Stantec

To:	Bernard Ching Alberta Transportation	From:	Leslie Cho and Carrie Murray Stantec Consulting Ltd.
File:	123315222	Date:	August 18, 2021

Reference: North Central Region, Stony Plain, Site NC33 - Highway 759:02 South of Tomahawk Spring 2021 Instrumentation Monitoring Report

1.0 OBSERVATIONS

1.1 FIELD PROGRAM AND INSTRUMENTATION STATUS

The Spring 2021 reading cycle consisted of instrument readings of one slope inclinometer (SI-1) and two pneumatic piezometers (PN-1 and PN-3). **Figure 1** attached provides a schematic of the site. The instruments were read by Owen Zhang, EIT and, Mahendran Senthooran, M.Eng., EIT on July 6, 2021.

The slope inclinometer (SI) was measured using an RST MEMS digital inclinometer probe with 0.5 m increments and handheld PC. Readings were taken based on cable markings in relation to the top of SI casing. The pneumatic piezometers (PN) were read with an RST Instruments C-109 Pneumatic Readout.

GPS coordinates of all instruments were obtained using a Garmin eTrex 10 handheld GPS unit.

2.0 INSTRUMENTATION READINGS

2.1 GENERAL

The slope inclinometer plots are attached and summarized in the following sections. Resultant plots in the A, B and X-direction along with rates of movement are provided for the SI. Piezometer results are also summarized in the following sections with resulting plots attached.

2.2 ZONES OF MOVEMENT

No new movement zones were identified in the SI. The existing zone of movement is summarized in **Table NC33-1** along with the depth of movement, total movement, and maximum rate of movement. Directions of movement are referenced to the azimuth of the A+ groove in the slope inclinometer casing.

2.3 MONITORING RESULTS

2.3.1 Slope Inclinometers

SI-1 has a zone of movement from 3.1 m to 9.1 m below ground surface that has steadily cumulated 38 mm displacement since initialization in 2006. The An incremental movement of 4 mm was recorded during the current reading cycle corresponding to a rate of movement of about 5 mm/yr.

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2.3.2 Piezometers

PN1 has increased by 1.0 m in piezometric level since the last reading in Fall 2020 and is within the historical trend since 2010.

PN-3 has shown relatively consistent readings since its initiation in 2006 to May 2018. However, the Fall 2018 reading cycle showed a significant decrease in piezometric level by 4.4 m in PN3. The readings returned to the historic trend in fall 2019. The current piezometric level records 0.7 m increase in piezometric level compared to last reading in Fall 2020.

Table NC33-2 summarizes the PN readings for the Spring 2021 reading cycle.

3.0 RECOMMENDATIONS

3.1 FUTURE WORK

It is recommended that all instruments be read during the Spring 2022 reading cycle.

3.2 INSTRUMENTATION REPAIRS

Currently, all operating instruments are in good condition.

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Table NC33-1: Spring 2021 Slope Inclinometer Reading Summary

Instrument Name	Date Initialized	Top of Casing Elevation (m) (aMSL) (1)	Coordinates (2) (UTM 11U, NAD1983) (m)		Total Cumulative Resultant Movement and Depth of Movement to Date (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)
			Northing	Easting							
SI-1	Aug 29, 2006	766.3	5912363	649336	38 mm over 3.1 m to 9.1 m depth in 1° direction	7 in May 2016	Operational	September 22, 2020	4	5	9

Notes:
(1) aMSL = Above Mean Sea Level
(2) Updated July 6, 2021 with approximate accuracy of ± 3 m.

Table NC33-2: Spring 2021 Pneumatic Piezometer Reading Summary

Instrument Name	Date Initialized	Top of Casing Elevation (m) (aMSL) (1)	Coordinates (2) (UTM 11U, NAD1983) (m)		Tip Elevation (m)(1)	Current Status	Maximum Pore Pressure	Measured Pore Pressure (kPa)	Piezometric Elevation (m) (Groundwater Level)	Change in Piezometric Level Since Previous Reading (m)
			Northing	Easting						
PN-1 (30247)	Aug 29, 2006	766.2	5912363	649336	761.4	Operational	46 kPa; May 2007	27.1	764.2 (2.0 m bgs)	+1.0
PN-3 (30249)	Aug 29, 2006	765.1	5912362	649288	759.0	Operational	57 kPa; May 2009 and June 2012	41.1	763.9 (1.2 m bgs)	+0.7

Notes:
(1) aMSL = Above Mean Sea Level
(2) Updated July 6, 2021 with approximate accuracy of ± 3 m.

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CLOSING

We trust this instrumentation report meets your requirements. If you have any questions, please do not hesitate to contact the undersigned.

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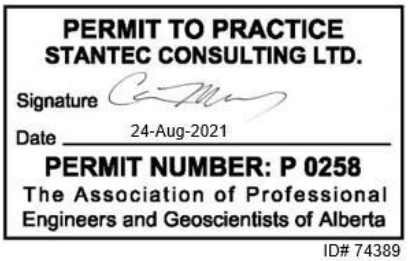

