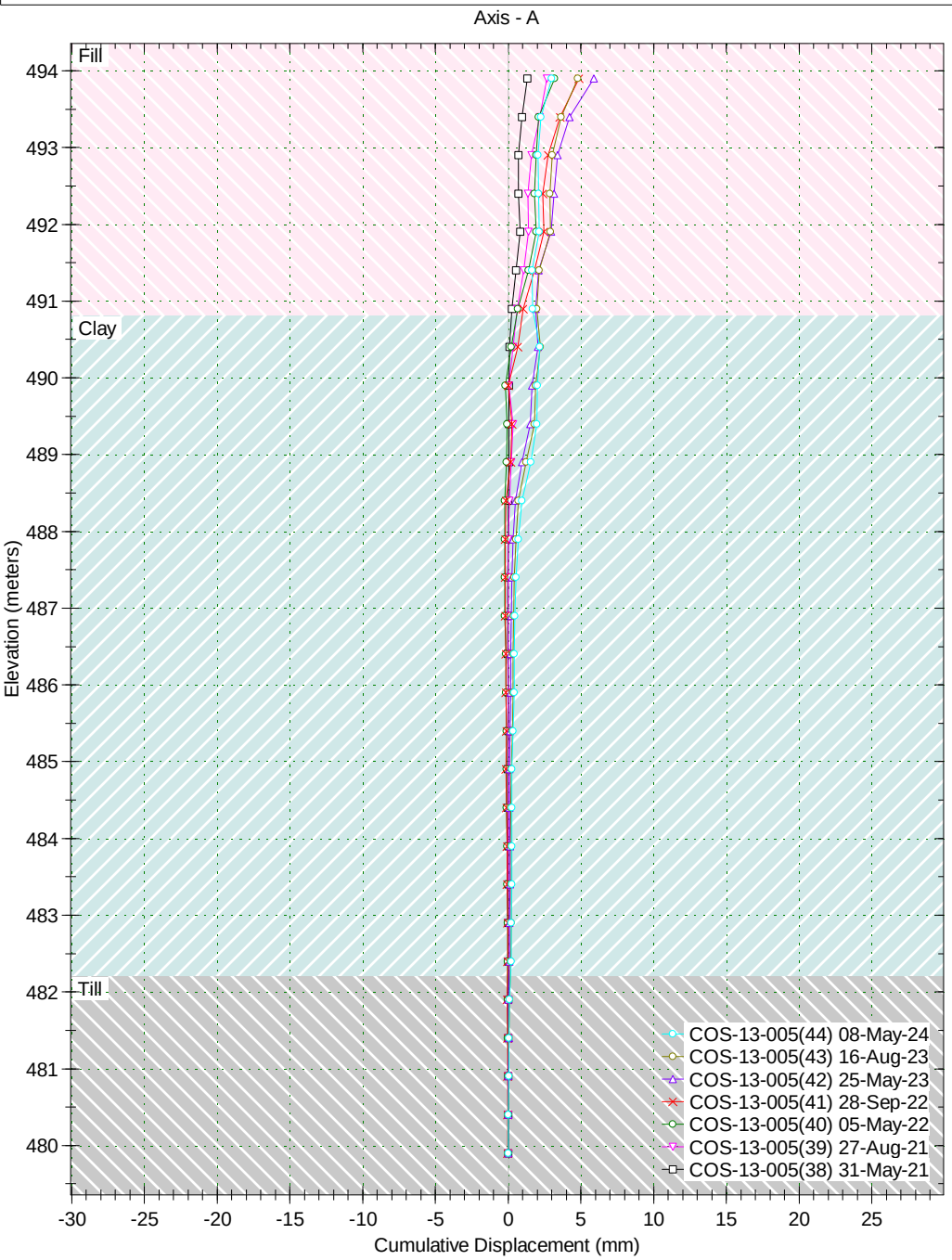
RST Instruments Ltd.

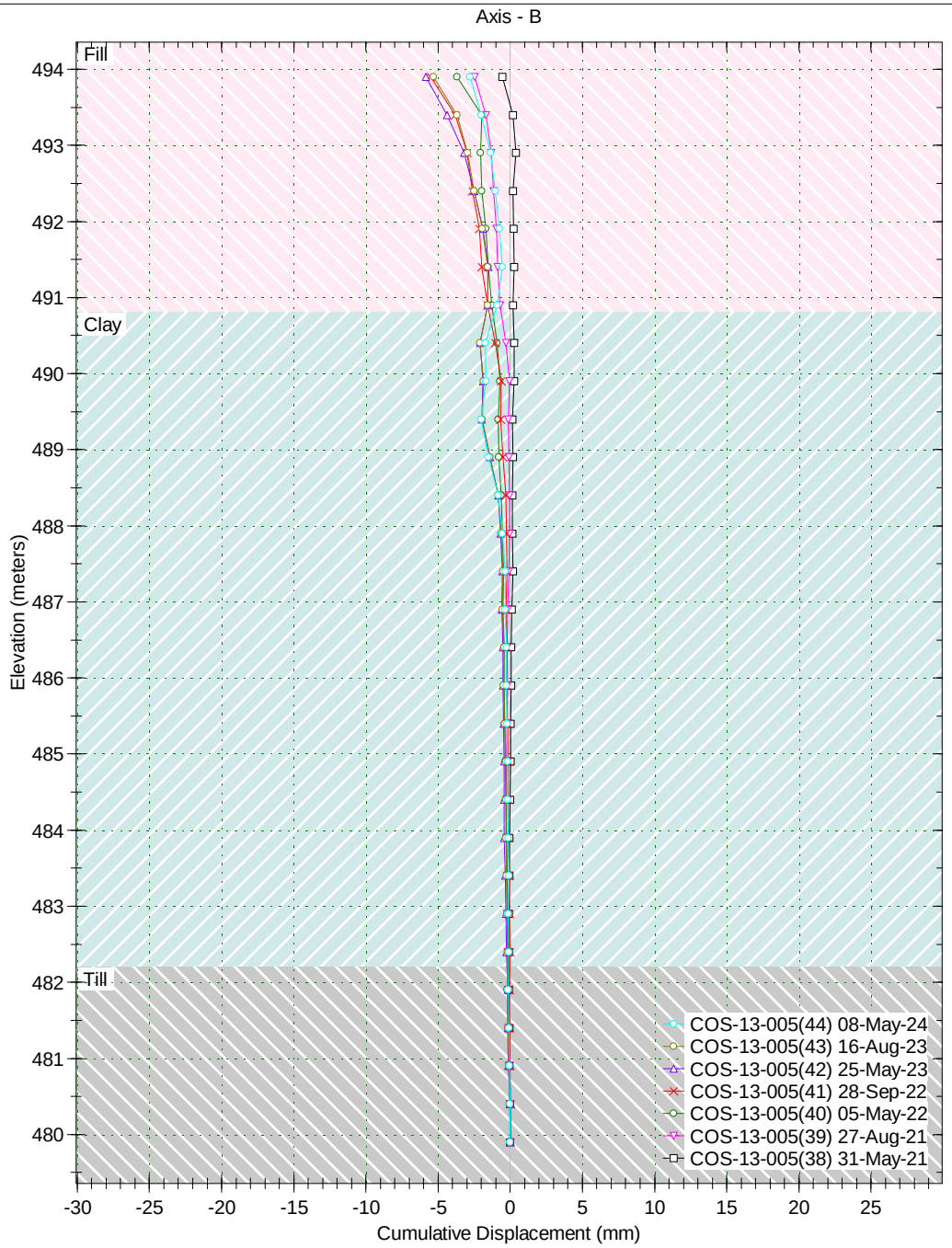
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.49.0

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





RST Instruments Ltd.

