



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 NC088: HWY 63:06 km 108 SETTLEMENT

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. FIELD PROGRAM AND INSTRUMENTATION STATUS

One slope inclinometer (SI18-4) and four pneumatic piezometers (PN18-3A, PN18-3B, PN18-4A and PN18-4B) were read at the Hwy 63:06 East and West Embankment Failures site on May 28, 2022, by Mr. Niraj Regmi, G.I.T. and Mr. Kyle Croymans, both of Thurber Engineering Ltd.

A site plan showing the approximate instrumentation locations is included in Appendix A.

The SIs were read using a RST Digital Inclinometer probe with a 2 ft. wheelbase and a RST Pocket PC readout. Inclinometer reading depths were defined as per cable markings with respect to the top of the inclinometer casings. The pneumatic piezometers were read using a RST C108 pneumatic piezometer reader.



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. Pneumatic piezometer results are also provided in Appendix A. The slope inclinometer and piezometer 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

No zones of new movement were identified in SI18-4 since the previous readings in the spring of 2022.

Zones of movement are summarized in Table NC088-1 below. Table NC088-1 also provides a historical account of the total movement, the depth of movement and the maximum rate of movement that has occurred in the SIs since initialization.



**TABLE NC088-1
FALL 2022 – HWY 63:06 KM 108 SETTLEMENT
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: September 21, 2022

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr.)	CURRENT STATUS OF SI	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.)
SI17-1	September 15, 2017	No discernible movement	N/A	Paved over	September 15, 2017	N/A	N/A	N/A
SI17-2	September 15, 2017	218.8 over 0.1 m to 7.4 m depth in 67° direction	295.3 on May 26, 2018	Destroyed during construction	January 13, 2019	N/A	N/A	N/A
SI18-3	December 9, 2018	39.7 over 6.5 m to 11.3 m depth in 51° direction	218.1 on January 16, 2019	Sheared 11.6 m below top of casing	October 7, 2021	N/A	N/A	N/A
SI18-4	December 9, 2018	30.0 over 0.3 to 2.1 m depth in 272° direction	729.4 on December 10, 2018	Operational	May 28, 2022	N/A	N/A	-1.6

Drawing 32122-NC088 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.



TABLE NC088-2
FALL 2022 – HWY 63:06 KM 108 SETTLEMENT
PNEUMATIC AND STANDPIPE PIEZOMETER INSTRUMENTATION READING SUMMARY

Date Monitored: September 21, 2022

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	CURRENT STATUS	HIGHEST MEASURED GROUNDWATER DEPTH (m)	MEASURED PORE PRESSURE (kPa)	CURRENT GROUNDWATER DEPTH (m)	PREVIOUS GROUNDWATER DEPTH (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
<i>PN17-1A (37669)</i>	<i>September 15, 2017</i>	<i>11.00</i>	<i>Paved Over</i>	<i>4.29 on September 15, 2017</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<i>PN17-1B (37663)</i>	<i>September 15, 2017</i>	<i>16.00</i>	<i>Paved Over</i>	<i>4.91 on September 15, 2017</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<i>PN17-2A (37668)</i>	<i>September 15, 2017</i>	<i>5.60</i>	<i>Damaged during construction</i>	<i>2.86 on September 15, 2017</i>	<i>N/A</i>	<i>N/A</i>	<i>3.24</i>	<i>N/A</i>
<i>PN17-2B (37662)</i>	<i>September 15, 2017</i>	<i>7.50</i>	<i>Damaged during construction</i>	<i>4.51 on May 26, 2018</i>	<i>N/A</i>	<i>N/A</i>	<i>4.47</i>	<i>N/A</i>
<i>PN18-3A (38153)</i>	<i>December 9, 2018</i>	<i>7.62</i>	<i>Operational</i>	<i>2.12 on May 27, 2019</i>	<i>23.60</i>	<i>5.22</i>	<i>5.31</i>	<i>0.09</i>
<i>PN18-3B (38150)</i>	<i>December 9, 2018</i>	<i>12.19</i>	<i>Operational</i>	<i>4.53 on December 10, 2018</i>	<i>43.4</i>	<i>7.86</i>	<i>7.77</i>	<i>-0.09</i>
<i>PN18-4A (38152)</i>	<i>December 9, 2018</i>	<i>6.10</i>	<i>Operational</i>	<i>3.57 on December 15, 2018</i>	<i>3.9</i>	<i>5.86</i>	<i>5.70</i>	<i>-0.16</i>
<i>PN18-4B (28151)</i>	<i>December 9, 2018</i>	<i>12.19</i>	<i>Operational</i>	<i>4.32 on December 17, 2018</i>	<i>64.0</i>	<i>5.68</i>	<i>5.67</i>	<i>-0.01</i>
<i>SP17-3</i>	<i>August 24, 2017</i>	<i>15.19</i>	<i>Could not be located</i>	<i>4.13 on October 18, 2017</i>	<i>N/A</i>	<i>N/A</i>	<i>4.13 (October 18, 2017)</i>	<i>N/A</i>