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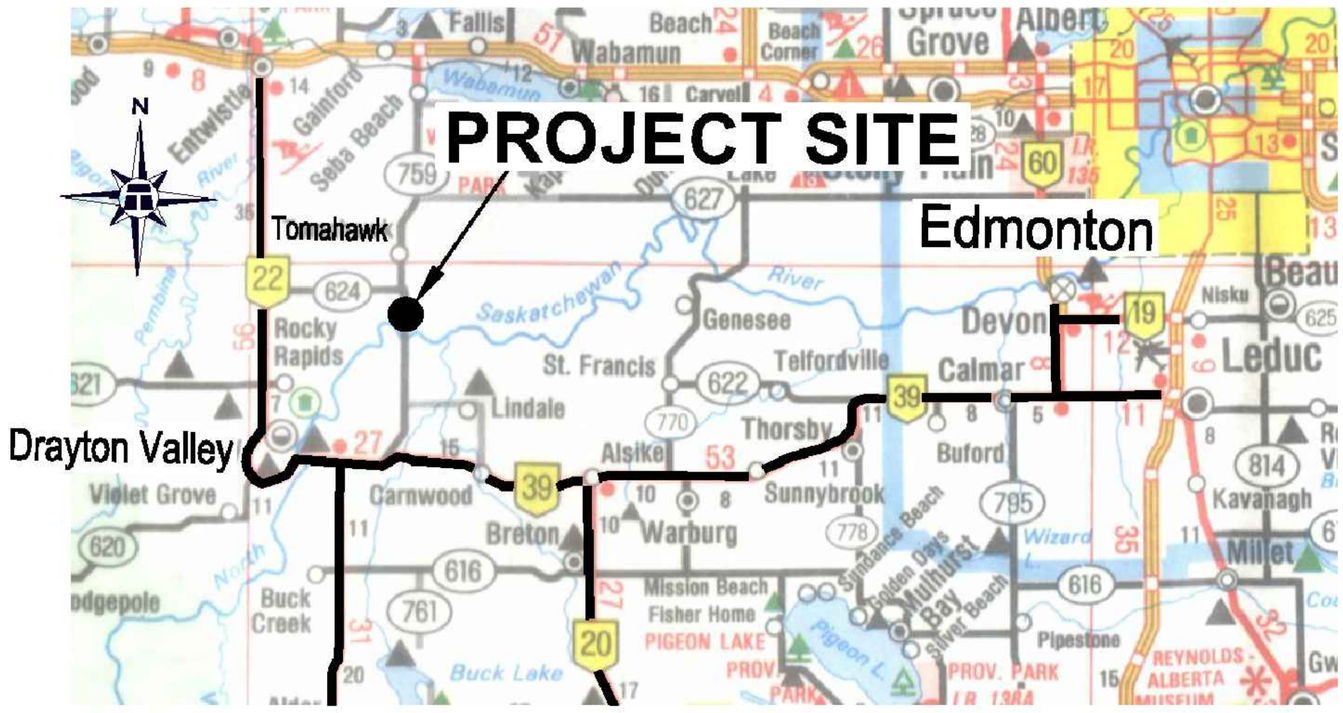
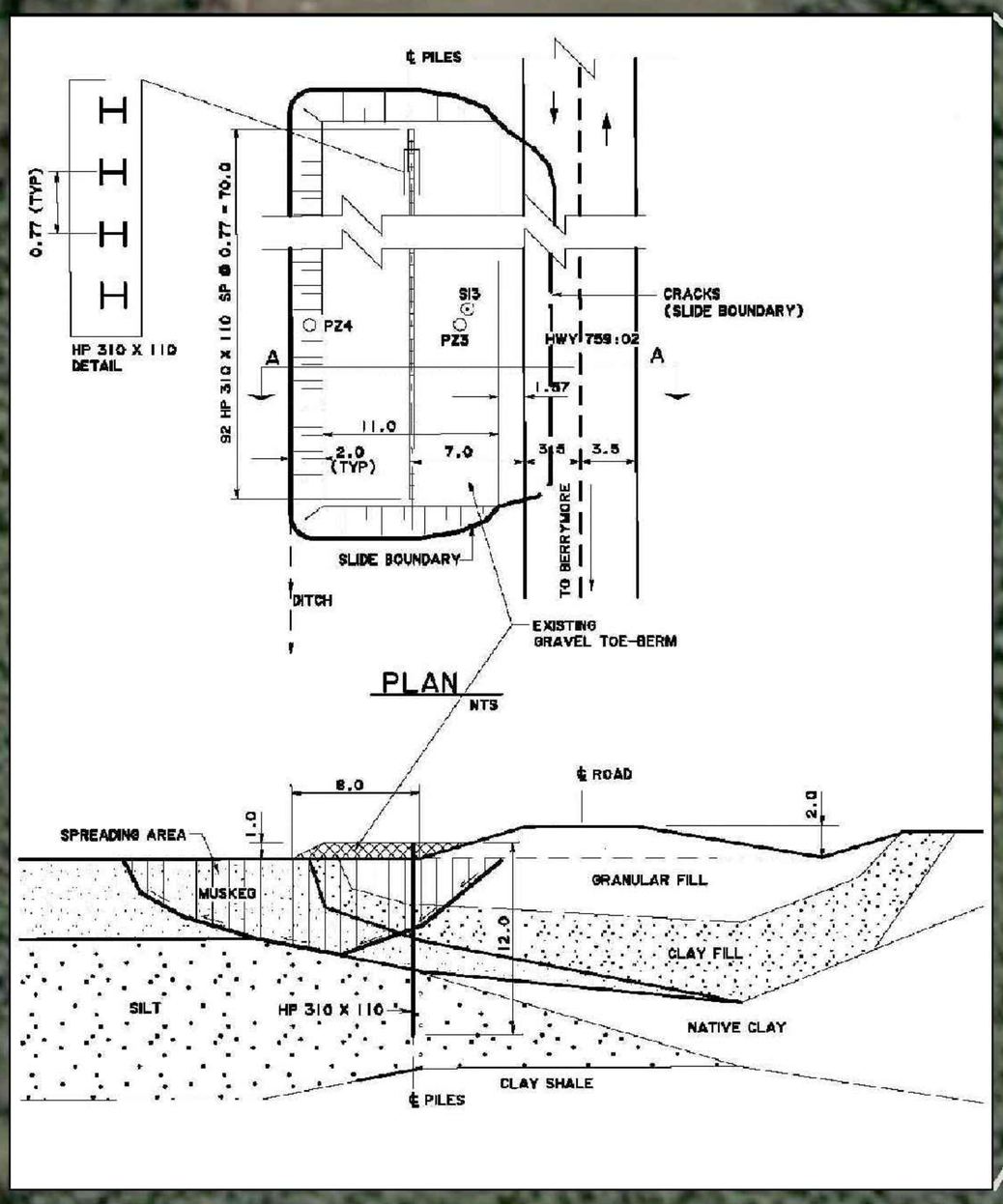
Attachment: Figure 1 – Site Plan
SI-01 Slope Inclinometer Plots
Pneumatic Piezometer Elevation vs. Time Plot