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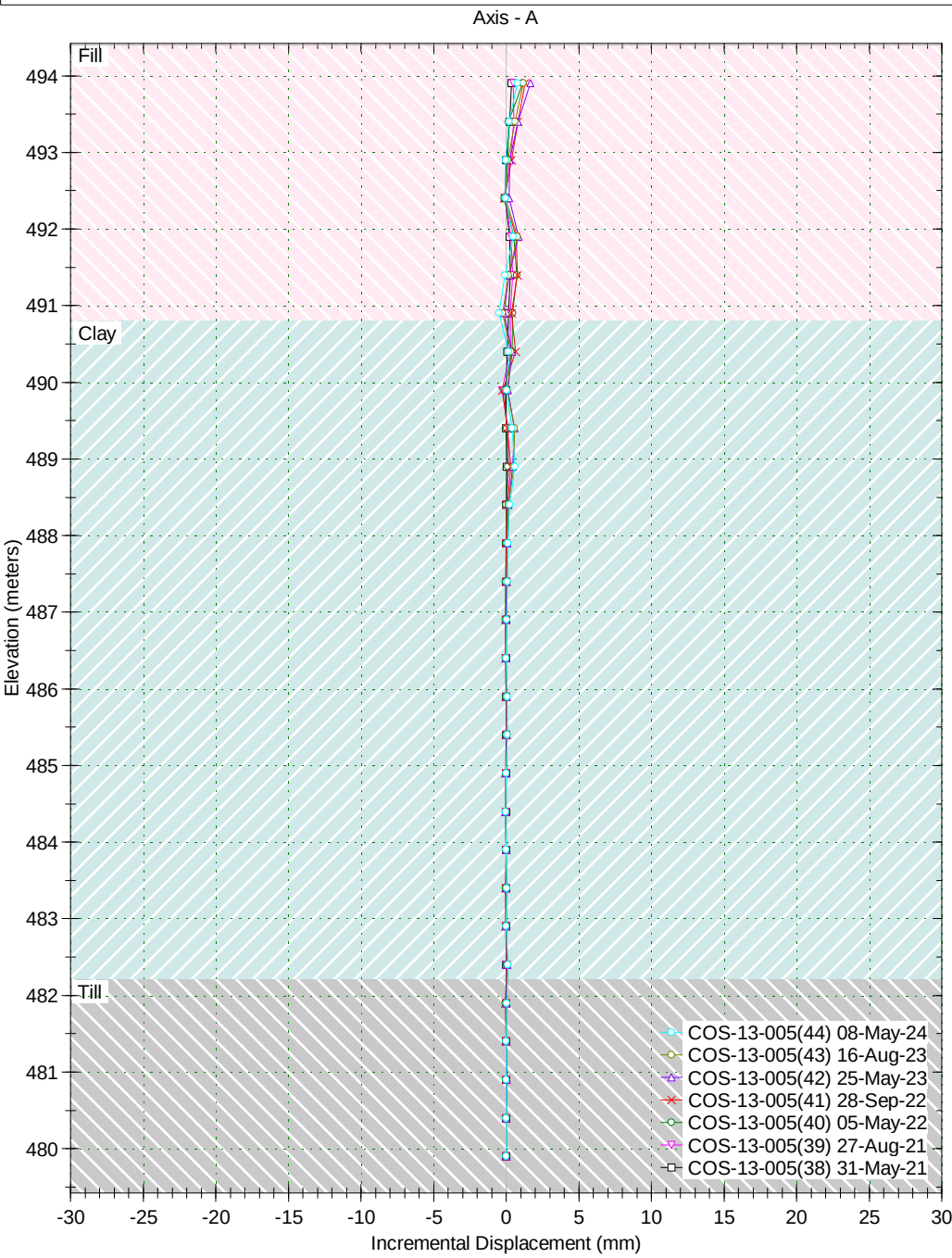
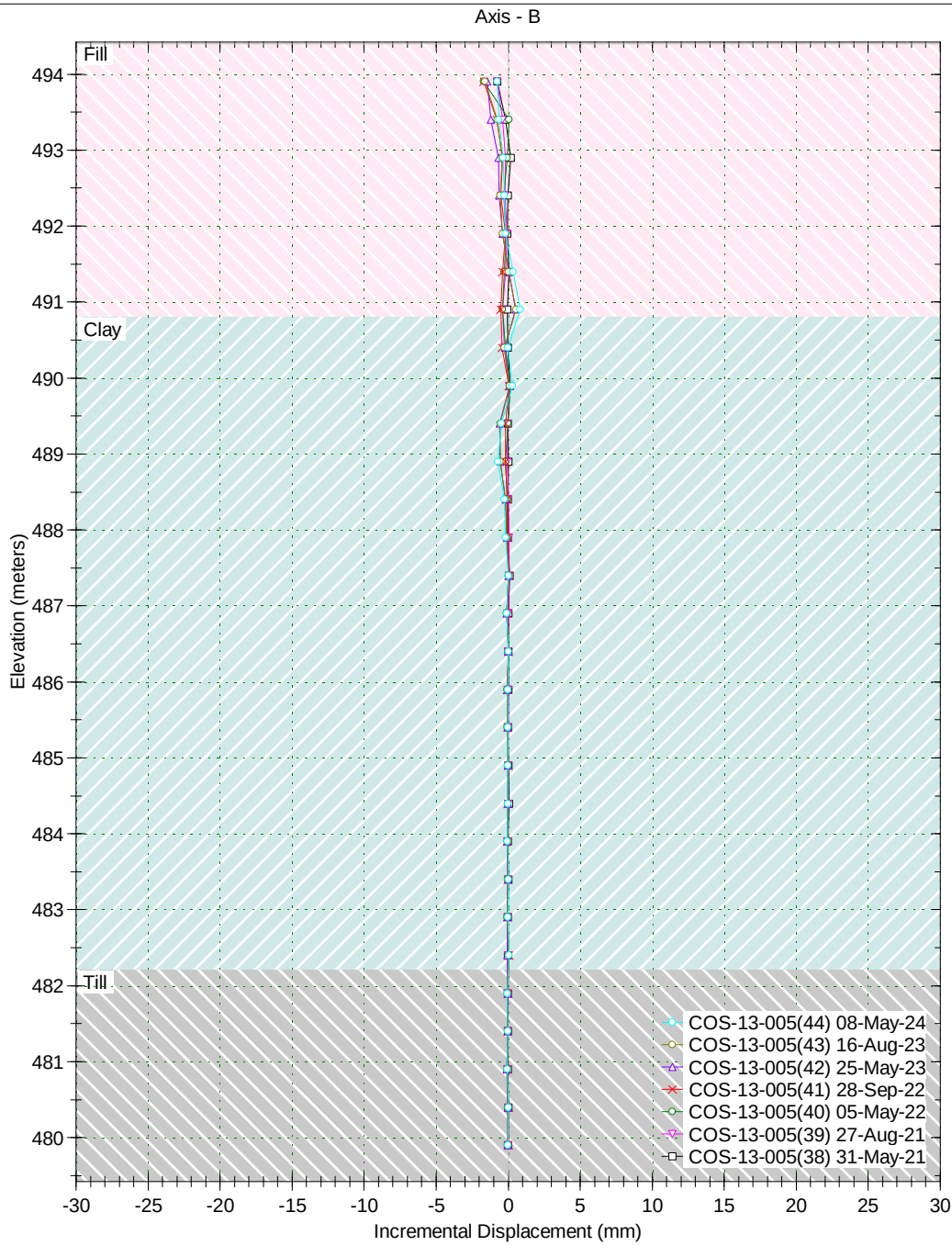




