

ALBERTA TRANSPORTATION AND  
 ECONOMIC CORRIDORS GRMP  
 NORTH CENTRAL (ATHABASCA AND FORT  
 McMURRAY DISTRICTS)  
 INSTRUMENTATION MONITORING- FALL 2024



Site Number	Location	Name	Hwy	km
NC106	HWY 63:08 km 27.9	Pavement Distress	63:08	27.9
<b>Legal Description:</b> 7-16-83-24 W5		<b>UTM Co-ordinates</b>		
		11V E 455134	N	6227955

<b>Current Monitoring:</b>	17-Sep-2024	<b>Previous Monitoring</b>	8-Jun-2024
<b>Instruments Read By:</b>	Mr. Niraj Regmi, G.I.T and Mr. Nixon Mationg, of Thurber		

Instruments Read During This Site Visit			
<b>Slope Inclinometers (SIs):</b> N/A	<b>Pneumatic Piezometers (PN):</b> N/A	<b>Vibration Wire Piezometers (VW):</b> N/A	<b>Standpipe Piezometers (SP):</b> N/A
<b>Load Cell (LC):</b> N/A	<b>Strain Gauges:</b> N/A	<b>SAA's:</b> N/A	<b>Others:</b>  <b>Extensometer strings:</b> (EXT21-1 and EXT21-2)  <b>Thermistor arrays:</b> (THERM21-2 and THERM21-3)  <b>Thermistor arrays installed as controls:</b> THERM21-1 (Pavement Control)  THERM 21-4 (Grassed Control)  <b>Weather Station</b>

Readout Equipment Used			
<b>Slope Inclinometers:</b>	<b>Pneumatic Piezometers:</b>	<b>Vibration Wire Piezometers:</b>	<b>Standpipe Piezometers:</b>
<b>Load Cell:</b>	<b>Strain Gauges:</b>	<b>SAA's:</b>	<b>Others:</b> All readings were downloaded from a Campbell Scientific CR6 datalogger
<b>Notes:</b>			

<b>Discussion</b>	
<b>Zones of New Movement:</b>	N/A
<b>Interpretation of Monitoring Results:</b>	<p>The extensometer data that was not downloaded correctly during the spring of 2024 readings was successfully recovered during the fall of 2024 readings and is included in the figures.</p> <p>The extensometer data is summarized in Table NC106-1 below and is plotted in Figures NC106-1 and NC106-2 in Appendix A. Extensometer EXT21-1, installed towards the southern end of the Cematrix repair section, shows a current total settlement of 2.9 mm, the majority of which is occurring within the peat layer. EXT21 2, installed towards the northern end of the Cematrix repair section, shows a current total settlement of 13.5 mm, the majority of which is within the peat layer. This corresponds to an overall increase in settlement of 1.3 mm since it was previously read on October 1, 2023.</p> <p>The thermistor results from the monitoring period are summarized in Table NC106-2 and the plots are presented in Figures NC106-3 to NC106-6. The near-surface temperature nodes from each of the thermistor arrays have been compared to the ambient temperature readings, and the results are plotted in Figure NC106-7. To compare the influence of the Cematrix on temperatures at depth, the 1.1 m to 1.3 m thermistor readings from all four locations are plotted in Figure NC106-8.</p> <p>The results indicate the following:</p> <ul style="list-style-type: none"> <li>(a) THERM21-1, installed south of the Cematrix repair zone, shows highly variable temperature readings within its shallowest thermistor nodes (above 1.1 m) reflecting changes in ambient air temperatures (Figure NC106-3). The thermistor nodes below 1.1 m have generally shown less fluctuations in temperatures. The nodes at 2.1 m and 3.1 m depth have recently shown significant scatter in the readings, possibly indicating issues with the sensors.</li> </ul> <p>A similar trend of fluctuating temperatures in response to changes in ambient temperature has been noted in the nodes above 1.3 m in THERM21-2 and THERM21-3, installed within the Cematrix repair section and in THERM21-4 installed within the grass covered area (Figures NC106-4 to NC106-6). The thermistor nodes below 1.3 m at all four locations has generally shown less fluctuations in temperatures.</p> <ul style="list-style-type: none"> <li>(b) As expected, the ground temperature tends to reduce with depth at all thermistor array locations (Figures NC106-3 to NC106-6).</li> <li>(c) The near-surface temperature nodes closely follow the trend of the ambient air temperatures. In addition, the shallow temperatures measured in the paved areas are significantly higher in the summer and colder in the winter compared to the grassed area (Figure NC106-7) as the grass, and accumulated snow in the winter, provides more insulation.</li> <li>(d) Figure NC106-8 shows that the thermistor nodes within the upper 1.3 m in the Cematrix section are less impacted by the changes in temperature when compared to the thermistor node within the upper 1.1 m of the pavement control section, reflecting the insulating properties of the Cematrix. The results from THERM21-2 and THERM21-3 have also demonstrated that the insulating properties of the Cematrix reduced the temperatures below 1.3 m depth, and fluctuation in</li> </ul>

	temperatures between the seasons in the treated section of the highway.
<b>Future Work:</b>	The instruments at this site should be read again in the spring of 2025.
<b>Instrumentation Repairs:</b>	The thermistor junctions and connections to the datalogger should be checked to confirm if this is the source of the noise and missing readings observed during the Fall 2024 readings. If it is not the connections, the issue is likely with mechanical damage to the wires or the thermistors.
<b>Additional Comments:</b>	

<b>Attachments:</b>	<ul style="list-style-type: none"> <li>• Table NC106-1 Fall 2024 – HWY 63:08 km 27.9 Pavement Distress, Extensometer Instrumentation Reading Summary</li> <li>• Table NC106-2 Fall 2024 – HWY 63:08 km 27.9 Pavement Distress, Thermistor Array Instrumentation Reading Summary</li> <li>• Table NC106-3 Fall 2024 – HWY 63:08 km 27.9 Pavement Distress, Weather Station Instrumentation Reading Summary</li> <li>• Statement of Limitations and Conditions</li> <li>• APPENDIX A – NC106-1 FALL 2024 <ul style="list-style-type: none"> <li>○ Field Inspector’s report</li> <li>○ Site Plan and Cross Sections Showing Approximate Instrument Locations (Drawings No. 32122-NC106 1)</li> <li>○ Figures NC106-1 and NC106-2 (Extensometer Data Plots)</li> <li>○ Figures NC106-3 through NC106-6 (Individual Thermistor Array Plots)</li> <li>○ Figure NC106-7 (Composite Plot of Shallow Thermistor Array Nodes and Ambient Air Temperature)</li> <li>○ Figure NC106-8 (Composite Plot of 1.1 m – 1.3 m depth Thermistor Array Nodes and Ambient Air Temperature)</li> </ul> </li> </ul>
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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.  
Partner | Senior Geotechnical Engineer

Lucas Green, P.Eng.  
Geotechnical Engineer

**Table NC106-1: Fall 2024 – Hwy 63:08 Km 27.9 Pavement Distress Extensometer Instrumentation Reading Summary**

Date Monitored: September 17, 2024 (Monitoring period from October 1, 2023 to September 17, 2024)

