

**TRANSPORTATION AND ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA &
FORT MCMURRAY DISTRICTS
2023 SITE INSPECTION**



THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
NC 073-1	36 km Northwest of the Junction of Hwy 2:46 and Hwy 44:04	Hwy 2:46 Mitsue Frost Heave	2:46	39.5
Legal Description		UTM Co-ordinates (NAD 83)		
N.W.14-72-4-W5M		12 N 6124047	E 658906	

	Date	PF	CF	Total
Previous Inspection:	March 05, 2020	9	2	18
Current Inspection:	May 16, 2023	6	2	12
Road WAADT:	3,200	Year:		2022
Inspected By:	Tarek Abdelaziz, José Pineda (Thurber) Arthur Kavulok, Amy Driessen, Kristen Tappenden (TEC)			
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue:	Differential heave between insulated and un-insulated roadway sections, resulting in sharp transverse bump cracks at the transition zones (Cracks A and D). The sharp drop across the crack surfaces, particularly at Crack A location, have been adversely affecting roadway rideability and safety of motorists. The sharp drop at Crack A location continued to constitute a safety hazard to motorists travelling along the highway surface.
Dimensions:	The heaved section of the highway to the west of the bump crack (Crack A) location is approximately 66 m long. Crack E defines the western limit of the heaved section of the highway.
Date of any remediation:	N/A
Maintenance/History:	<p>Frost heave repairs were completed in October 2008 and consisted of insulating an approximately 90 m long section of the highway to the east of existing bump crack. The repair consisted of excavating the pavement structure and placing 150 mm (3 layers, each 50 mm thick) of extruded polystyrene insulation (STYROFOAM Brand High Load 100) on the top of the prepared sub-grade. The new pavement structure consisted of 220 mm of ACP and 500 mm of granular base course.</p> <p>A temporary remedial measure was implemented after the call-out site visit in March 29, 2011 and consisted of milling the highway surface at the crack location to create an even pavement surface and provide a smooth ride to travellers.</p> <p>A sink hole developed on the highway WBL and was filled a few times with ACP between March 2011 and June 2012.</p> <p>Potholes were filled in 2014 and 2015; the highway was patched at Crack A location and ACP was used to fill around Crack D location.</p> <p>ACP overlay in September 2016; cracks reappeared on the highway surface in the winter of 2017; speed reduction and bump warning signs were placed in 2017; a sharp drop at Crack A location was noted in the early winter of 2018 and an asphalt taper was placed to smooth out the drop.</p>

	An intermediate remedial, consisting of the installation of a subdrain and a manhole within the south ditch, to lower the groundwater levels and reduce the frost heave movement, was implemented by TEC in 2022.	
Observations:	Description	Worse?
<input checked="" type="checkbox"/> Pavement Distress	Crack A in the western limit of the insulated section: 20 mm drop across the highway; Crack B: 10 to 20 mm wide with 10 mm drop; Crack C: 10 to 50 mm wide with 15 mm drop.	<input type="checkbox"/>
<input type="checkbox"/> Slope Movement	N/A	<input type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	The highway side slope within the area of subdrain installation in 2022 was bare of vegetation (construction warranty issue addressed by the Contractor after the inspection site visit)	<input type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	Water flowing from the subdrain outlet	<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	50 mm of sediment accumulation at the subdrain outlet; bump warning signs on both directions were removed; the lid of the manhole installed in 2022 was bent, covered with sediment, and could not be opened	<input type="checkbox"/>
Instrumentation: None		
Assessment (Refer to attached Drawings):		
<p>There is still a bit of movement along the old cracks developed within the highway surface. However, the movement at Crack A location was not as severe as noted in the past to significantly impact the highway rideability and safety of motorists. The highway condition may however get worse during the winter season.</p> <p>It is early to assess whether the interim measure is successful in mitigating the highway movement. It will likely take a couple of years to assess the effectiveness of the implemented remedial measure. During this period, future maintenance of the highway, including milling and sealing/patching of cracks, may still be required.</p> <p>There is a steady flow from the outlet of the subdrain pipe, and this should reduce groundwater levels below the highway with time. If the subdrain pipe gets plugged in the future, possibly due to sediment accumulation, groundwater levels will likely rise and impact the integrity of the highway.</p>		
Recommendations:		
<p>The Local MCI should undertake the following:</p> <ul style="list-style-type: none"> • Monitor and maintain records of the highway condition (e.g., measurements of width and depth of cracks, and make observations of any bump at Crack A location), particularly during the winter season. • Seal all open cracks inside and outside the treated section of the highway to prevent surface water infiltration into the sub-grade material. • Reinstate the bump warning signs and reduce the speed in both directions, If the highway condition deteriorates significantly, particularly during the winter season, to warn motorists of the hazard. • Clear sediment accumulated around manhole; open, adjust, and relock the manhole lid. • Check periodically (at least once a year) the flow from the subdrain pipe outlet, and get the pipe flushed (as needed) using the cleanout manhole. <p>Depending on the performance of the intermediate repair measures, a long-term repair may be required. The long-term remedial measure is to extend the insulation outside the treated section of the</p>		