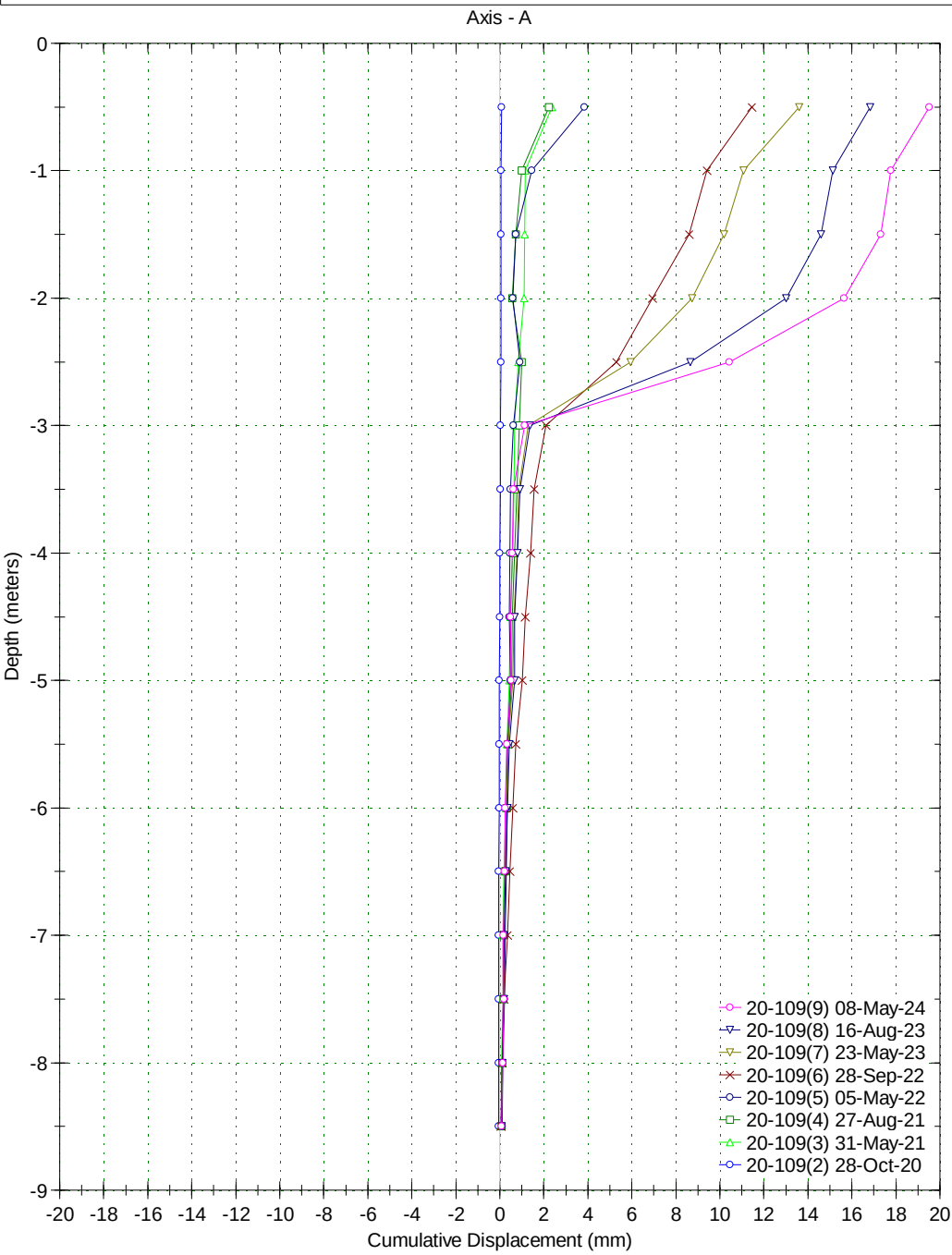
RST Instruments Ltd.