SETTLEMENT ZONE <sup>(1)</sup>	DATE INITIALIZED	CURRENT STATUS	CURRENT SETTLEMENT (mm)	PREVIOUS SETTLEMENT (mm) (OCT 1, 2023)	CHANGE IN SETTLEMENT (mm) <sup>(2)</sup>
<b>EXT21-1</b>					
Total Settlement (0 m to 5.83 m depth)	May 18, 2021	Operational	2.9	2.9	0
Settlement in Clay Till (4.83 m to 5.83 m depth)			0.2	0.5	-0.3
Settlement in Peat (1.33 m to 4.83 m depth)			1.7	1.4	0.3
Settlement in Cematrix, Clay Cap and GBC (0 m to 1.33 m depth)			1.0	1.1	-0.1
<b>EXT21-2</b>					
Total Settlement (0 m to 5.76 m depth)	May 18, 2021	Operational	13.5	12.2	1.3
Settlement in Clay Till (4.76 m to 5.76 m depth)			0.8	1.0	-0.2
Settlement in Peat (1.26 m to 4.76 m depth)			9.3	8.1	1.2
Settlement in Cematrix, Clay Cap and GBC (0 to 1.26 m depth)			3.4	3.1	0.3

Drawings 32122-NC106-1 through 32122-NC106-3 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.

- Notes: (1) Depth measured from top of granular base coarse (GBC)  
 (2) Negative (-) change in relative settlement indicates upward movement (heave) and positive (+) change in settlement indicates downward movement (settlement)

**Table NC106-2: Fall 2024 – Hwy 63:08 Km 27.9 Pavement Distress Thermistor Array Instrumentation Reading Summary**

Date Monitored: September 17, 2024 (Monitoring period from June 8, 2024 to September 17, 2024)

NODE DEPTH <sup>(1)</sup> (m)	DATE INITIALIZED	CURRENT STATUS	MAX TEMPERATURE OVER MONITORING PERIOD (°C)	MIN TEMPERATURE OVER MONITORING PERIOD (°C)	MEAN TEMPERATURE DURING MONITORING PERIOD (°C)
<b>THERM21-1 (Pavement Control)</b>					
0.1	June 6, 2021	Operational	26.2 (July 23, 2024)	8.5 (June 8, 2024)	18.7
1.1			20.2 (July 24, 2024)	9.0 (June 11, 2024)	16.0
2.1			16.2 (Aug. 12, 2024)	12.0 (June 17, 2024)	14.8
3.1			17.9 (June 11, 2024)	11.4 (July 17, 2024)	13.6
4.1			9.3 (Sep. 16, 2024)	3.7 (June 11, 2024)	7.0
5.1			7.3 (Sep. 15, 2024)	3.0 (June 12, 2024)	5.1
<b>THERM21-2 (Cematrix section)</b>					
0.1	June 6, 2021	Operational	28.3 (July 23, 2024)	10.0 (June 9, 2024)	20.6
0.4			28.4 (July 23, 2024)	11.5 (June 9, 2024)	21.4
0.8			23.7 (July 23, 2024)	9.7 (June 10, 2024)	18.1
1.3			11.4 (Sep. 11, 2024)	5.7 (June 12, 2024)	9.6
2.3			10.3 (Sep. 15, 2024)	5.0 (June 8, 2024)	8.1
3.3			8.3 (Sep. 16, 2024)	3.9 (June 8, 2024)	6.2

Drawings 32122-NC106-1 through 32122-NC106-3 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.

Notes: (1) Depth measured from top of granular base coarse (GBC)

**Table NC106-2 – Continued: Fall 2024 – Hwy 63:08 Km 27.9 Pavement Distress Thermistor Array Instrumentation Reading Summary**

Date Monitored: September 17, 2024 (Monitoring period from June 8, 2024 to September 17, 2024)

NODE DEPTH <sup>(1)</sup> (m)	DATE INITIALIZED	CURRENT STATUS	MAX TEMPERATURE OVER MONITORING PERIOD (°C)	MIN TEMPERATURE OVER MONITORING PERIOD (°C)	MEAN TEMPERATURE DURING MONITORING PERIOD (°C)
<b>THERM21-3 (Cematrix Section)</b>					
0.3	June 6, 2021	Operational	27.4 (July 23, 2024)	9.2 (June 9, 2024)	19.8
1.3			12.2 (Sep. 10, 2024)	4.9 (June 8, 2024)	11.4
2.3			11.2 (Sep. 15, 2024)	3.6 (June 9, 2024)	10.0
3.3			7.3 (Sep. 15, 2024)	3.0 (June 8, 2024)	6.0
4.3			5.5 (Sep. 15, 2024)	4.2 (June 16, 2024)	4.9
5.3			4.8 (Sep. 16, 2024)	4.4 (July 2, 2024)	4.5
<b>THERM21-4 (Grassed Control)</b>					
0.3	June 6, 2021	Operational	13.2 (Aug. 25, 2024)	0.8 (June 9, 2024)	8.5
1.3			(N/A) <sup>(2)</sup>	(N/A) <sup>(2)</sup>	(N/A) <sup>(2)</sup>
2.3			5.1 (Sep. 15, 2024)	3.9 (Aug. 8, 2024)	3.9
3.3			4.8 (June 9, 2024)	4.2 (Sep. 11, 2024)	4.2
4.3			5.3 (June 9, 2024)	5.0 (Sep. 15, 2024)	5.0
5.3			5.2 (June 9, 2024)	5.0 (Sep. 15, 2024)	5.0

Drawings 32122-NC106-1 through 32122-NC106-3 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.

Notes: (1) Depth measured from top of GBC (THERM21-3), from ground surface (THERM21-4)

(2) THERM21-4 Node at 1.3 m below ground surface not operating since June 19, 2023



**Table NC106-3: Fall 2024 – Hwy 63:08 Km 27.9 Pavement Distress Weather Station Instrumentation Reading Summary**

Date Monitored: September 17, 2024 (Monitoring period from June 8, 2024 to September 17, 2024)

MONITORING PERIOD	MAX TEMPERATURE (°C)	MIN TEMPERATURE (°C)	MEAN TEMPERATURE (°C)	TOTAL PRECIPITATION (mm)	MAX HOURLY WIND SPEED (m/s)	MEAN HOURLY WIND SPEED (m/s)	MEAN BAROMETRIC PRESSURE (mbar)	MEAN RELATIVE HUMIDITY (%)
Jun. 8, 2024 to Sep. 17, 2024	33.3 on July 10, 2024	0.7 on June 17, 2024	16.2	166.8	16.2 on Sep. 6, 2024	5.0	935.9	74.8

Drawings 32122-NC106-1 through 32122-NC106-3 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.



## 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.

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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.

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### 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.

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**THURBER** ENGINEERING LTD.