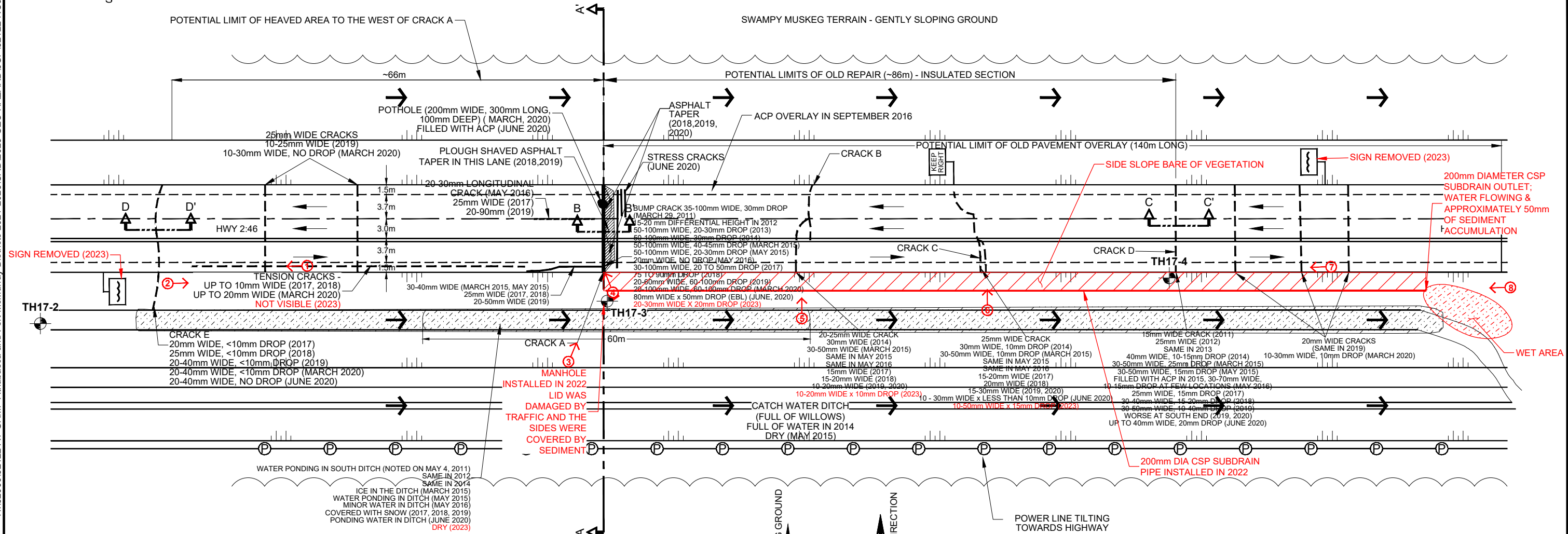
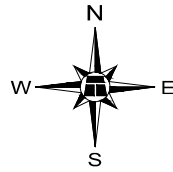
highway for approximately 70 m to the west of Crack A location. This option will require excavating the highway surface, reconstruction of the pavement structure, and alternating lane closures to complete the repair work. The ballpark cost for the long-term repair would be in the order of \$1 million.

Closure:

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.

Yours very truly,
Thurber Engineering Ltd.
Tarek Abdelaziz, Ph. D, P.Eng.
Principal | Geotechnical Review Engineer

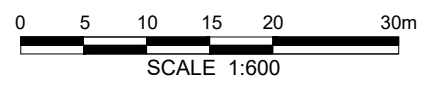
José Pineda, M.Eng., P.Eng.
Associate | Senior Geotechnical Engineer



LEGEND

- APPROXIMATE TEST HOLE LOCATION
- CRACKS
- BUMP CRACK
- SLOPING GROUND
- POWER POLE
- BUMP WARNING SIGN
- WATER FLOW DIRECTION IN DITCH
- TREE LINE
- PHOTOGRAPH NUMBER AND APPROXIMATE LOCATION AND DIRECTION

NOTE:
MAY 16, 2023 SITE OBSERVATIONS ARE SHOWN IN RED.