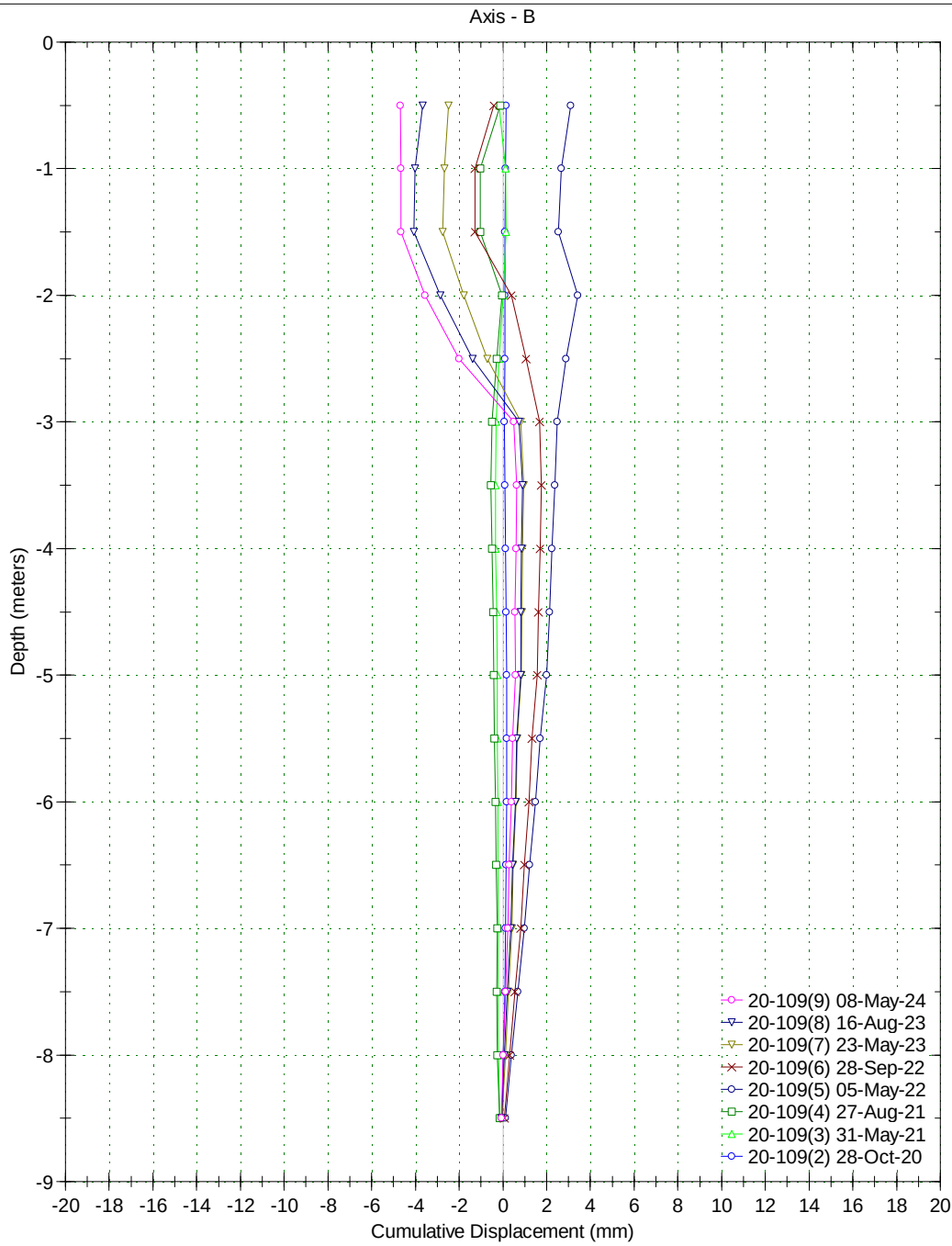
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.49.0

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





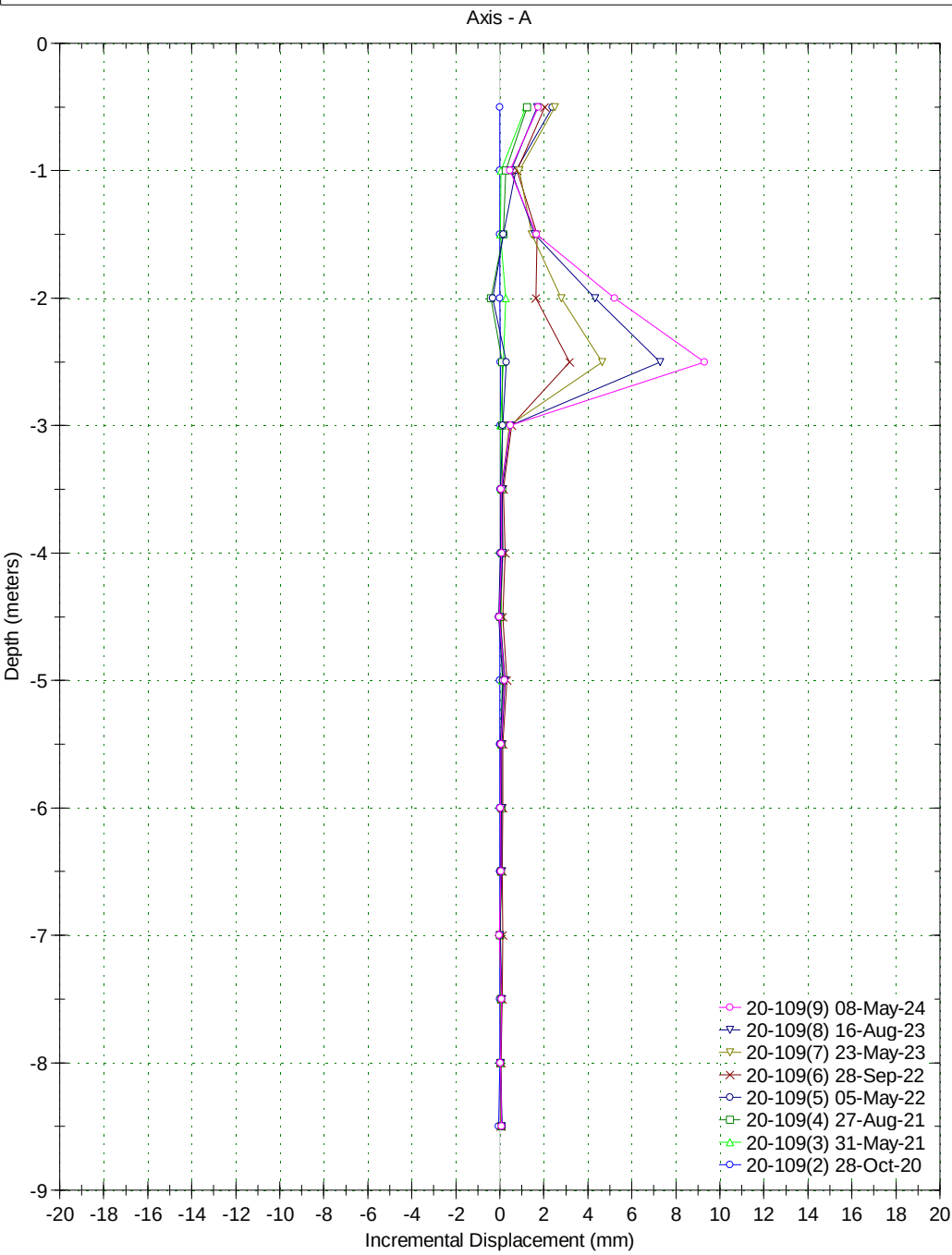
RST Instruments Ltd.