Figure 32122-NC088-1 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.



3. INTERPRETATION OF MONITORING RESULTS

SI18-4 showed no discernible movement over 0.3 m to 2.1 m depth since the spring of 2022 readings. The movement rate of the west landslide appears to have reduced significantly since the completion of the interim repair measures.

Pneumatic piezometer PN18-3A showed an increase in groundwater level of 0.09 m since the spring of 2022 readings. PN18-3B, PN18-4A, and PN18-4B showed decreases in groundwater level of 0.09 m, 0.16 m, and 0.01 m, respectively, since the spring of 2022 readings. PN18-3A has shown a trend of gradually decreasing groundwater level since the spring of 2019. The pneumatic piezometer readings are summarized in Table NC088-2, and are plotted on Figure NC088-1, included in Appendix A.

4. RECOMMENDATIONS

4.1 Future Work

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

4.2 Instrumentation Repairs

No instrument repairs are required at this time. However, it is recommended to replace SI18-3 to continue monitoring the movement rate of the northbound lane landslide.



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

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-NC088)
 - SI Reading Plots
 - Figure NC088-1 (Piezometric Depths)



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

FALL 2022

**APPENDIX A
DATA PRESENTATION AND SITE PLANS**

SITE NC088: HWY 63:06 km 108 SETTLEMENT

**ALBERTA TRANSPORTATION
NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS
INSTRUMENTATION MONITORING FIELD SUMMARY (NC088)
FALL 2022**

Location: HWY 63:06 (RI 11.570) - km 108 Settlement File Number: 32122 Probe: RST Set 8R Cable: RST Set 8R	Readout: RST PN C108 Unit 1 Casing Diameter: 2.75" Temp (deg C): 17 Read by: NKR/KTC
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SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (UTM 12)		Date	Stickup (m)	Readings Depth from top of casing (ft)	Azimuth of A+ Groove degree	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Northing	Easting					A+	A-	B+	B-		
SI18-4	6172648	426558	21-Sep-22	0.66	58 to 2	270	729	-713	-40	51	8R/8R	West Side