**NORTH CENTRAL
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
2023 GEOHAZARD ASSESSMENT**

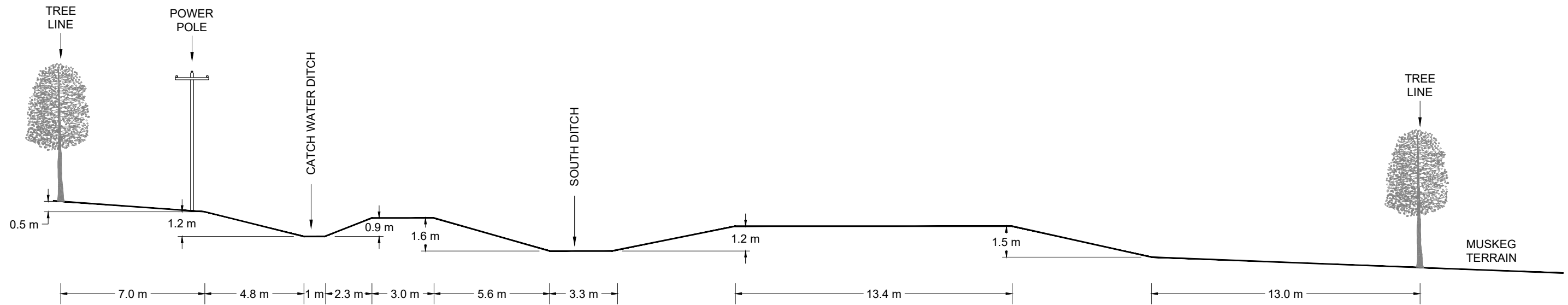
**NC073-1: HWY 2:46 MITSUE FROST HEAVE
SITE PLAN**

DWG NO. NC073-1-1

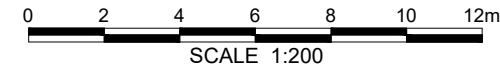
DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:600
DATE	JUNE 2023
FILE No.	32122

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H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\CAD\2023 GEO HAZARD\GP\32122-NC073-1-2.dwg - 2 - Jun. 15, 2023

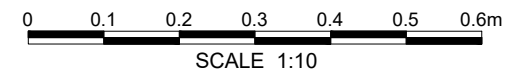
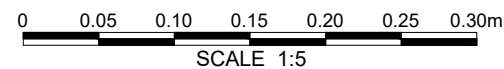
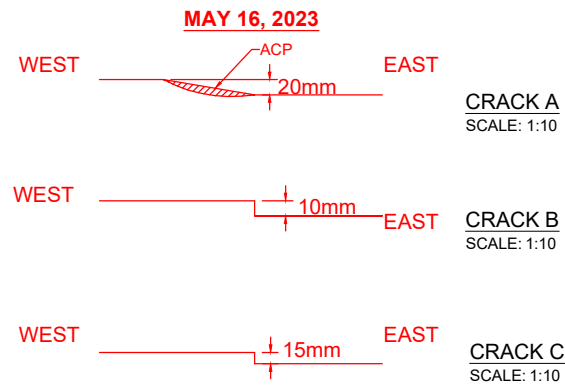


CROSS SECTION A-A'
SCALE 1:200



NOTES:

CROSS SECTION A-A' IS BASED ON APPROXIMATE SIMPLE FIELD MEASUREMENTS AND MAY NOT REPRESENT THE ACTUAL PROFILE AT THE AREA OF CONCERN.



NORTH CENTRAL (ATHABASCA AND FORT MCMURRAY DISTRICTS) 2023 GEOHAZARD ASSESSMENT	
NC073-1: HWY 2:46 MITSUE FROST HEAVE CROSS SECTIONS A-A', B-B', AND C-C'	
DWG NO. NC073-1-2	
DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	AS SHOWN
DATE	JUNE 2023
FILE No.	32122

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Photo # 1 Looking west at south ditch and highway shoulder from the western limit of the site



Photo # 2 Looking east at south ditch from the western limit of the site; falling silt fencing



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Photo # 3 Looking north at highway side slope and the 1.2 m CSP Manhole. The manhole lid was bent and could not be opened; accumulated sediment around the manhole



Photo # 4 Looking north at the bump crack (Crack A); 20 to 30 mm wide and 20 mm drop



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Photo # 5 Looking north at Crack B; 10 to 20 mm wide and 10 mm drop



Photo # 6 Looking north at Crack C; 10 to 50 mm wide and 15 mm drop

Client: Alberta Transportation

File No.: 32122 NC073



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Photo # 7 Looking west from the eastern limit of the site



Photo # 8 Looking west at the outlet of the 200 mm diameter CSP subdrain pipe; reddish-brown stained water was flowing from the pipe and silt accumulated within the bottom of the pipe (approximately 50 mm in thickness; 25 percent of pipe diameter)