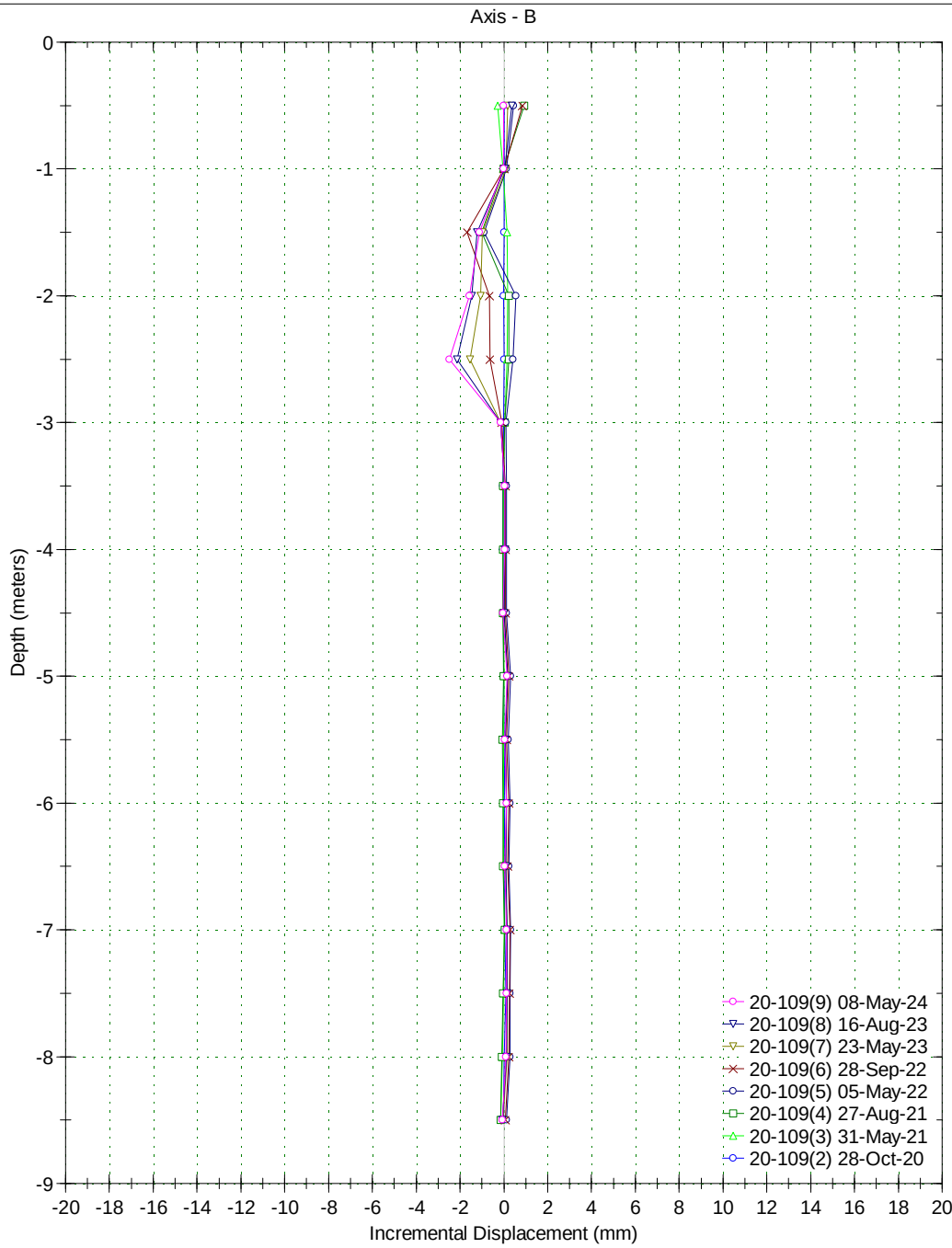
INCREMENTAL DISPLACEMENT

Inclinalysis v. 2.49.0

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





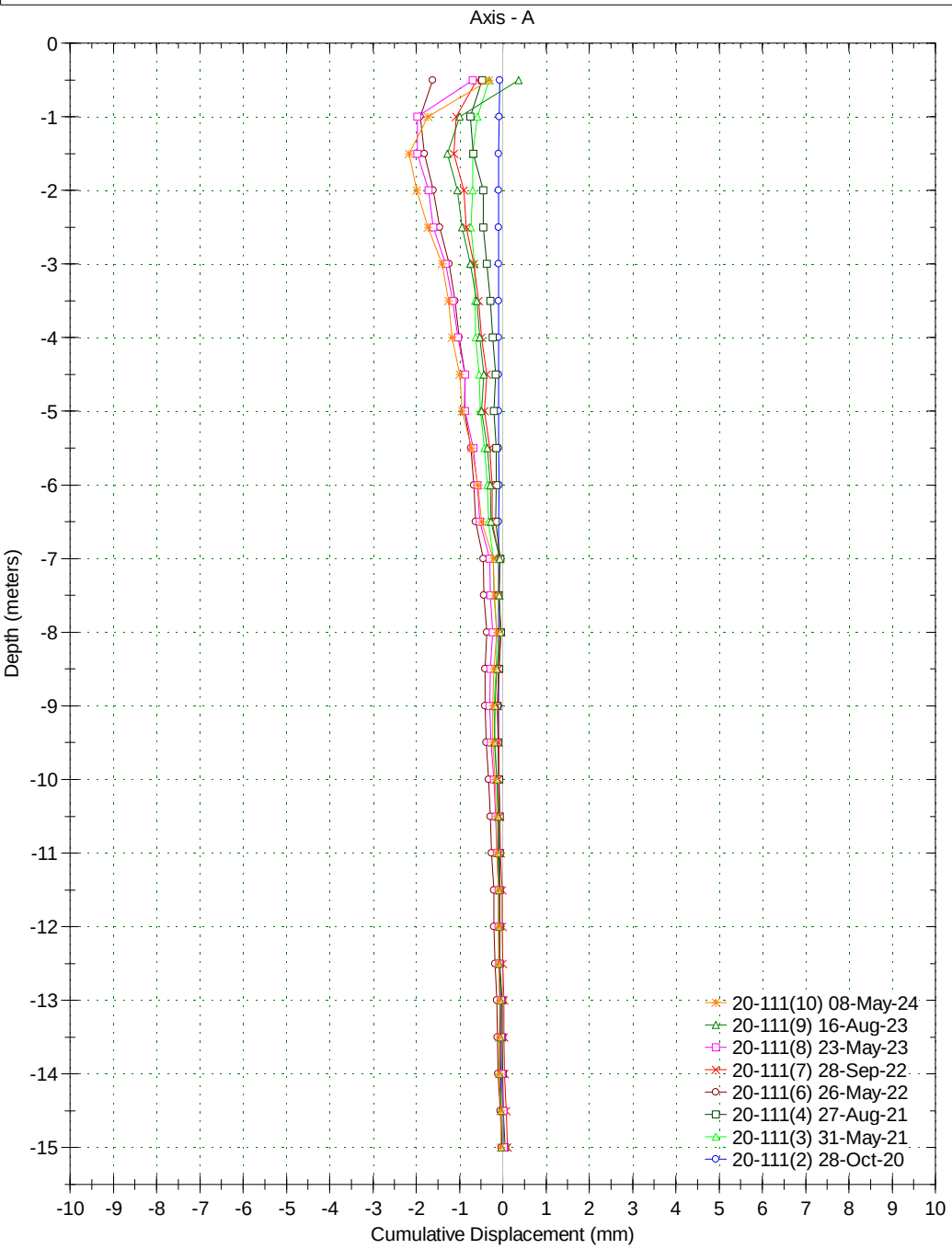
RST Instruments Ltd.