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

**FALL 2024**

**APPENDIX A  
DATA PRESENTATION AND DRAWINGS**

**SITE NC106: HWY 63:08 km 27.9 PAVEMENT DISTRESS**

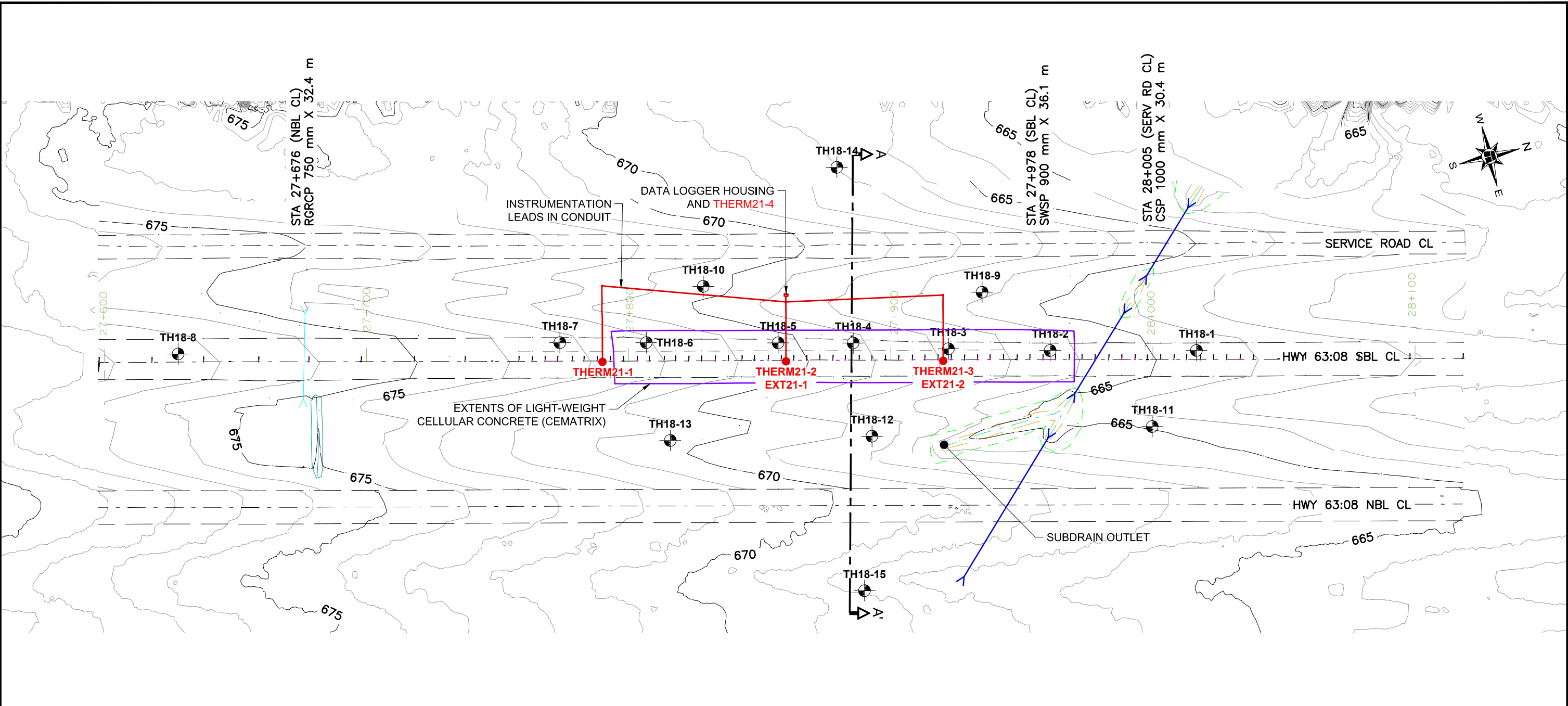
**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS  
 NORTH CENTRAL REGION - ATHABASCA AND FORT McMURRAY DISTRICTS  
 INSTRUMENTATION MONITORING FIELD SUMMARY (NC106)  
 FALL 2024**

<b>Location:</b> Hwy 63:08 km 27.9 Pavement Distress	<b>Temp (deg C):</b> 7
<b>File Number:</b> 32122	<b>Read by:</b> NKR

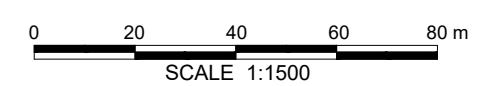
**DATALOGGER STATION READINGS**

Instruments	GPS Location (UTM 12)		Datalogger Serial #	Date	Remarks
	Easting (m)	Northing (m)			
Extensimeters, thermistors and weather station	455134.00	6227955.00	CR6 15875	17-Sep-24	Data downloaded

<b>Confirm that recent dates have been downloaded for all DAT files prior to leaving site. Use "collect now" option in loggernet.</b>
Download data from CR6 logger - need unique key to unlock logger enclosure
Site is between km marker 174 and 176 on southbound lane of Hwy 63



- LEGEND**
- APPROXIMATE TEST HOLE LOCATION
  - PATCH
  - THERM THERMISTOR STRING
  - EXT EXTENSOMETER



BASE PLAN PROVIDED BY ARA ENGINEERING, SURVEYED JUNE 2021;  
LIDAR PROVIDED BY ALBERTA TRANSPORTATION



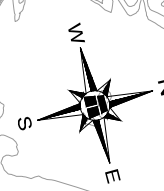
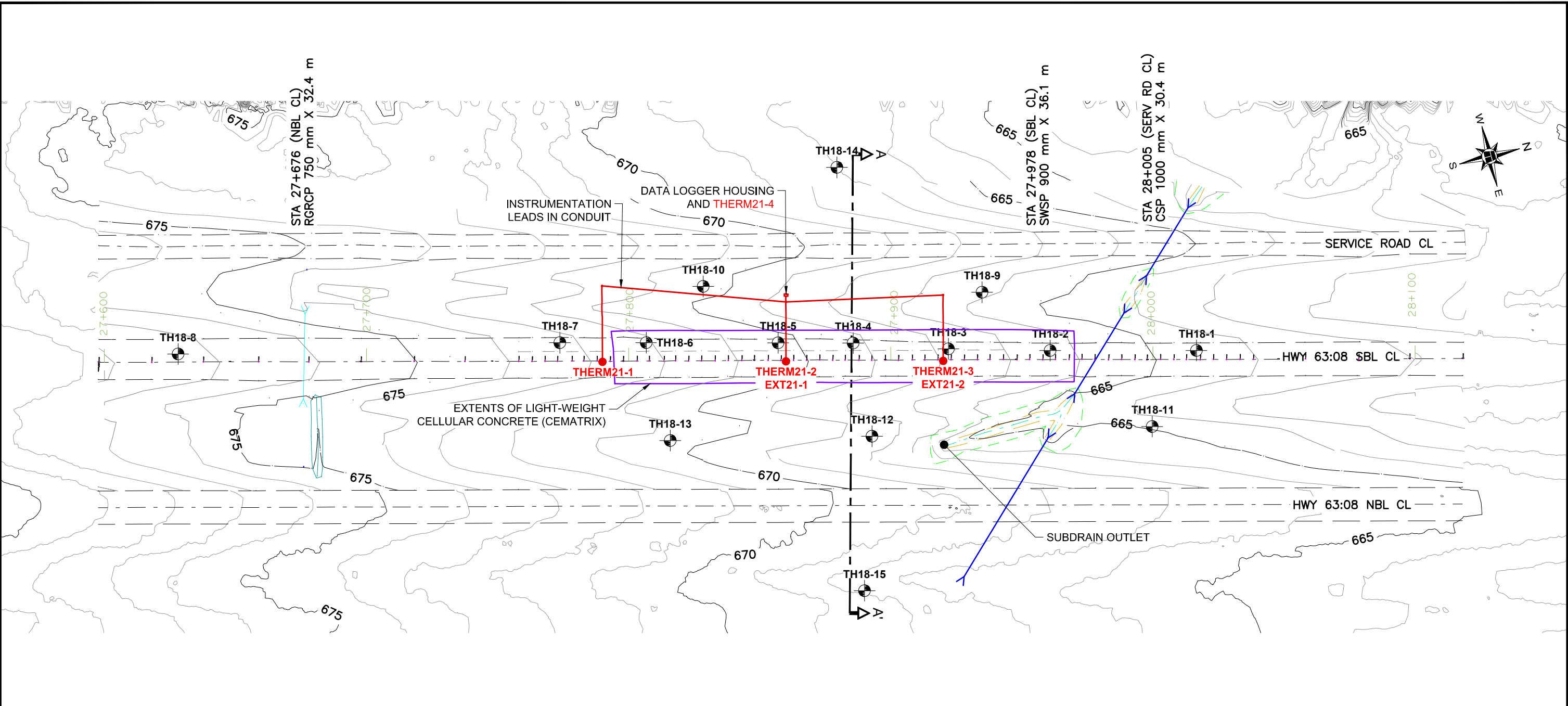
**NC106: HIGHWAY 63:08 km 27.9 PAVEMENT DISTRESS  
NEAR WANDERING RIVER, ALBERTA**