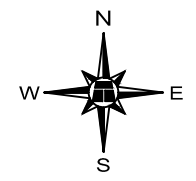
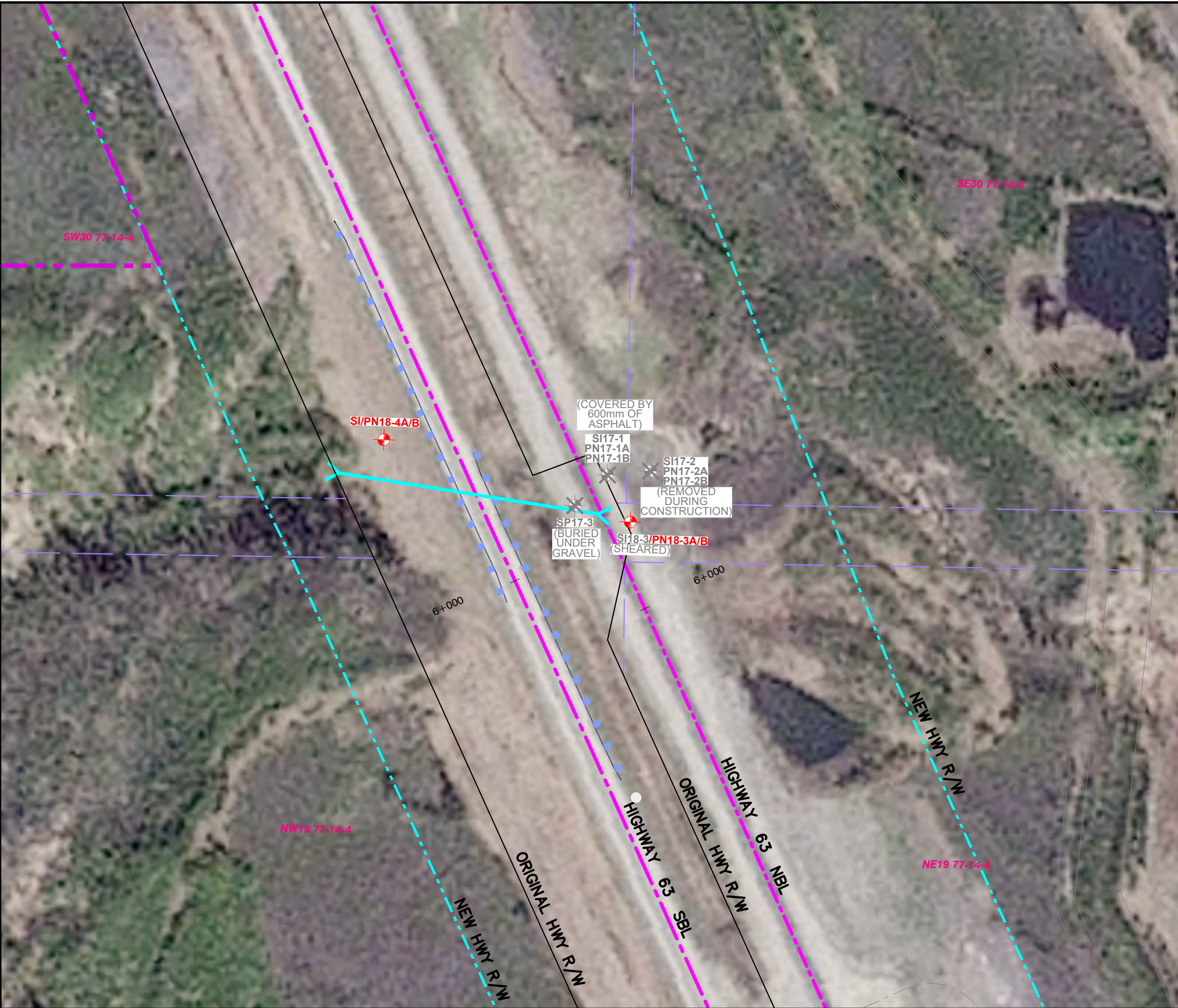
PNEUMATIC PIEZOMETER (PN) READINGS

PN #	Serial	GPS Location (UTM 12)		Location	Date	Reading (kPa)	Comments
		Northing	Easting				
PN18-3A	38153	6172605	426683	Attached to SI18-3	21-Sep-22	23.6	East Side
PN18-3B	38150	6172605	426683	Attached to SI18-3	21-Sep-22	42.5	East Side
PN18-4A	38152	6172648	426558	Attached to SI18-4	21-Sep-22	2.4	West Side
PN18-4B	38151	6172648	426558	Attached to SI18-4	21-Sep-22	63.9	West Side







INSPECTOR REPORT

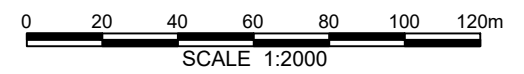
Site is at 108 Km marker on Hwy 63 Northbound lane - SI 18-3
Site is at 108 Km marker on Hwy 63 Southbound lane - SI 18-4

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\CAD\32122 INSTRUMENT 2022\32122-NC088.dwg - 1N - Jun. 17, 2022



LEGEND

-  APPROXIMATE THURBER TEST HOLE LOCATION
-  SLOPE INCLINOMETER
-  PNEUMATIC PIEZOMETER
-  STANDPIPE PIEZOMETER
-  ORIGINAL 1200mm Ø CULVERT
-  NON-OPERATIONAL INSTRUMENT