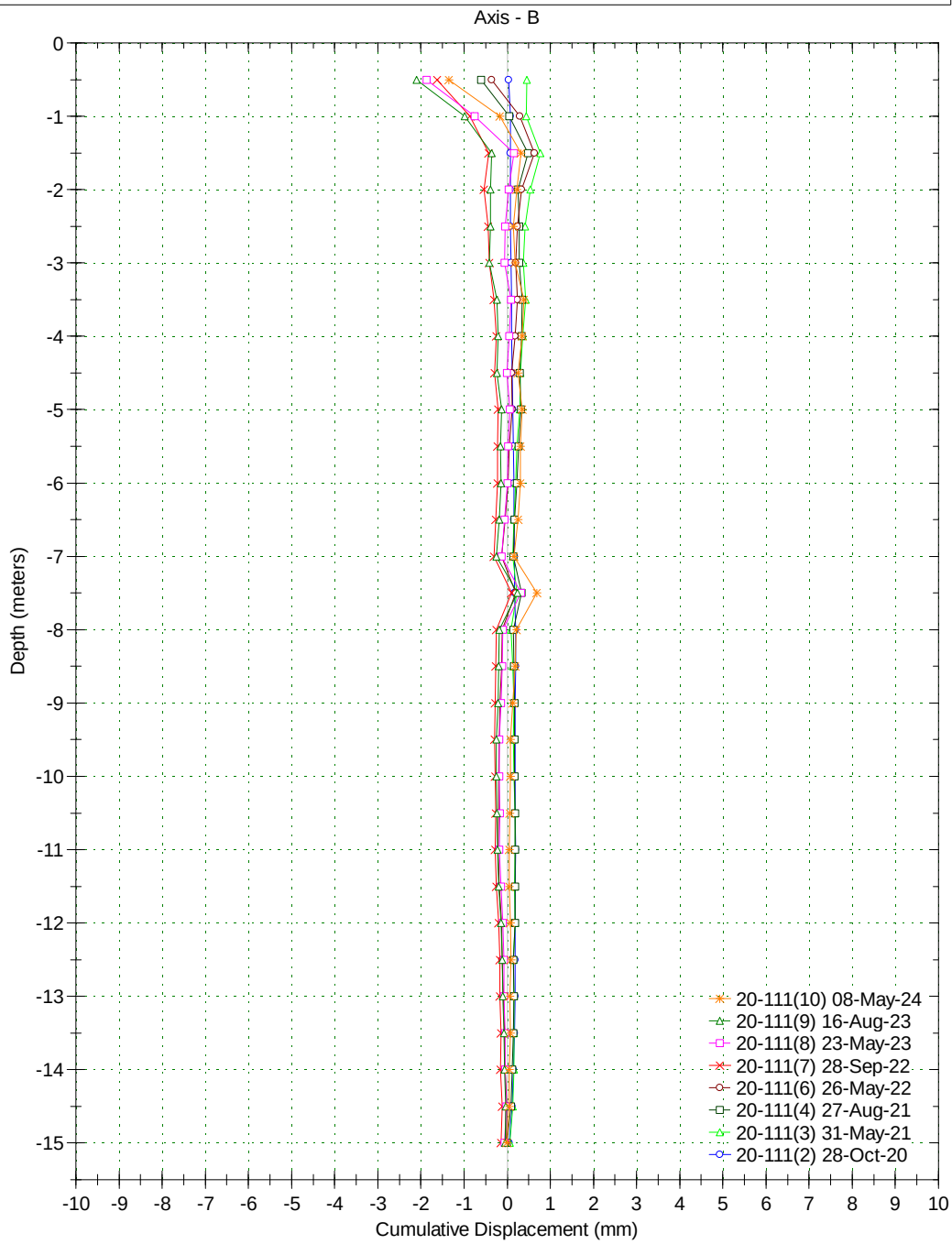
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.49.0

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





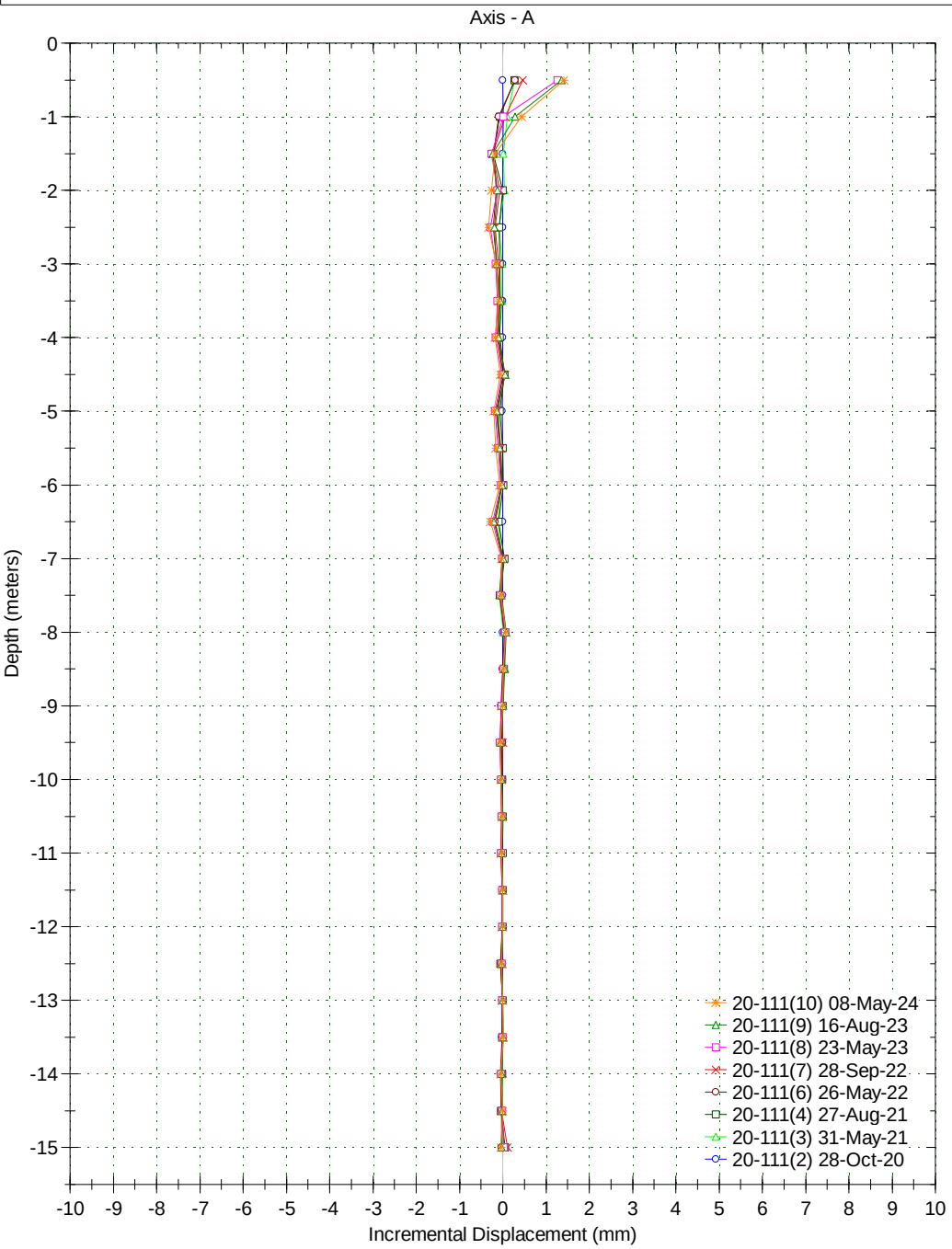
RST Instruments Ltd.