KEY PLAN
N.T.S



TOE BERM/PILE DETAIL
N.T.S

NORTH BOUND LANE SLUMPING (2017, 2018)

EXCAVATED PEAT TO PROMOTE DRAINAGE IN 2013 (2016)
WET & SLOW FLOWING 2018)
NO FLOW TO SLOW FLOWING (2019)

NORTH BOUND LANE SLUMPING (2016)
SLIGHTLY VISIBLE (2017, 2018)

HWY 759:02

CULVERT

DIPPING AND SETTLEMENT (2016)
PAVED OVER (2017)
NO CHANGE (2018, 2019)

PN-2
SI-2
SI-1
SI-3
SI-4
PN-4
PN-1
PN-3

EXPOSED H PILES (2016, 2018, 2019)

0 100m

LEGEND

SI	SLOPE INCLINOMETER
PN	PNEUMATIC PIEZOMETER
◉	**INSTRUMENT LOCATION**
✖	**DESTROYED INSTRUMENT**

NOTES

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. INSTRUMENTS ARE SHOWN IN RED.
3. TOE BERM/PILE DETAIL AS PER A.T. DESIGN SKETCH (2012)

NOTES

1. **PREVIOUS OBSERVATIONS SHOWN IN YELLOW**
2. **2019 OBSERVATIONS SHOWN IN ORANGE**

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ALBERTA TRANSPORTATION
GEOHAZARD MONITORING PROGRAM
NC33 SOUTH OF TOMAHAWK
HWY 759:02 - SITE PLAN

DRAWN	WW	CHECK	XL	APPROVE	LC
DATE	16 JUL 2019	SCALE	AS SHOWN	PROJECT #	123315222

FIGURE -1 -

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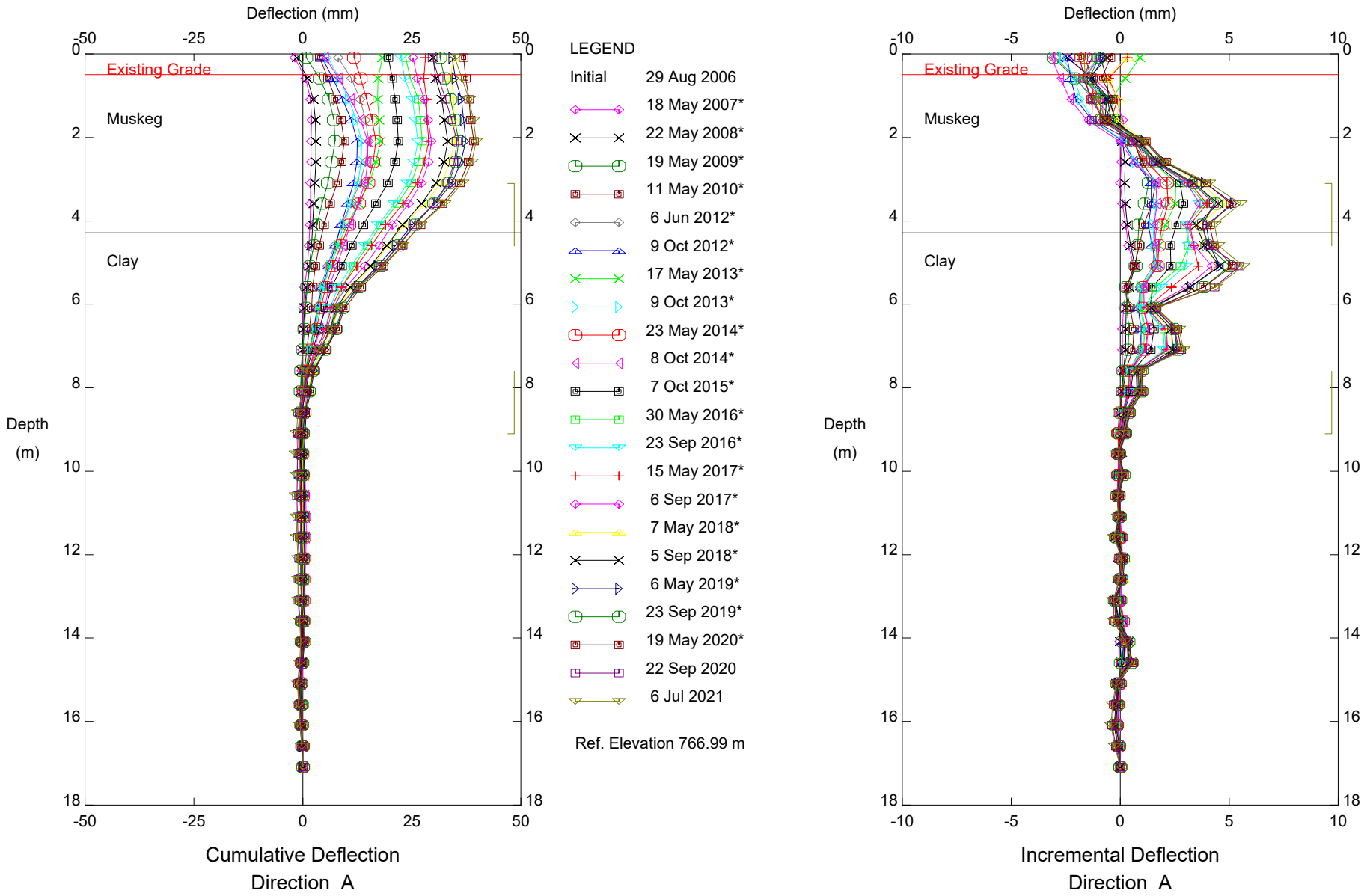