**AS-BUILT SITE PLAN SHOWING LOCATIONS  
OF INSTRUMENTATION AND REPAIR**

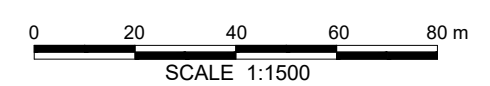
DWG No. 32122-NC106-1

DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	RVC
SCALE	1:1500
DATE	NOVEMBER 2021
FILE No.	32122





- LEGEND**
- APPROXIMATE TEST HOLE LOCATION
  - PATCH
  - THERM THERMISTOR STRING
  - EXT EXTENSOMETER



BASE PLAN PROVIDED BY ARA ENGINEERING, SURVEYED JUNE 2021;  
LIDAR PROVIDED BY ALBERTA TRANSPORTATION



**NC106: HIGHWAY 63:08 km 27.9 PAVEMENT DISTRESS  
NEAR WANDERING RIVER, ALBERTA**

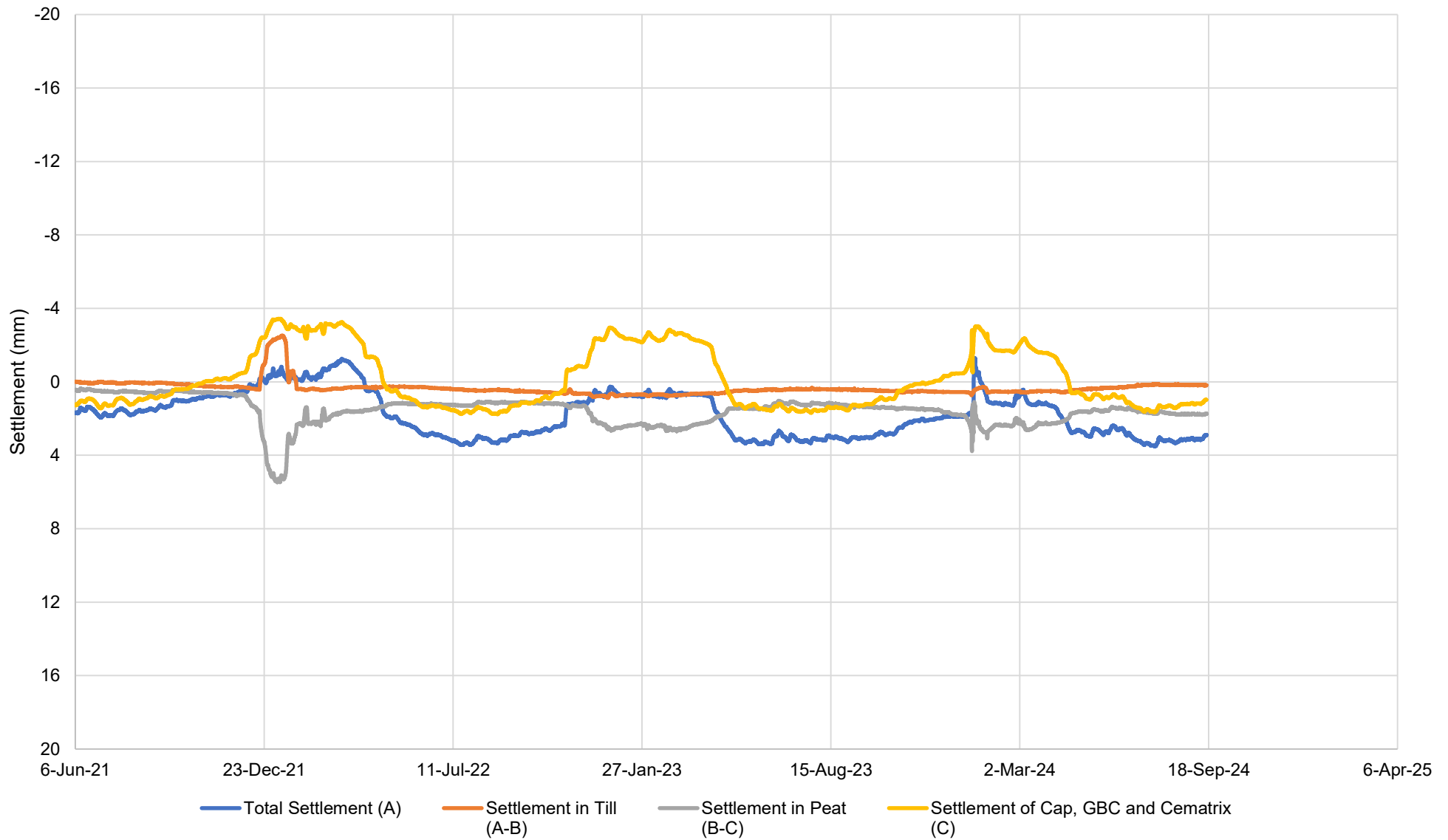
**AS-BUILT SITE PLAN SHOWING LOCATIONS  
OF INSTRUMENTATION AND REPAIR**

DWG No. 32122-NC106-1

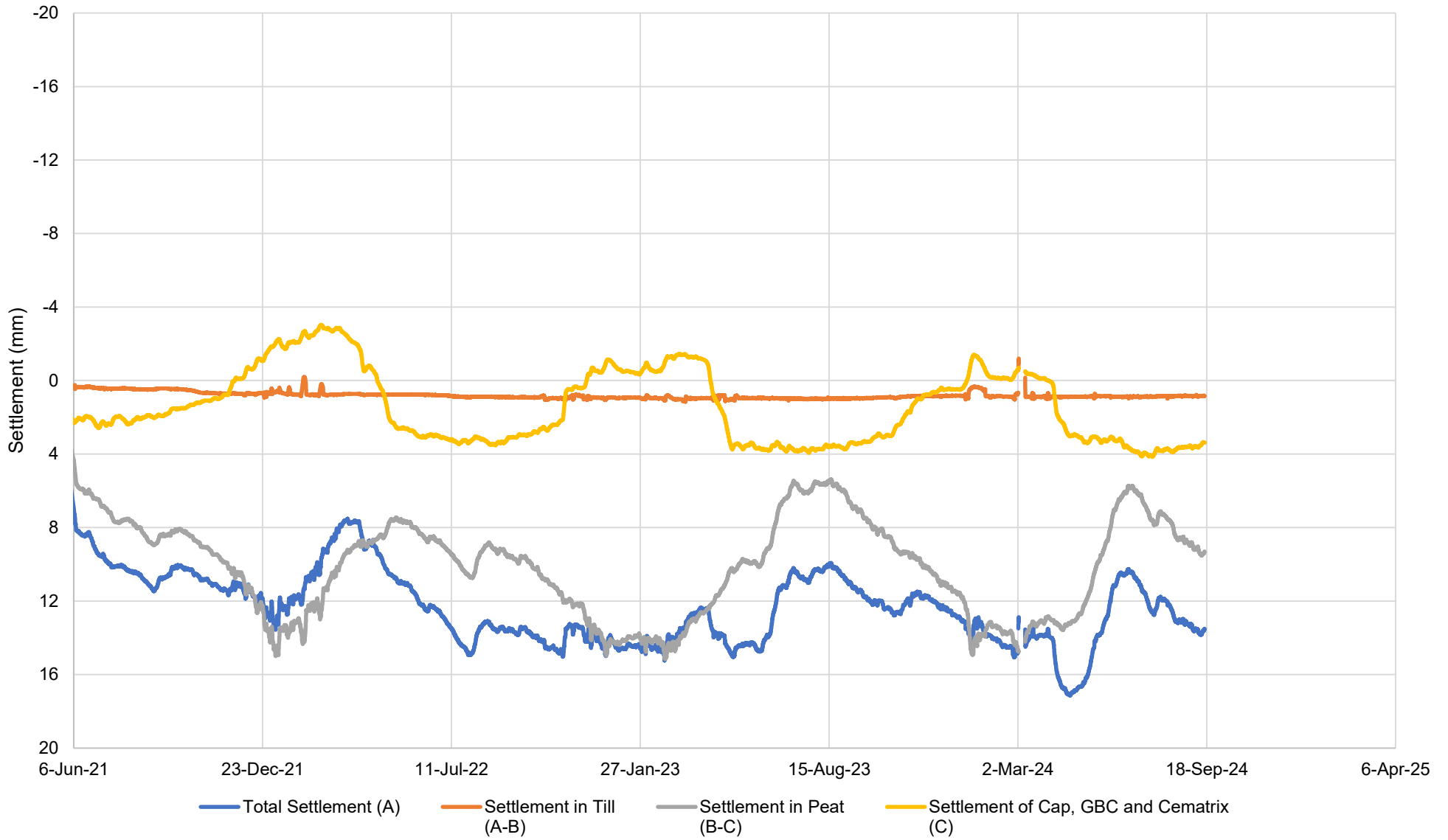
DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	RVC
SCALE	1:1500
DATE	NOVEMBER 2021
FILE No.	32122



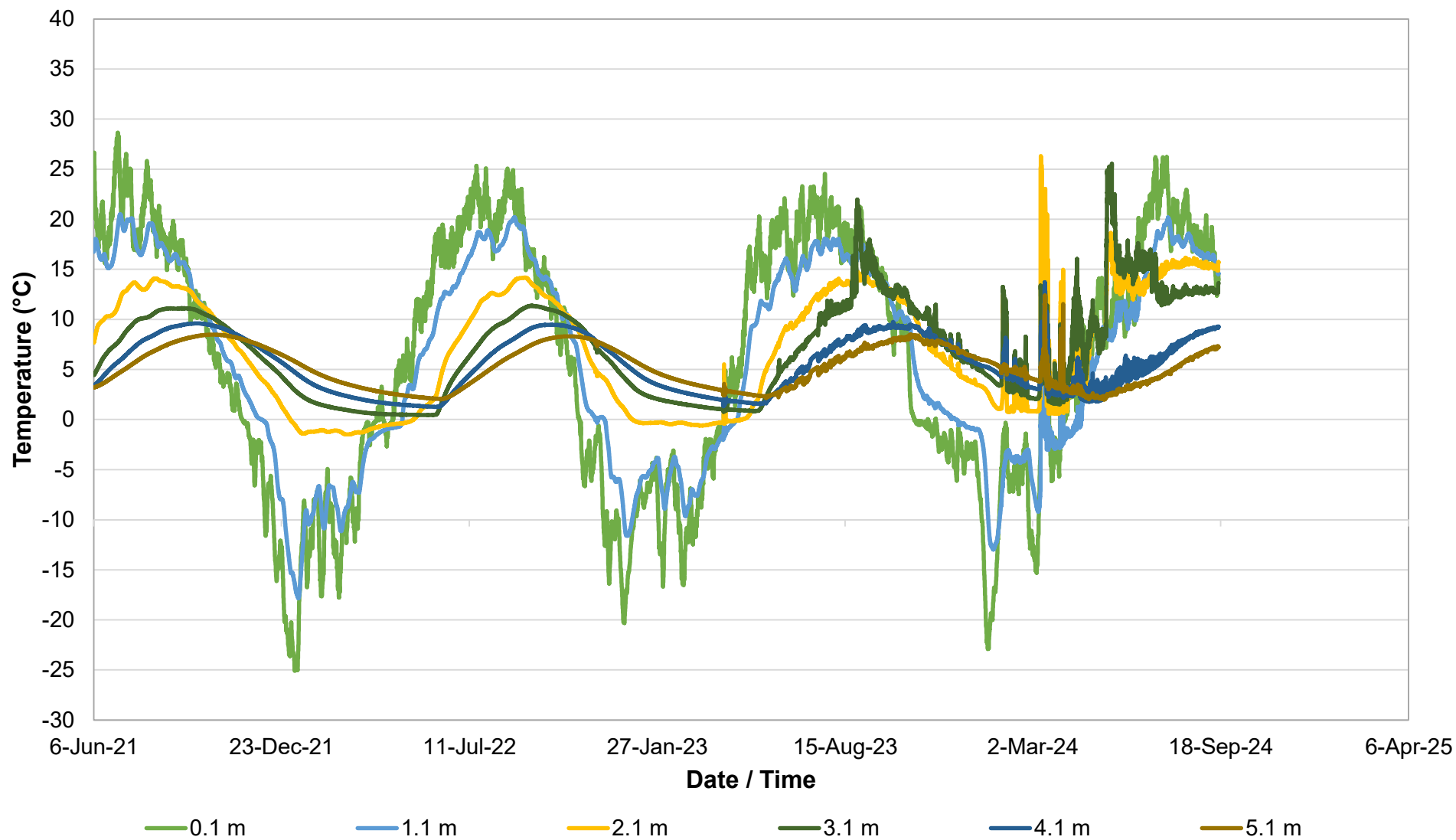
**Figure NC106-1**  
**Highway 63:08 km 27.9 Pavement Distress Near Wandering River, Alberta**  
**EXT21-1 - Displacement**