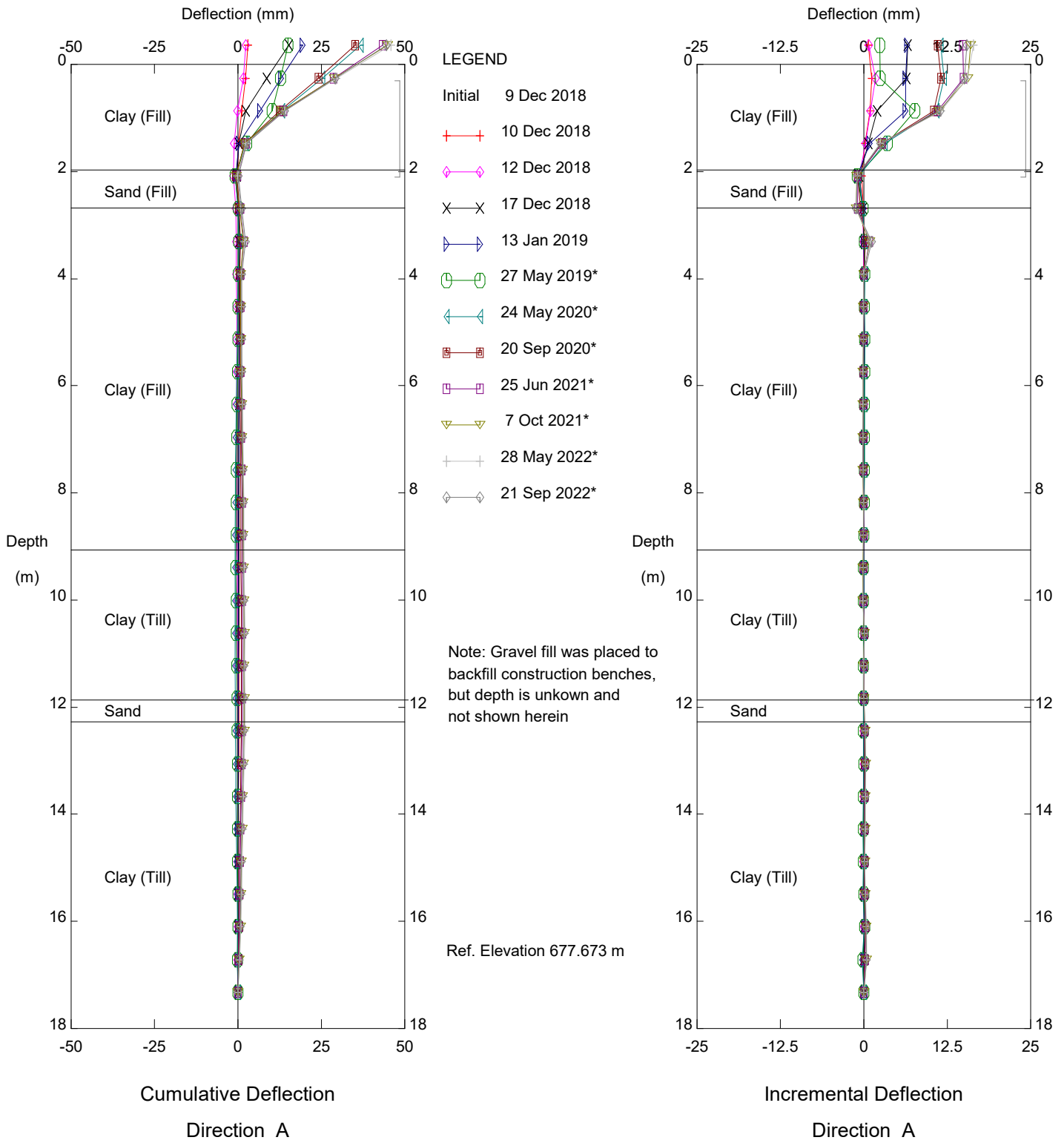
BASE PLAN PROVIDED BY ALBERTA TRANSPORTATION; AIR PHOTO PROVIDED BY VALTUS



**NORTH CENTRAL
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
NC088: HWY 63:06 EAST AND WEST
EMBANKMENT FAILURES (km 4.9)
SITE PLAN SHOWING APPROXIMATE
INSTRUMENT LOCATIONS
DWG No. 32122-NC088**