NC33, Inclinometer SI-1

Alberta Transportation

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

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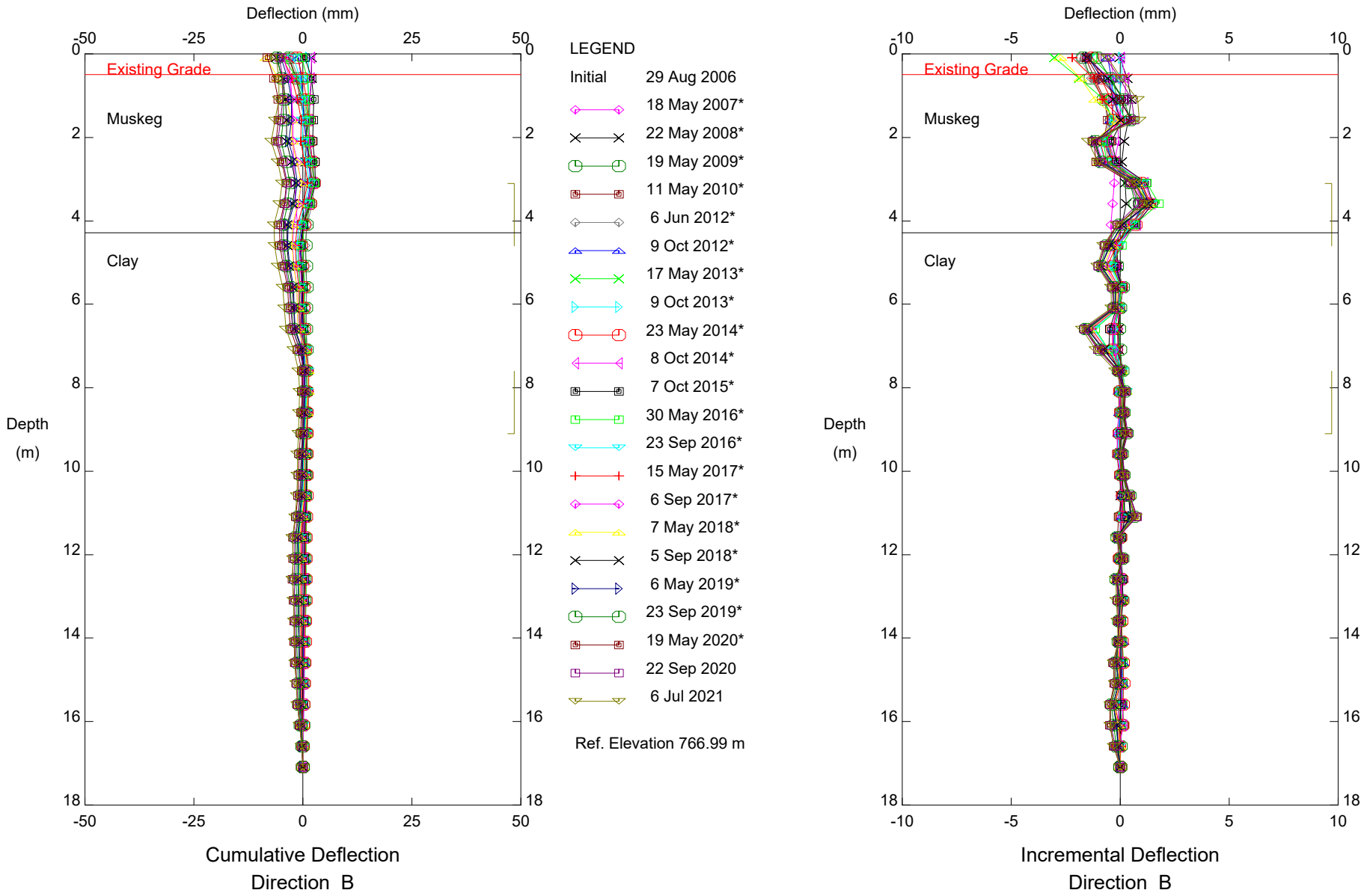