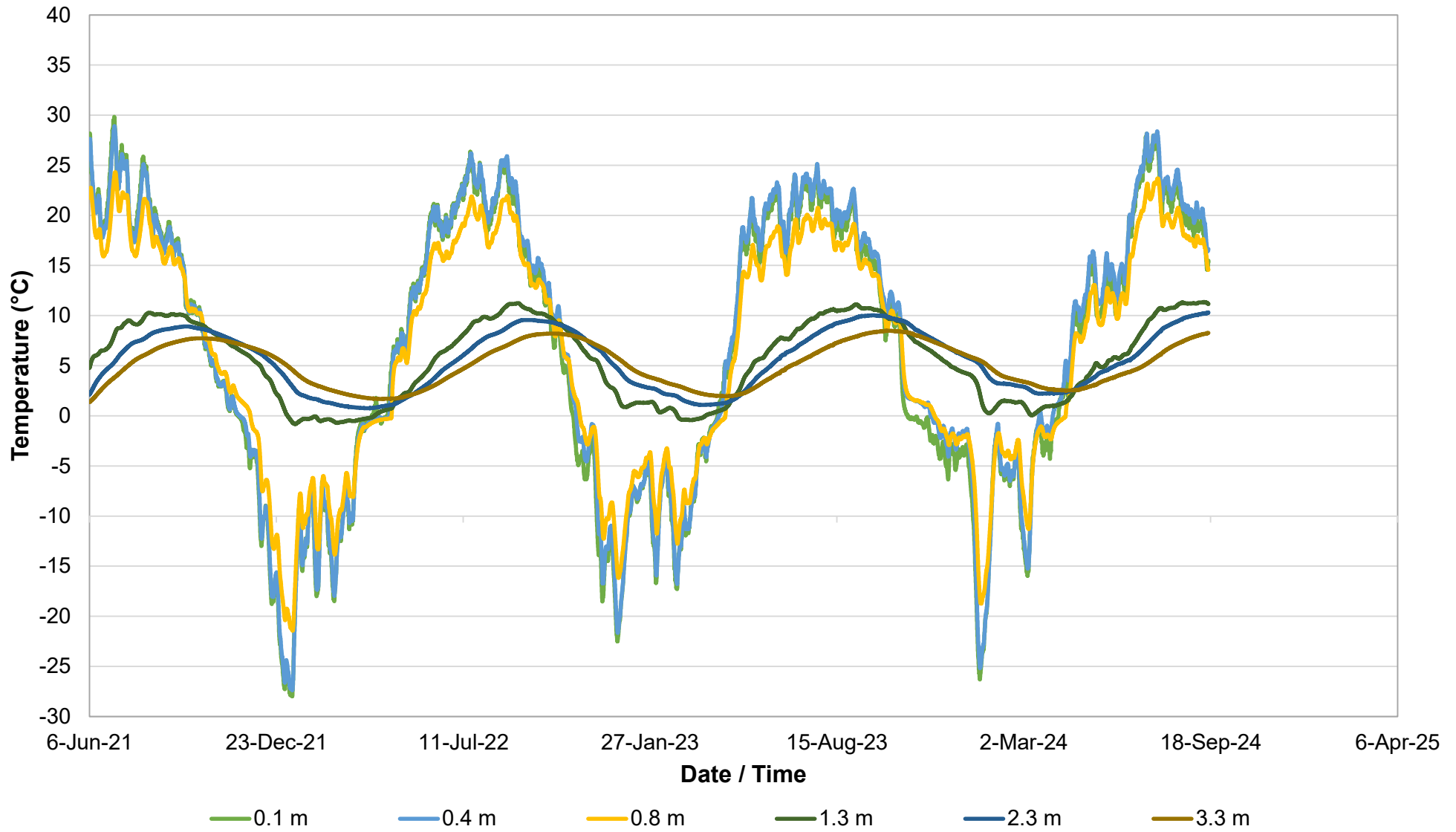
**Figure NC106-2**  
**Highway 63:08 km 27.9 Pavement Distress Near Wandering River, Alberta**  
**EXT21-2 - Displacement**



**Figure NC106-3**  
**Highway 63:08 km 27.9 Pavement Distress Near Wandering River, Alberta**  
**THERM21-1 (Pavement Control)**