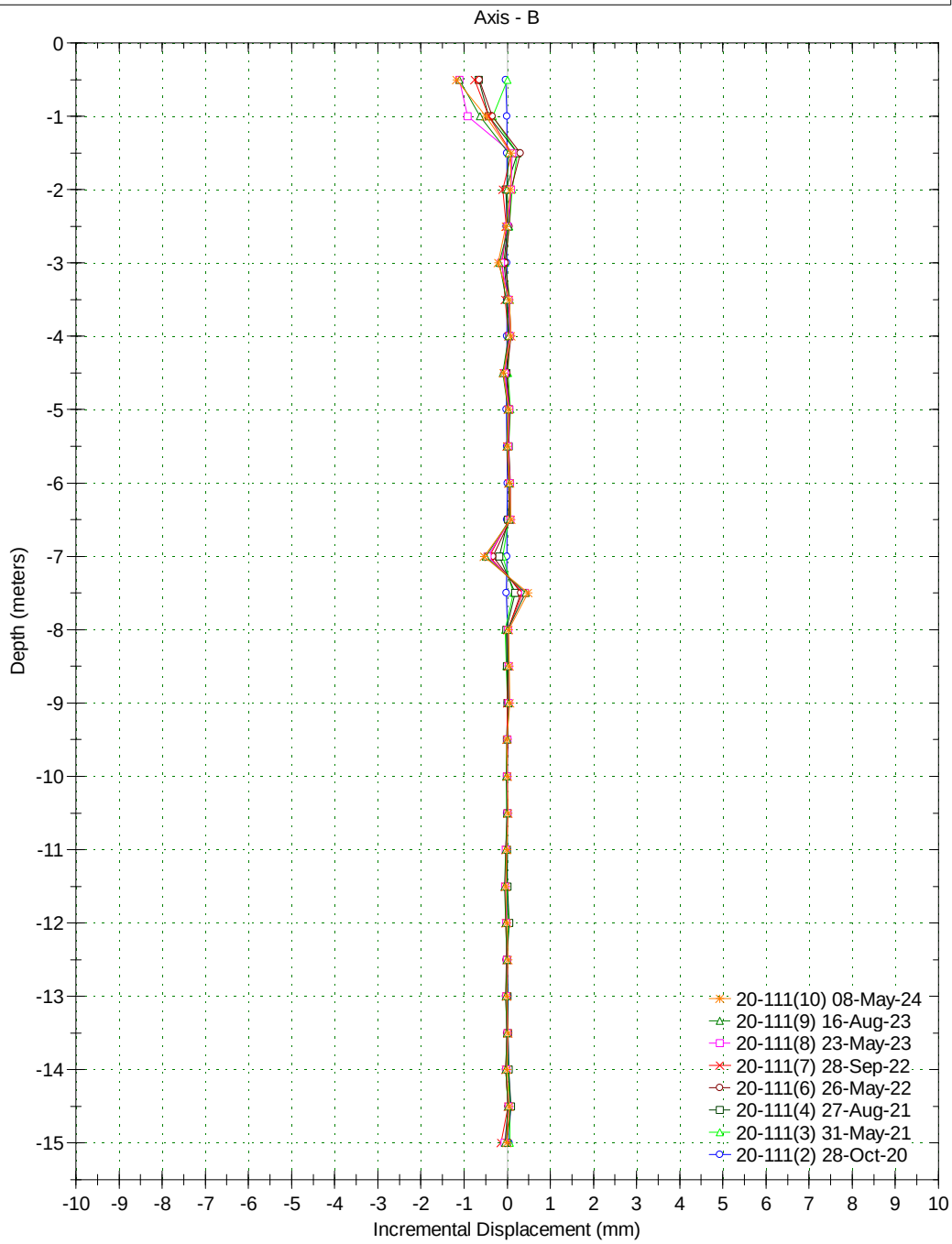
INCREMENTAL DISPLACEMENT

Inclinalysis v. 2.49.0

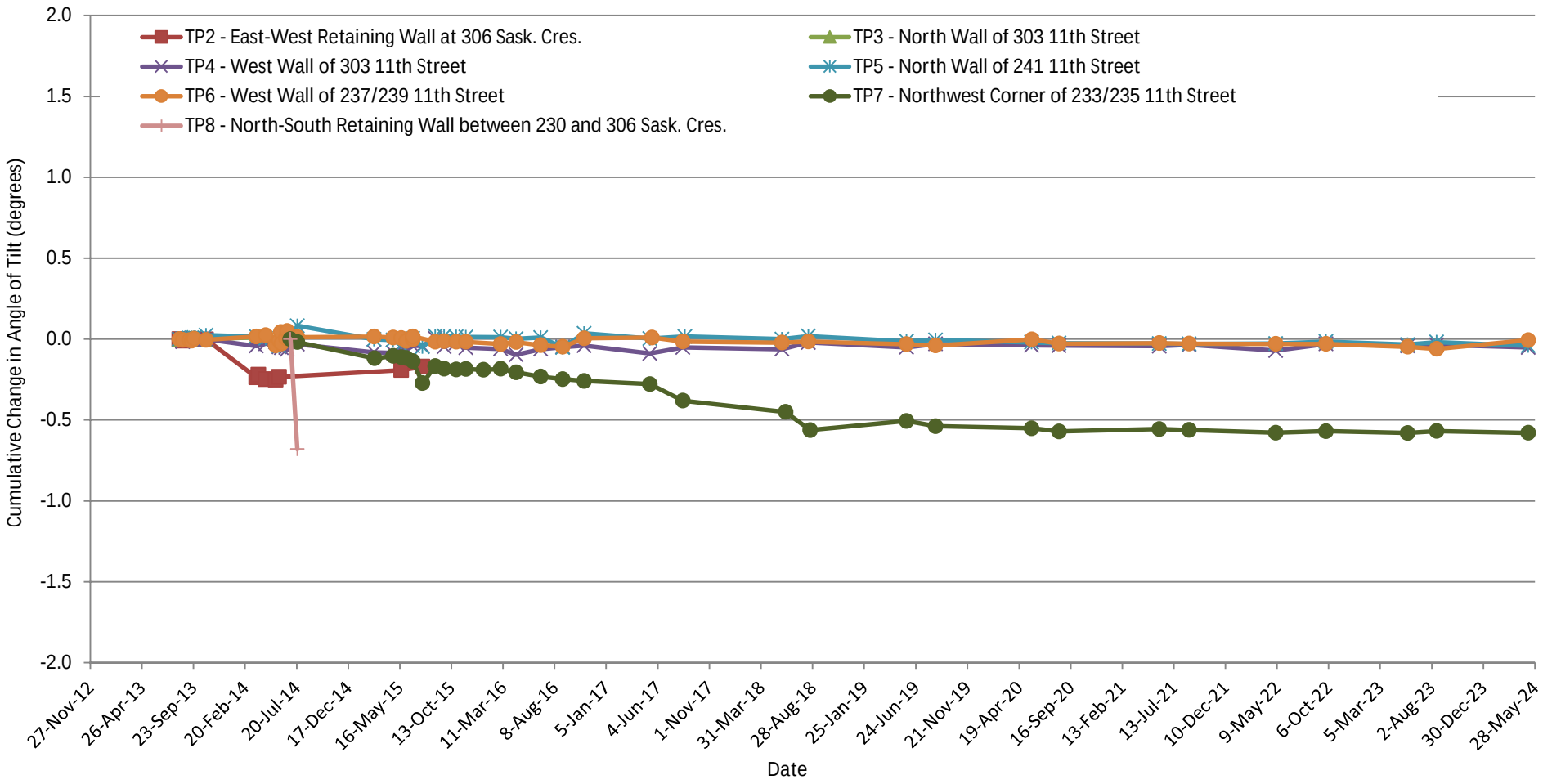
Borehole : 20-111
Project : Nutana Slope
Location :
Northing : 5775568
Easting : 385953
Collar :

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 resutls 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.

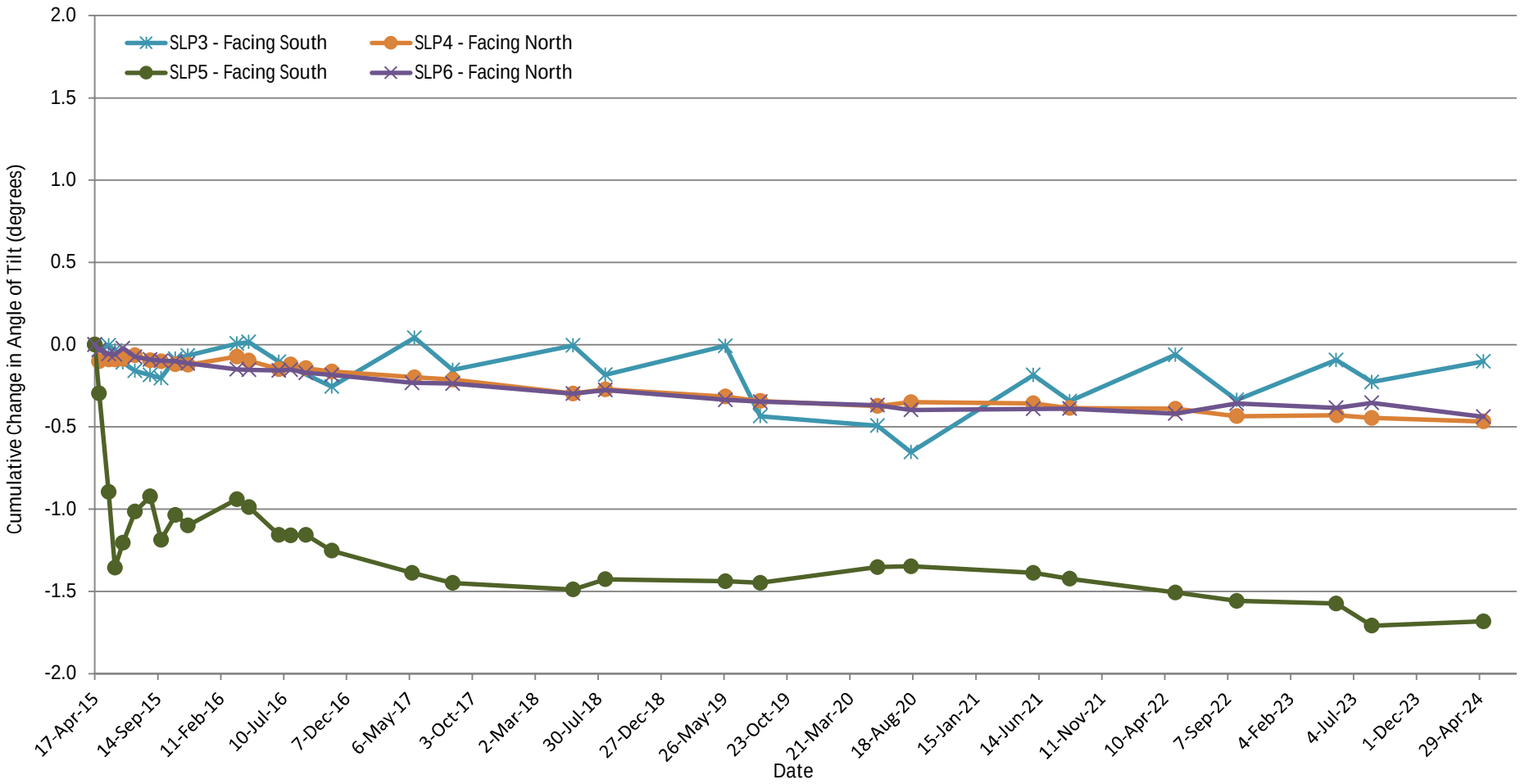
PROJECT: City of Saskatoon — NUTANA SLOPE INSTABILITY

TITLE: **RESULTS OF TILT MONITORING**
May 2024 Monitoring

WSP

PROJECT	CA0029692.9234	FILE No.
DESIGN		SCALE N/A REV.
CADD		
CHECK		
REVIEW		

FIGURE: B1



Notes:
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PROJECT: City of Saskatoon — NUTANA SLOPE INSTABILITY

TITLE: **RESULTS OF TILT MONITORING**
May 2024 Monitoring

WSP

PROJECT	CA0029692.9234	FILE No.
DESIGN		SCALE N/A REV.
CADD		
CHECK		**FIGURE: B2**
REVIEW		