NC33, Inclinometer SI-1

Alberta Transportation

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

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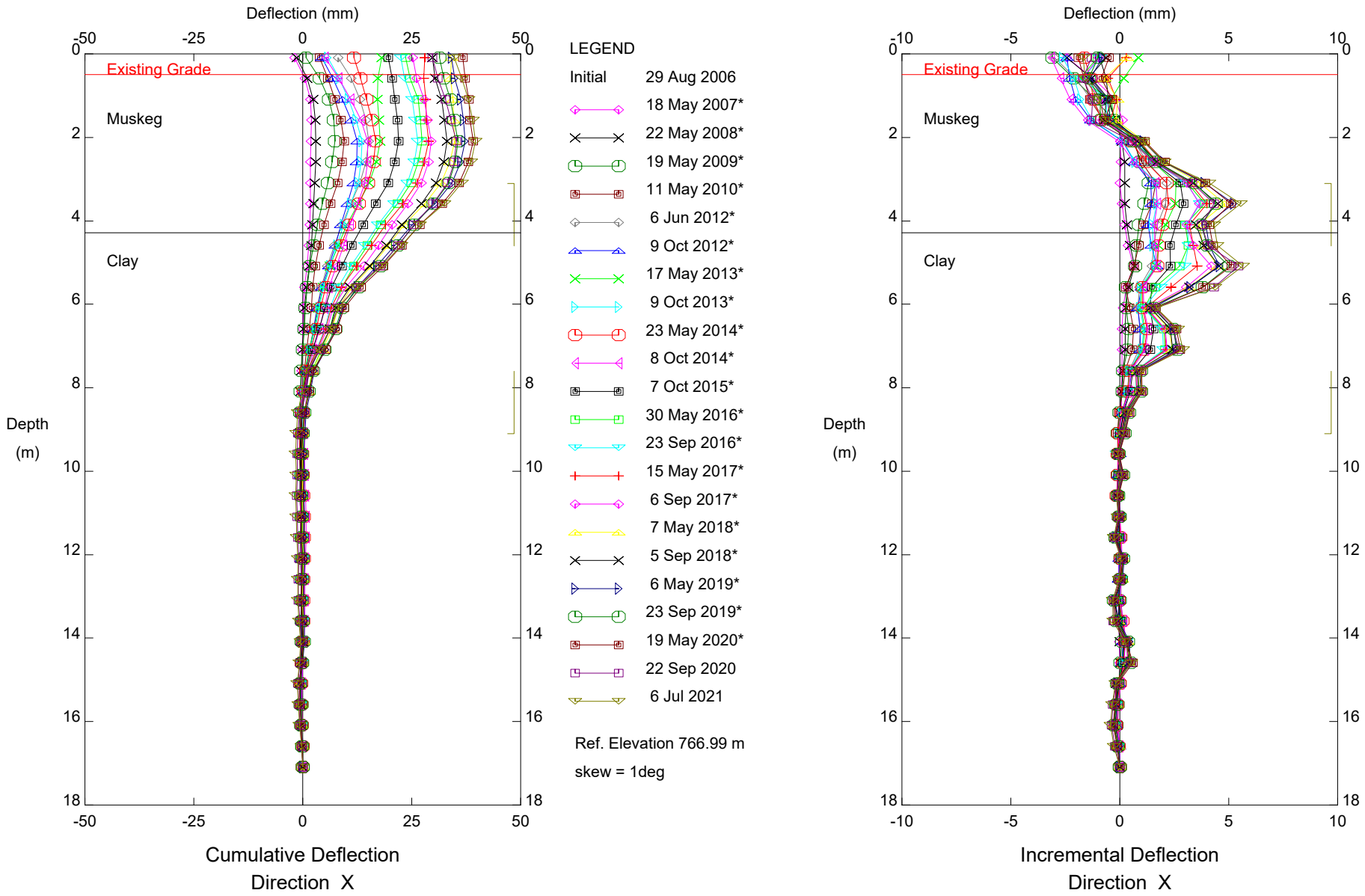

NC33, Inclinometer SI-1

Alberta Transportation

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

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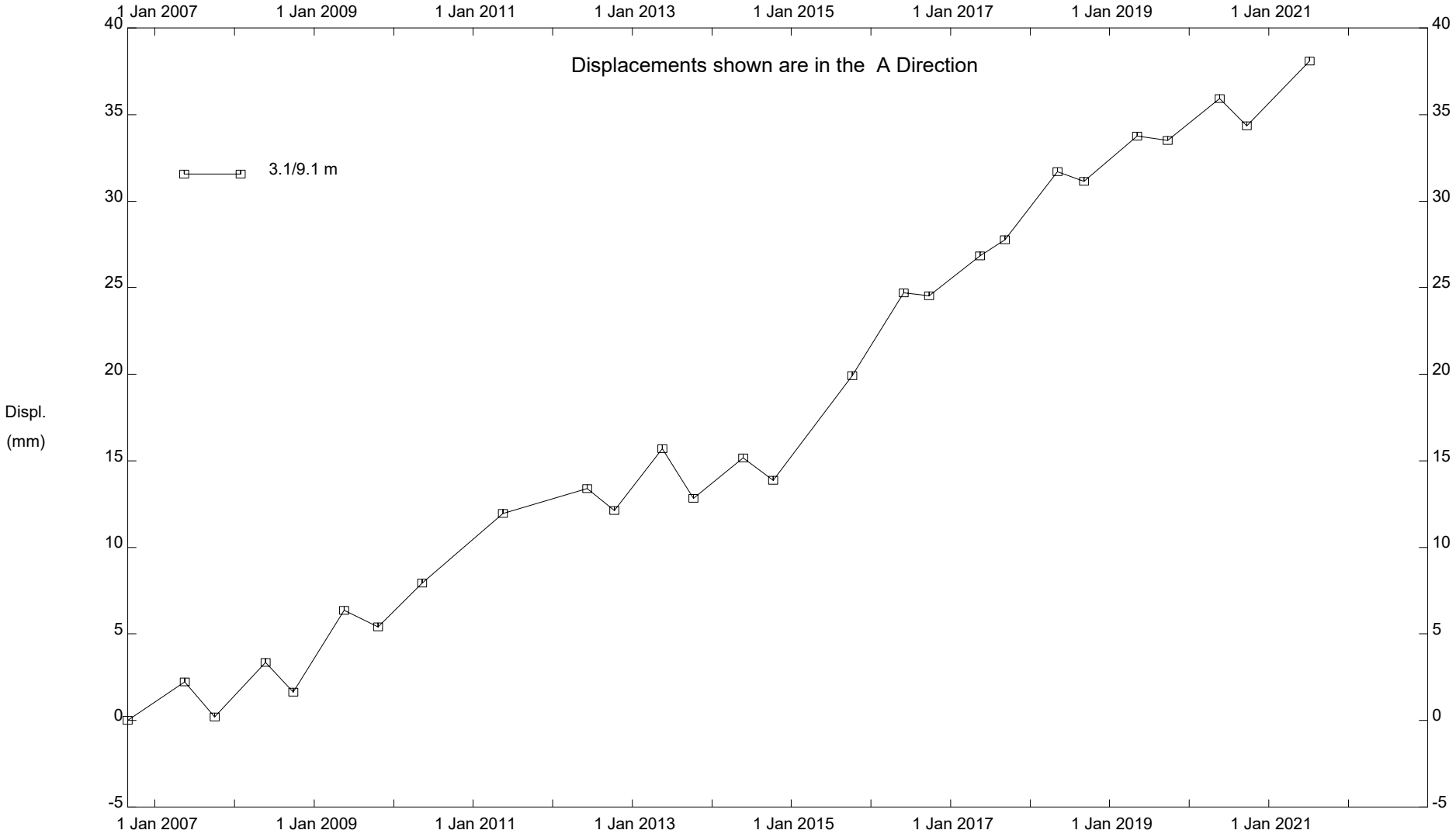