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	TSA
SCALE	1:2000
DATE	JUNE 2022
FILE No.	32122



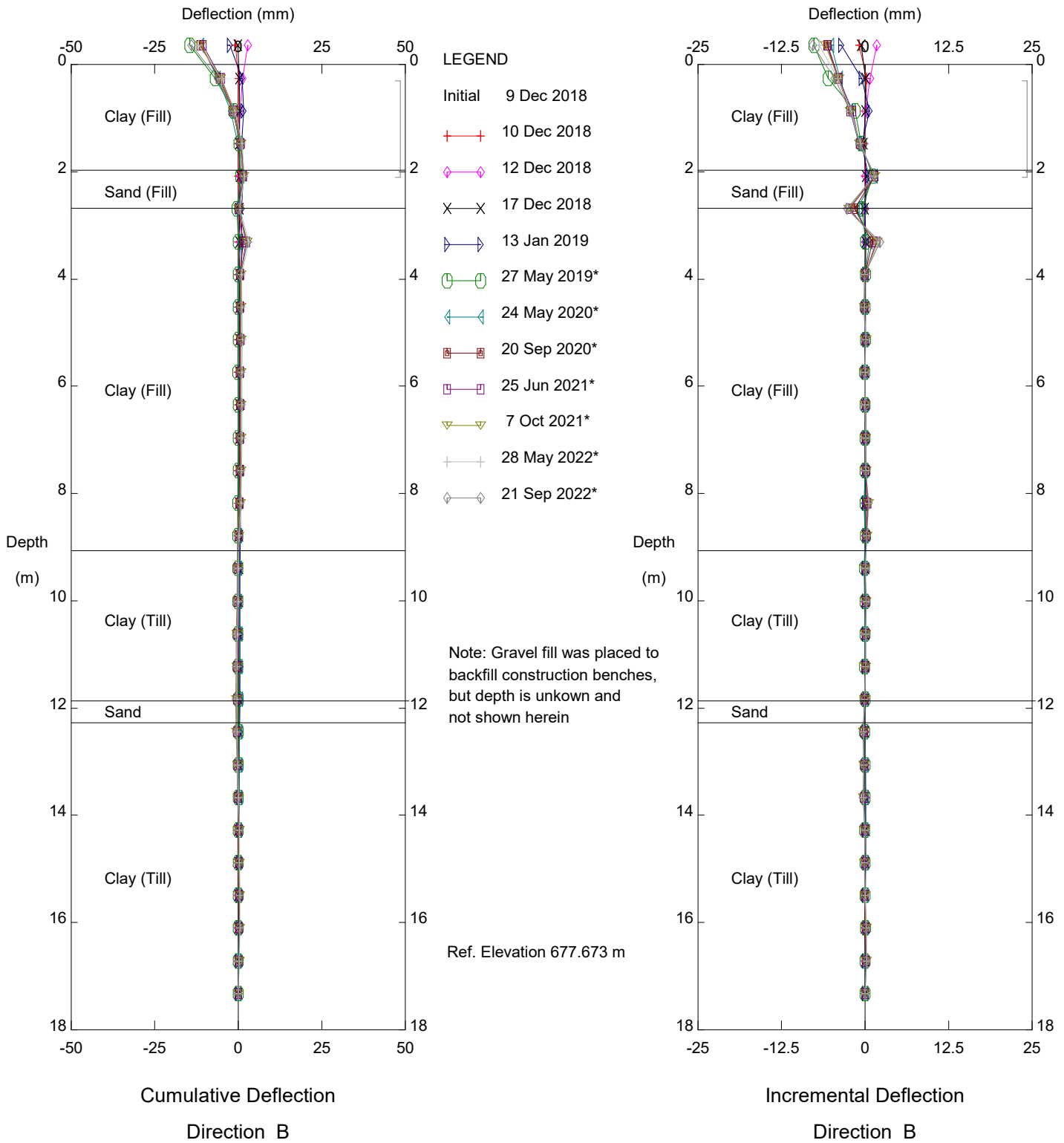


NC088 - West Embankment, Inclinometer SI18-4