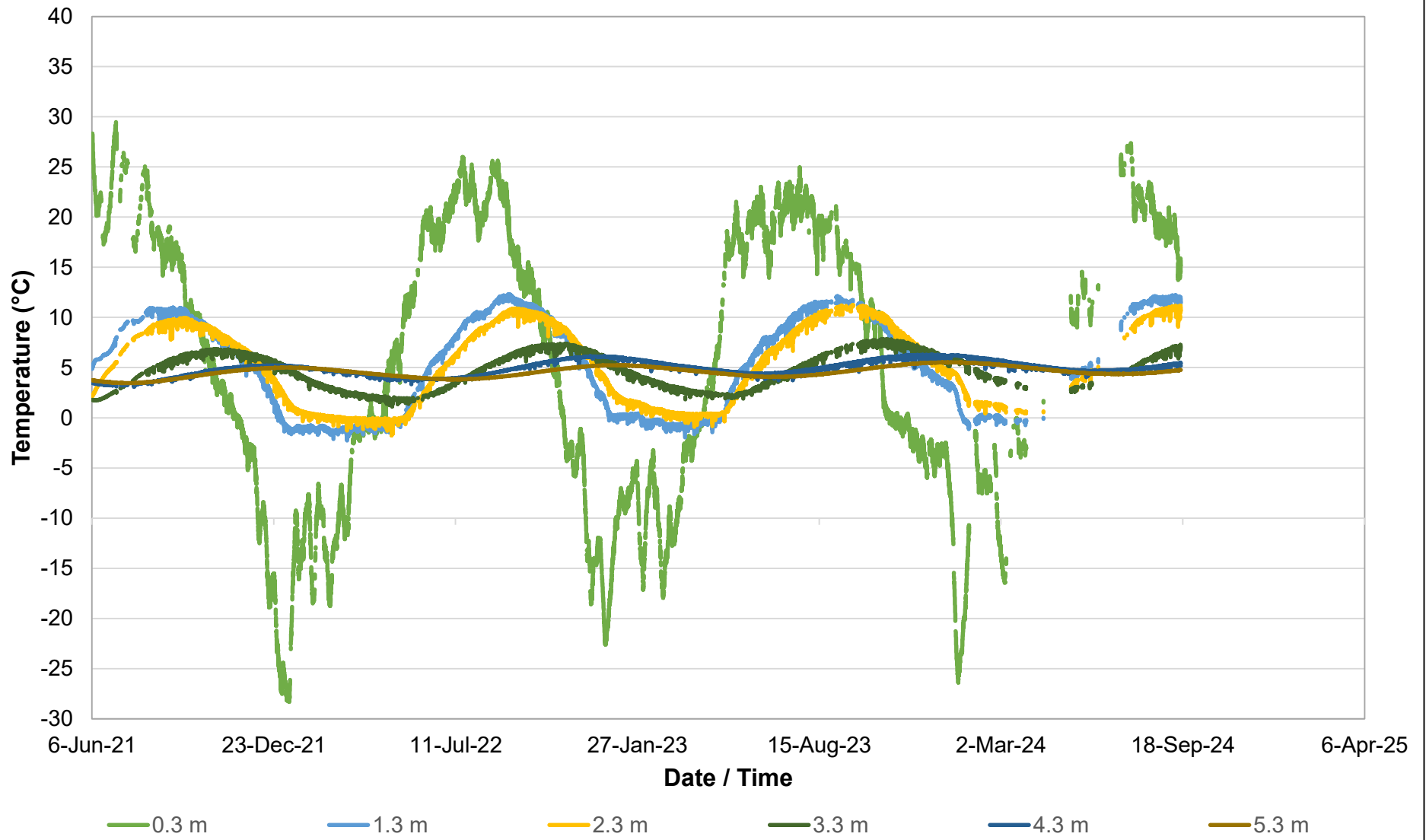


**Figure NC106-4**  
**Highway 63:08 km 27.9 Pavement Distress Near Wandering River, Alberta**  
**THERM21-2 (Pavement Test)**