NC33, Inclinometer SI-1

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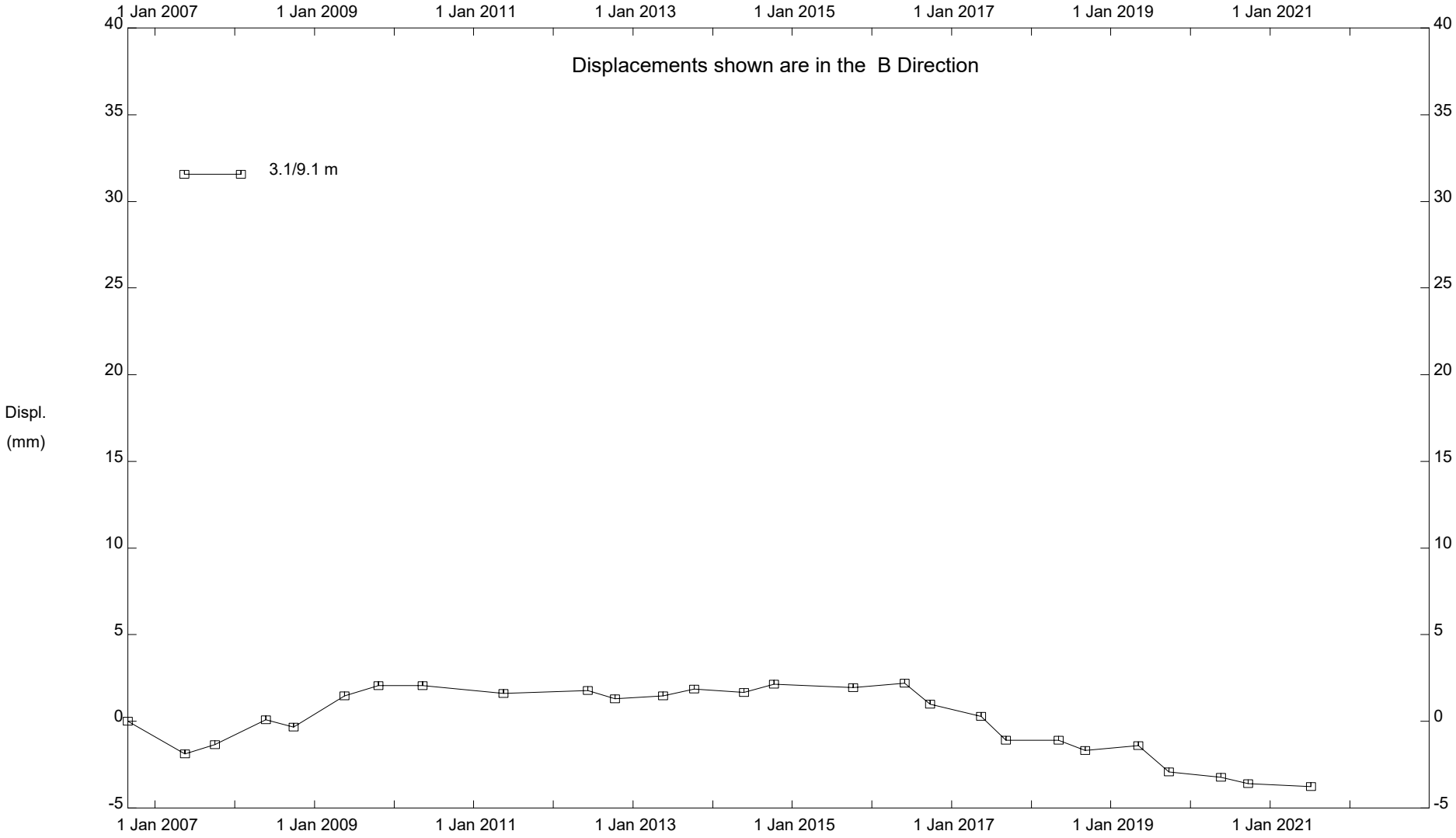