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

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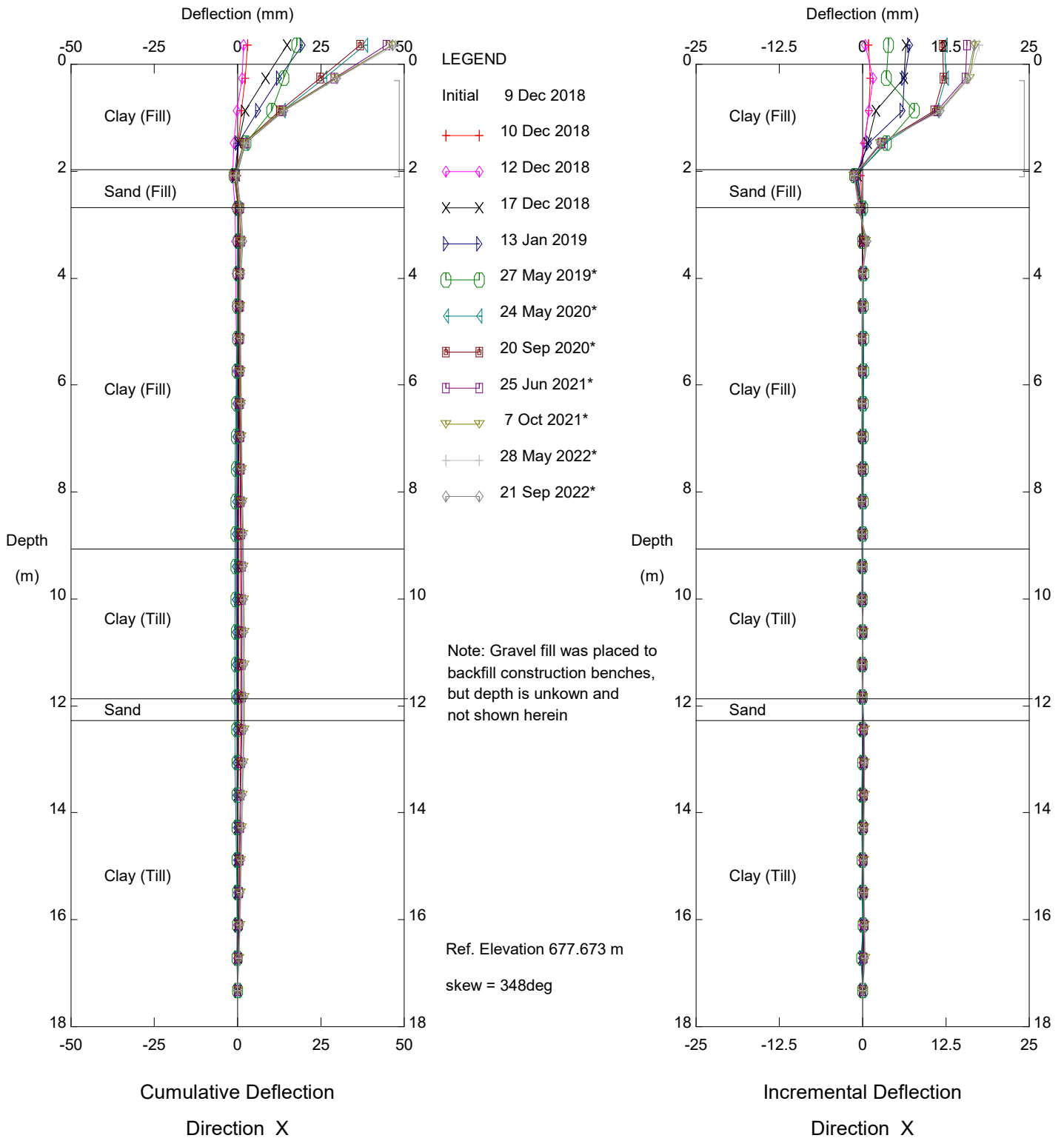