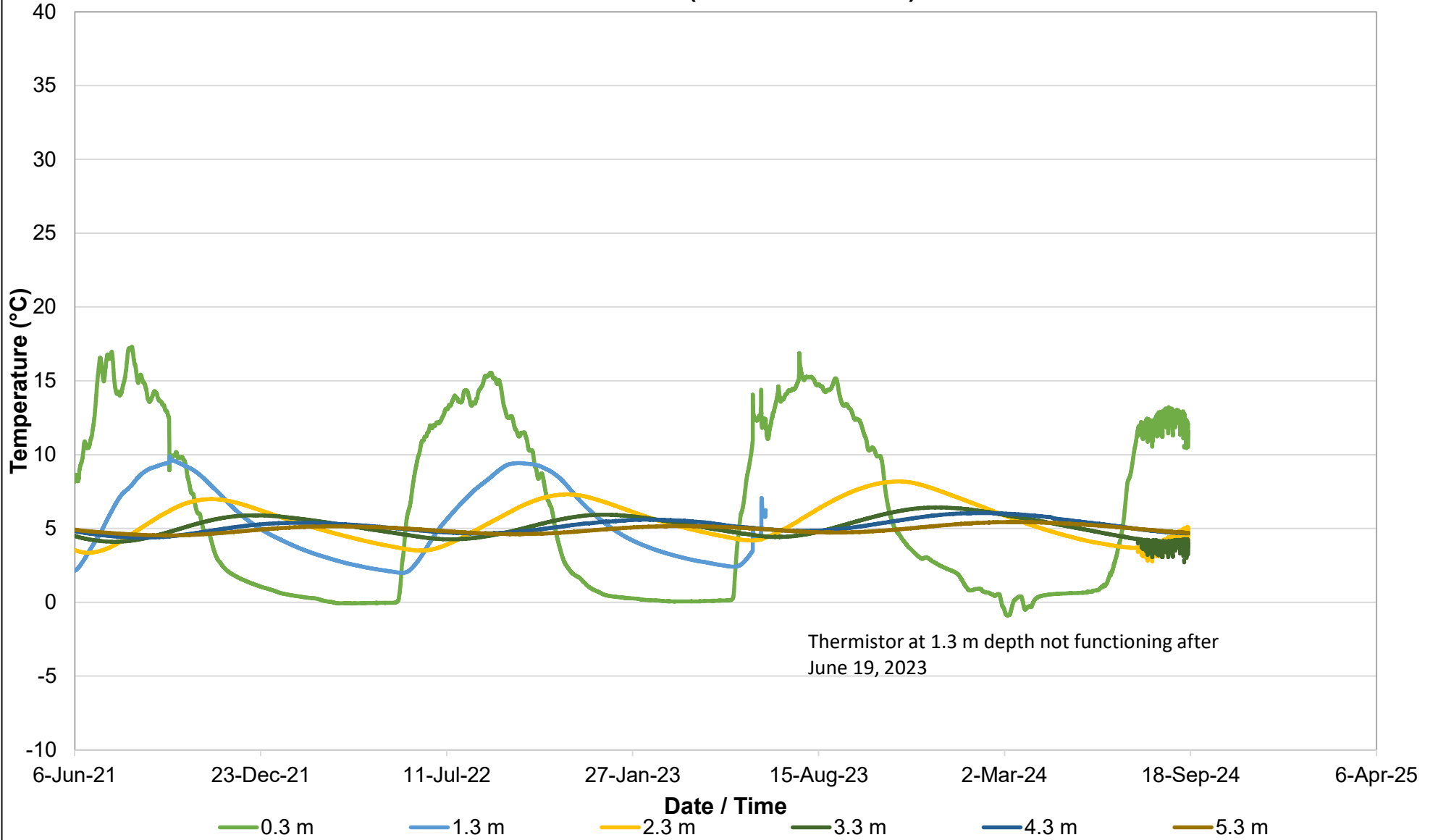




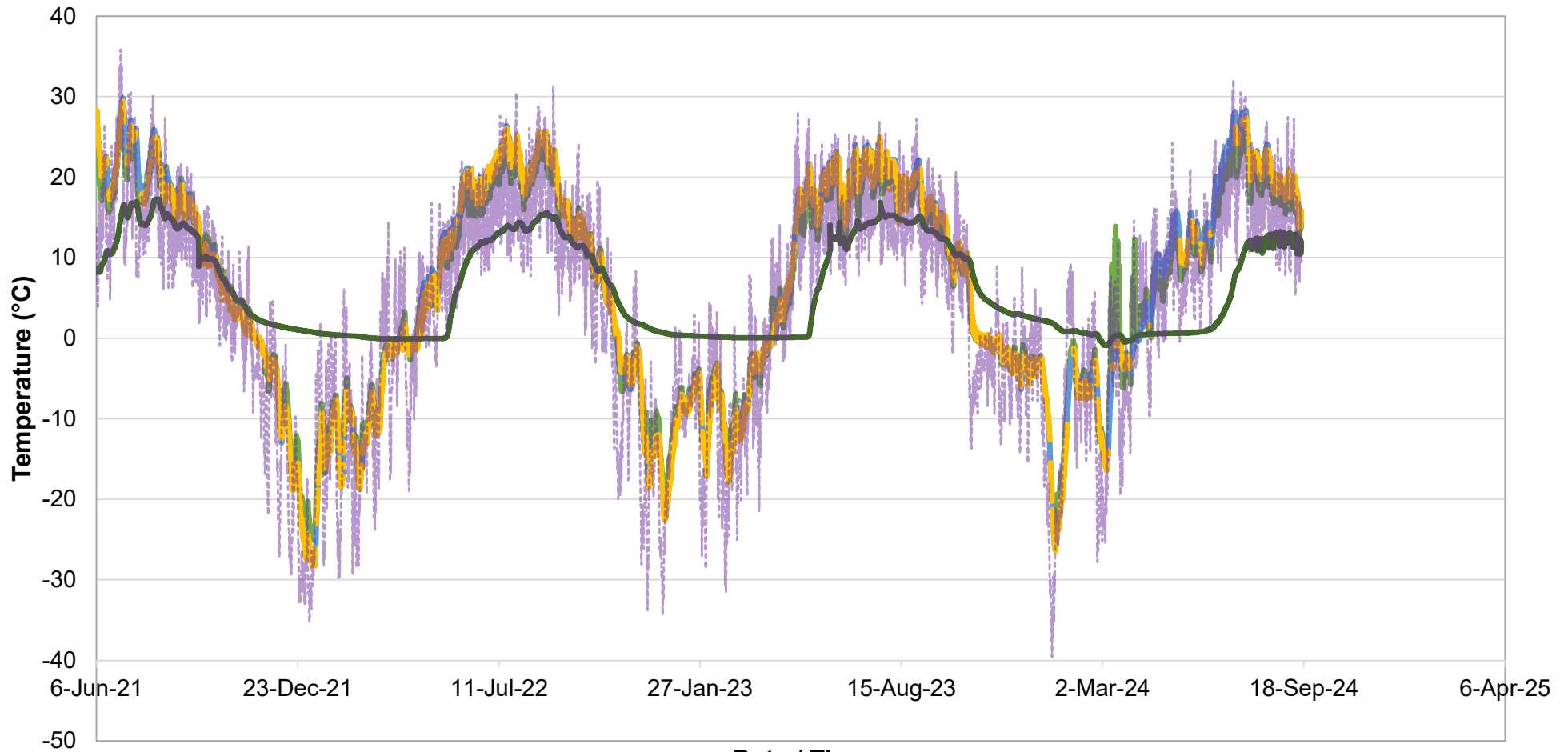
**Figure NC106-5**  
**Highway 63:08 km 27.9 Pavement Distress Near Wandering River, Alberta**  
**THERM21-3 (Pavement Test)**



**Figure NC106-6**  
**Highway 63:08 km 27.9 Pavement Distress Near Wandering River, Alberta**  
**THERM21-4 (Control Grassed)**

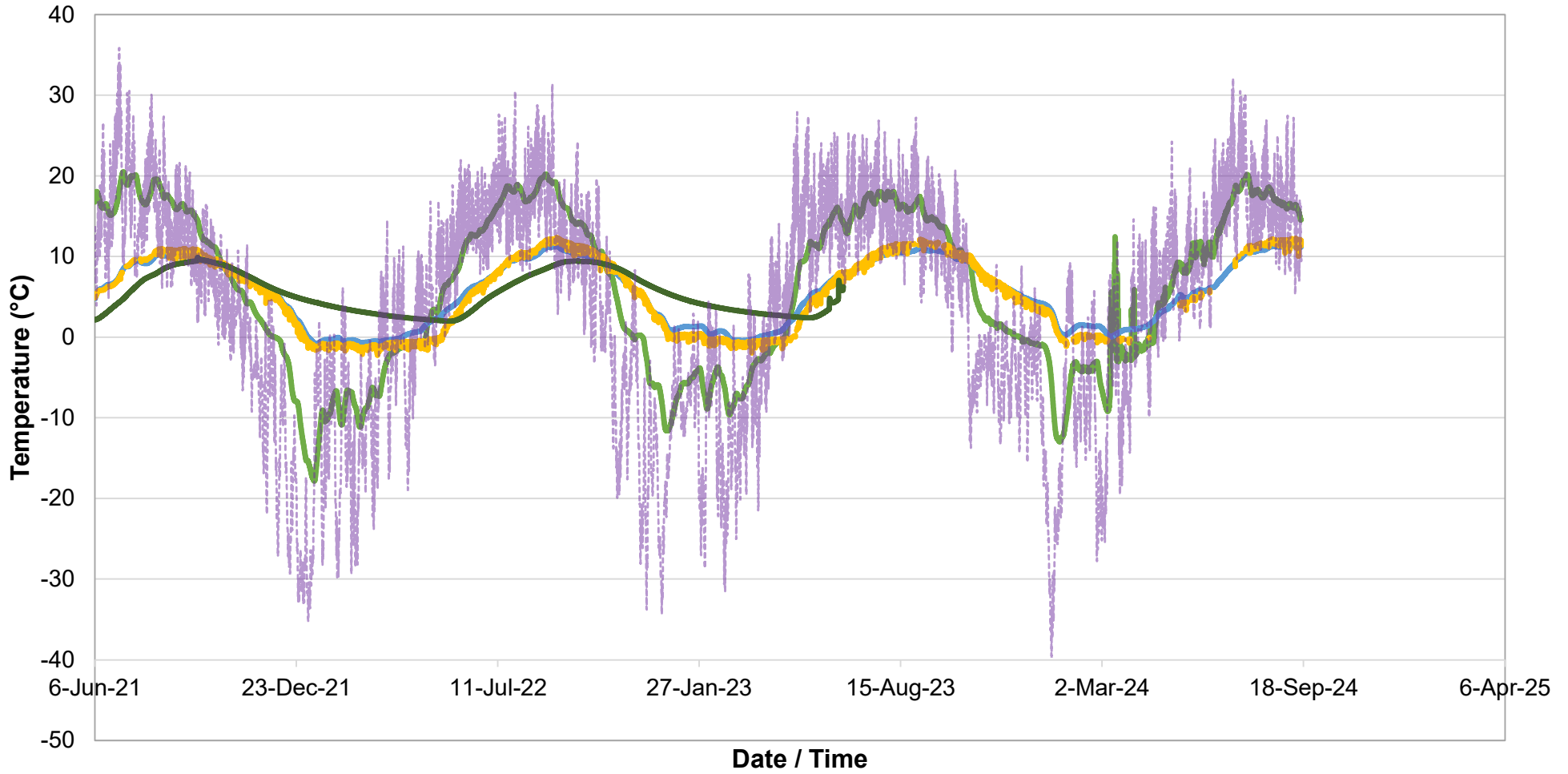


**Figure NC106-7**  
**Highway 63:08 km 27.9 Pavement Distress Near Wandering River, Alberta**  
**Surface Thermistors and Weather Data**



- THERM 21-1 (Pavement Control - 0.1 m)
- THERM 21-2 (Cematrix Test Section 1 - 0.1 m)
- THERM 21-3 (Cematrix Test Section 2 - 0.3 m)
- THERM 21-4 (Control - Grass - 0.3 m)
- - - 6 per. Mov. Avg. (Ambient Air Temperature)

**Figure NC106-8**  
**Highway 63:08 km 27.9 Pavement Distress Near Wandering River, Alberta**  
**1.1 m - 1.3 m Depth Thermistors and Weather Data**



- THERM 21-1 (Pavement Control - 1.1 m)
- THERM 21-2 (Cematrix Test Section 1 - 1.3 m)
- THERM 21-3 (Cematrix Test Section 2 - 1.3 m)
- THERM 21-4 (Control - Grass - 1.3 m)
- 6 per. Mov. Avg. (Ambient Air Temperature)