NC33, Inclinometer SI-1

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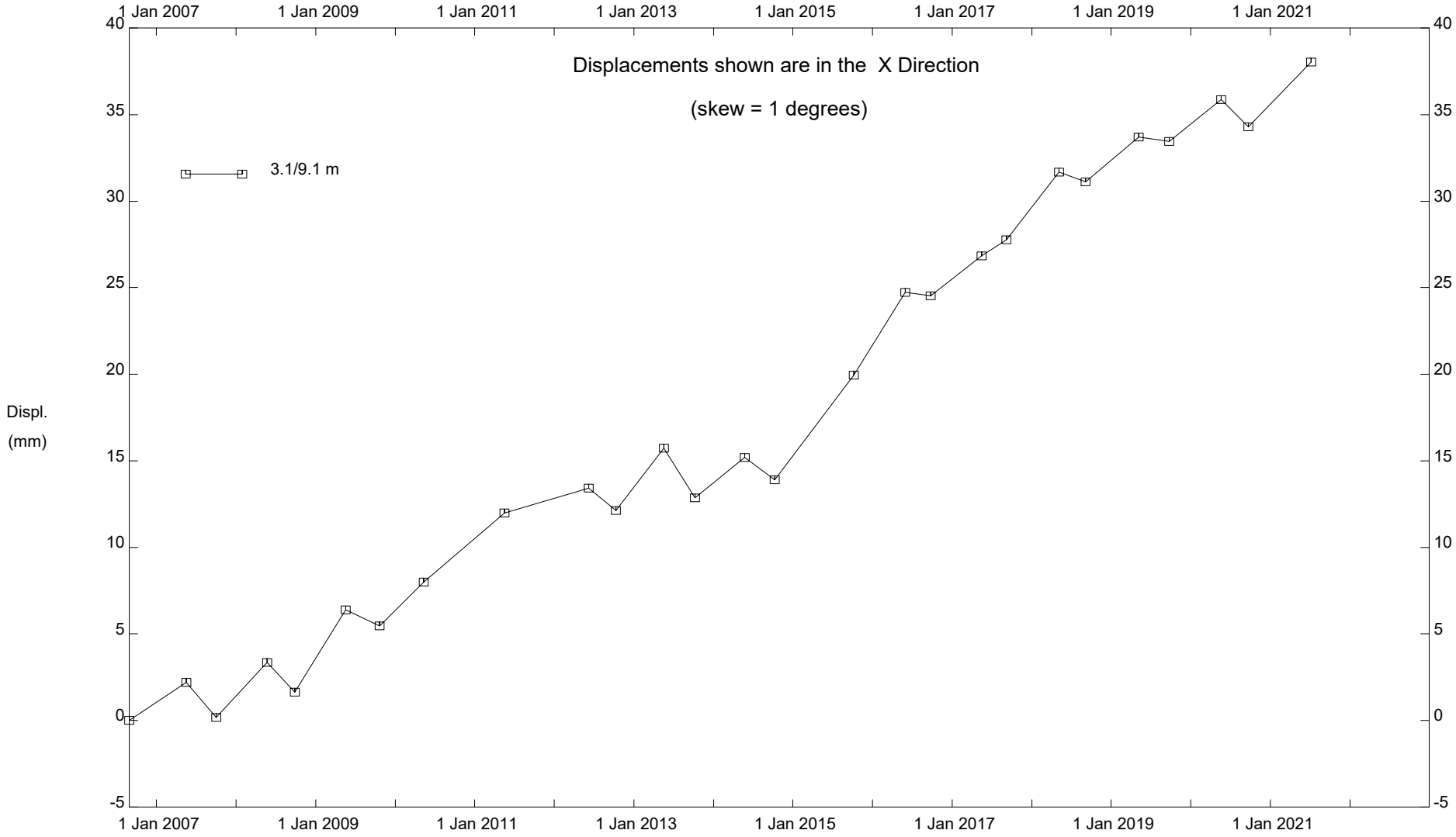