NC088 - West Embankment, Inclinometer SI18-4

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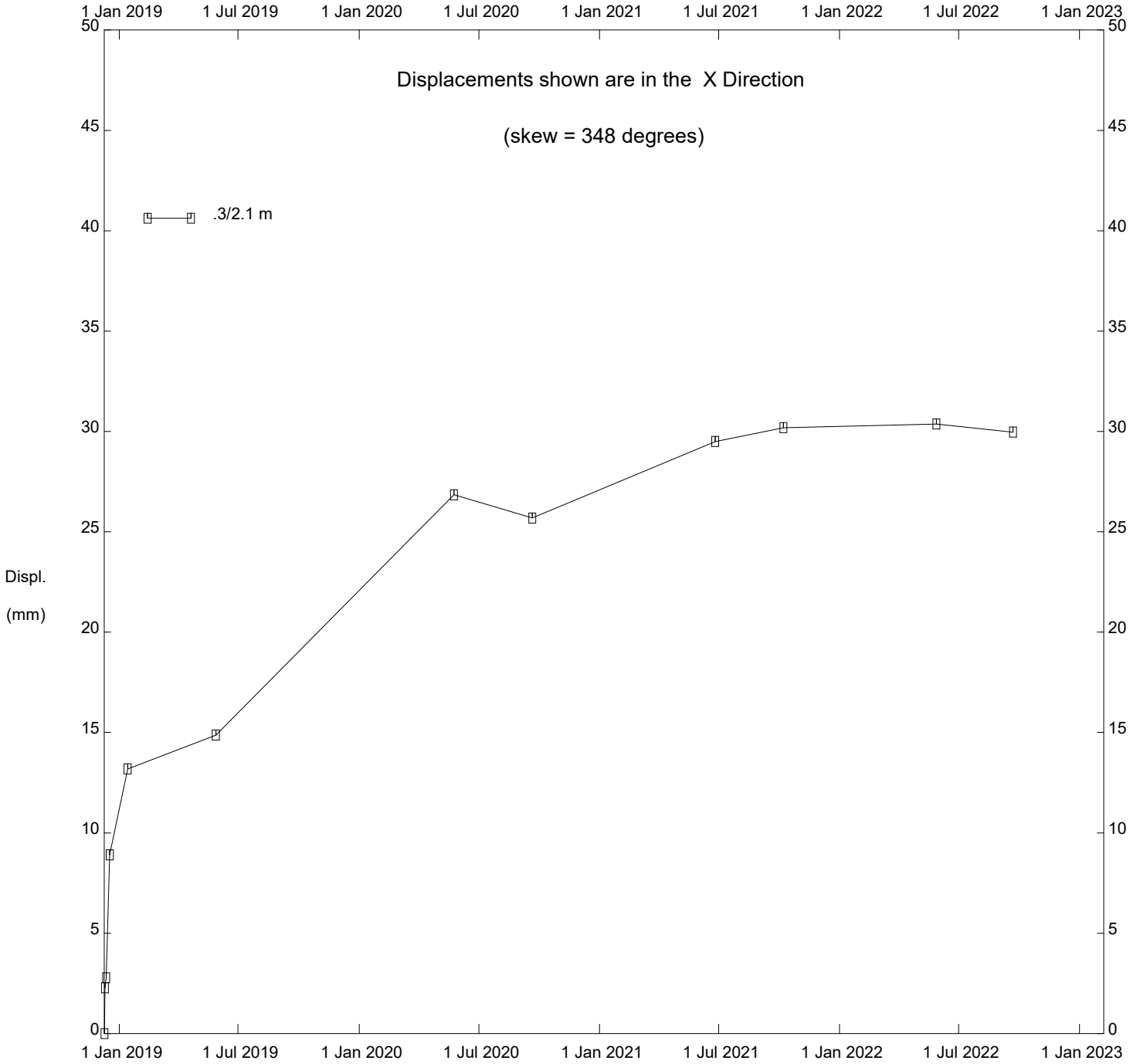


NC088 - West Embankment, Inclinometer SI18-4

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

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NC088 - West Embankment, Inclinometer SI18-4

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**FIGURE NC088-1
PIEZOMETER DATA FOR HWY 63:06 EAST AND WEST EMBANKMENT
FAILURES (km 4.90)**