NC33, Inclinometer SI-1

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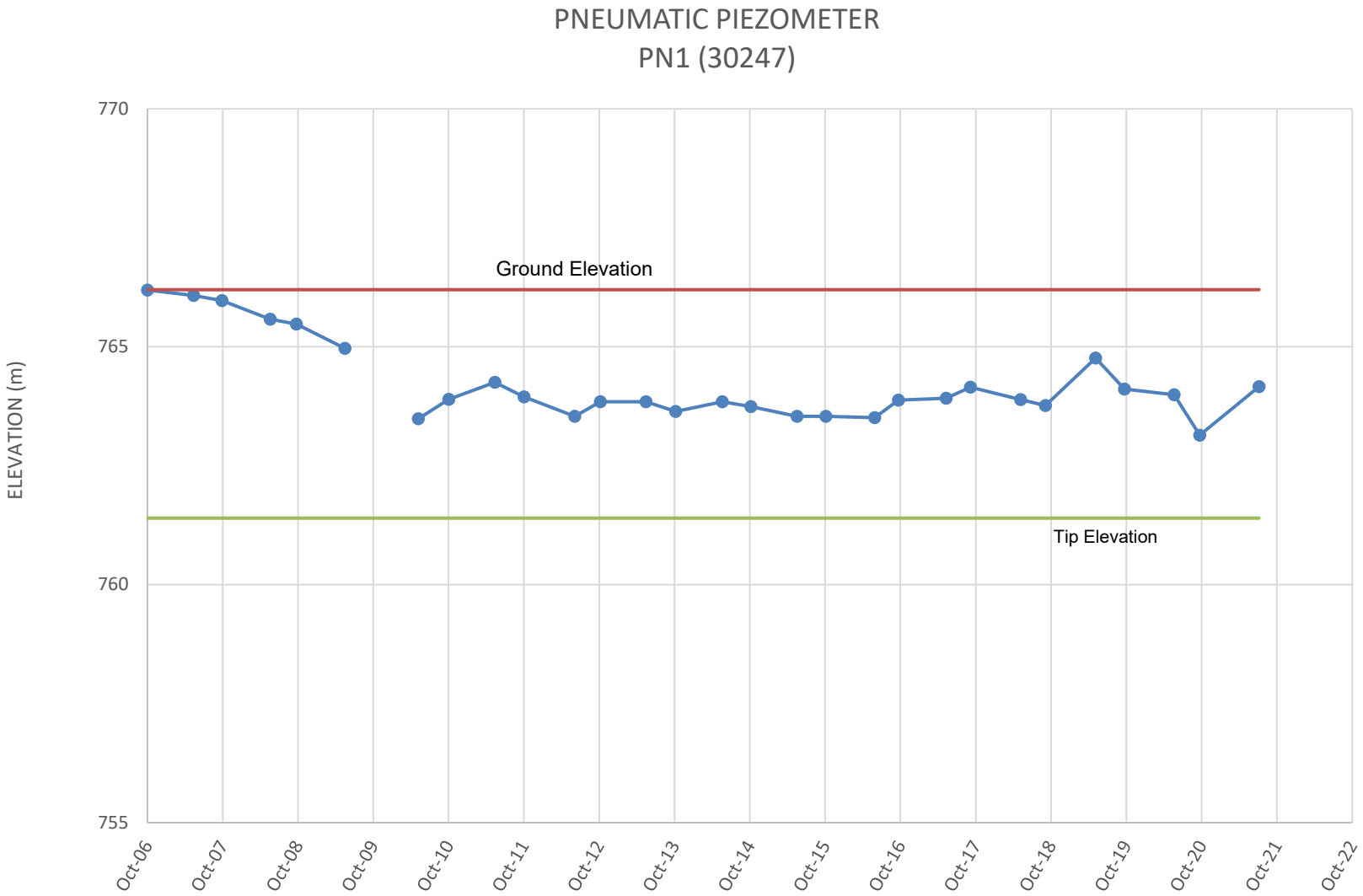
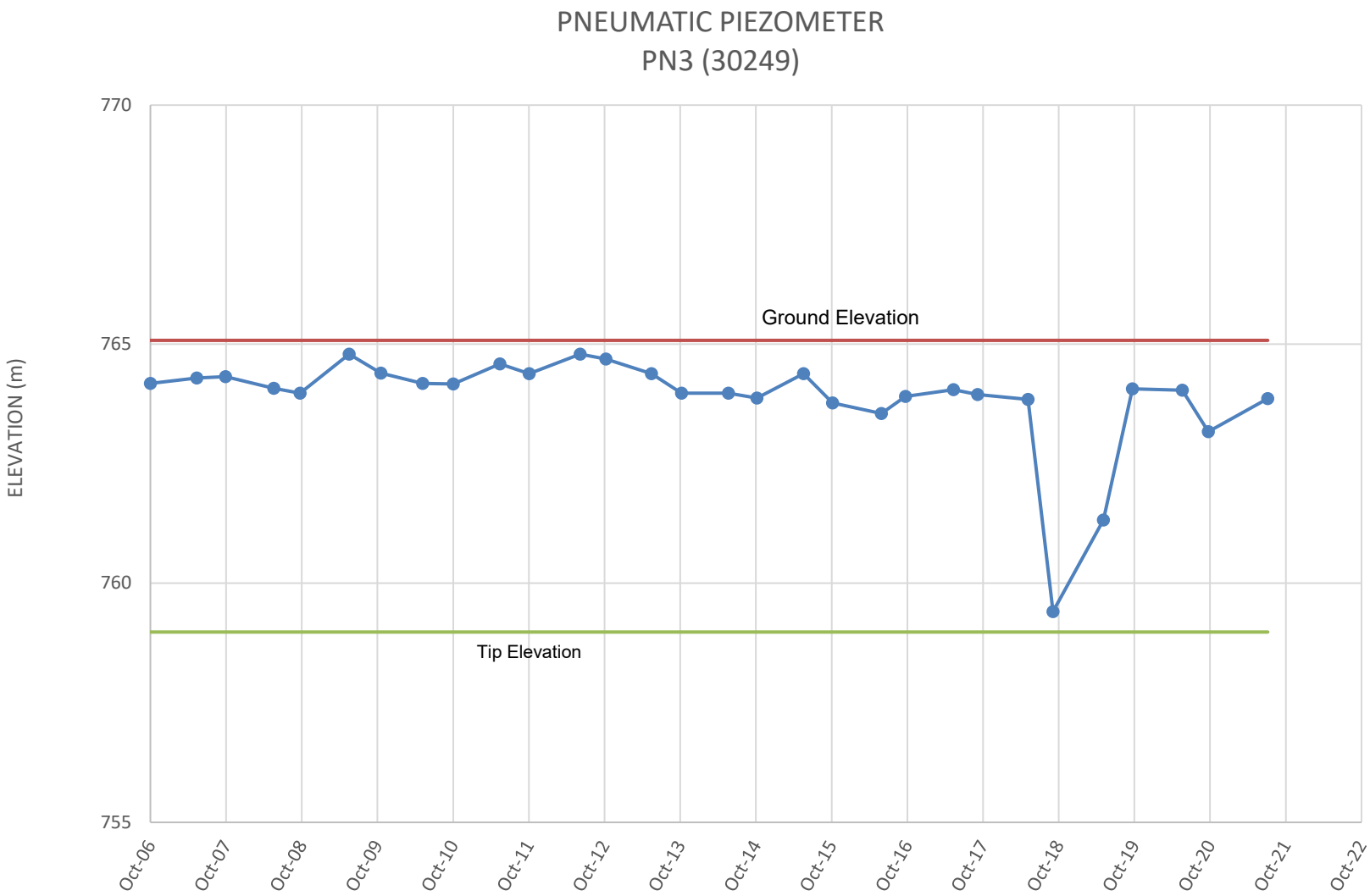

PNEUMATIC PIEZOMETER
PN1 (30247)
ELEVATION (m)
770
765
760
755
Ground Elevation
Tip Elevation
Oct-06
Oct-07
Oct-08
Oct-09
Oct-10
Oct-11
Oct-12
Oct-13
Oct-14
Oct-15
Oct-16
Oct-17
Oct-18
Oct-19
Oct-20
Oct-21
Oct-22

Stantec


PNEUMATIC PIEZOMETER
PN3 (30249)
ELEVATION (m)
770
765
760
755
Ground Elevation
Tip Elevation
Oct-06
Oct-07
Oct-08
Oct-09
Oct-10
Oct-11
Oct-12
Oct-13
Oct-14
Oct-15
Oct-16
Oct-17
Oct-18
Oct-19
Oct-20
Oct-21
Oct-22