

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA &
FORT MCMURRAY DISTRICTS
2021 SITE INSPECTION**



Site Number	Location	Name	Hwy	km
NC087	20.75 km north of the junction of Hwy 55 and 63	FISCHER TRAIL SLIDE	63:02	20.75
Legal Description		UTM Co-ordinates (NAD 83)		
SE-22-69-17-W4M		12 N 6094104.70	E	404166.89

	Date	PF	CF	Total
Previous Inspection:	June 25, 2020	14	4	56 (Highway 63)
Current Inspection:	June 24, 2021	14	4	56 (Highway 63)
Road AADT:	3,520		Year:	2020
Inspected By:	José Pineda, Tarek Abdelaziz (Thurber) Arthur Kavulok, Kristen Tappenden, Bernard Ching (Alberta Transportation)			
Report Attachments:	<input checked="" type="checkbox"/> Photographs		<input checked="" type="checkbox"/> Plans	<input type="checkbox"/> Maintenance Items

Primary Site Issue	<p>Upper landslide block: Active slide movement causing severe distress for about 140 m along the Fischer trail surface and affecting Hwy 63 southbound lanes west side slope.</p> <p>Lower landslide block: Active slide movement causing severe distress for about 85 m along Fischer trail surface.</p>
Dimensions:	<p>Upper landslide block: About 140 m wide along the trail alignment and 120 m long perpendicular to the trail alignment.</p> <p>Lower landslide block: About 90 m wide along the trail alignment and 95 m long perpendicular to the trail alignment.</p>
Site History/Maintenance:	<p>Fischer trail is a gravel surfaced road located on the west side of the HWY 63:02 southbound lane embankment. Based on discussions with AT and WSP, it is understood that Fischer Trail is a private road that was upgraded in 2014 during the construction of the highway twinning project at this location as part of land negotiations. Prior to construction, the subject area was low-lying and covered with shrubs and trees. During construction, about 1 m to 1.5 m of peat was removed from below the trail alignment to expose the firm clay foundation. As per the information provided by WSP, it is understood that up to 3 m of clay fill was placed on the exposed native clay to establish the design profile of the trail. However, shortly after the fill was placed, tension cracks were noticed along the trail surface and near the toe of the highway embankment side slope. The movement has also resulted in the tilting of one of the power poles. Survey monitoring was conducted after the cracking was observed and a vertical drop of 50 to 70 cm was noted shortly after monitoring began. During construction, an attempt to stabilize the slope was made by flattening the side slope of Fischer trail and re-grading the road. Thurber was called out to the site during construction in September 2014 and May 2015 and preliminary assessment letters were submitted to WSP. In 2015, the survey monitoring program</p>

	<p>conducted by WSP indicated a reduction in the movement rates and hence a decision was made to seal up open cracks on the highway side slope and to get the Fortis Alberta to straighten the affected power pole.</p> <p>Based on information provided by AT in early 2017, it is understood that the Fischer Trail lease was recently extended until December 15, 2025, and the road authority was transferred over to the County of Athabasca November 18, 2015. AT resurfaced the trail with gravel in late 2016.</p>
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Observations:	Description	Worse?
<input checked="" type="checkbox"/> Pavement Distress	Severe sinkholes and subsidence along Fischer trail; longitudinal and transverse cracks on the HWY (SBL) 40 to 50 mm wide no drop; no noticeable dips on HWY 63:02 paved surface	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Tension crack within 6.5 m from the edge of the highway; open head scarp cracks within the upper and lower landslide blocks (100 to 600 mm wide, and 100 mm to 1 m drop); leaning/tilting trees between the west edge of the trail and the pronounced toe roll area	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Erosion gully within the trail east ditch (10 m long x 2 to 3 m wide x 0.8 m deep) and at the 800 mm diameter culvert inlet (4.5 m long x 3.5 m wide x 1.5 m deep)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	Fisher trail surface is wet and standing water was noted in the trail surface and the east ditch; previously noted water ponding in the highway east ditch between culverts C2 and C3 located to the south of the landslide area was dry. Water is partially flowing under culvert C3 inlet.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	The existing 800 mm CSP culvert, installed during construction below the trail had been separated resulting in the formation of multiple sinkholes that have converged into a large sinkhole (6 m in diameter and 1.5 m deep); accumulated sediment at the outlet of culvert C1	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Other	<p>La Biche river outside bend of the meander is located 90 m and 125 m to the west of the western edge of the trail and highway, respectively.</p> <p>Fence posts have moved approximately 1 m toward the river.</p> <p>Power poles are tilting within the slide area by 2 degrees.</p>	<input checked="" type="checkbox"/>

<p>Instrumentation Readings (Spring 2021):</p> <p>Between the spring and the fall of 2018: SI17-1, SI17-2 and SI17-3, installed near the edge of the trail, were sheared off at depths varying between 5.6 m and 8.1 m below the trail surface; SI17-5, installed between the fence and the highway was damaged at 1.3 m below ground surface. SI17-1, SI17-2, SI17-3 and SI17-4 moved at maximum rates ranging between 55 and 160 mm per year.</p> <p>Groundwater levels in the pneumatic piezometers ranged between 0.7 m below ground surface to 0.2 m above ground surface (artesian). The groundwater level in standpipe piezometers is within 0.8 m below ground surface.</p>
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Assessment (Refer to attached Figures):

The site condition has deteriorated since the 2020 site visit.

Based on the above site observations, and LiDAR information, the distress observed along Fischer trail and the side slope of the highway SBLs reflects an actively moving deep-seated landslide (i.e., upper landslide block). The depth of movement ranges from 5.6 to 8.1 m below the trail surface. The upper landslide continues to cause severe distress of the trail surface and is retrogressing to the highway surface.

A secondary landslide block (i.e. a lower landslide block of smaller size) has been developed and it is only impacting the trail surface. The lower landslide block appears to be very active, and the scarp cracks of the landslide bounds the most distressed area of the trail surface.

It is suspected that the low-lying area of the original trail alignment was located within the crest of an ancient landslide that is toeing into the outside bend of the La Biche river. Placement of grading fill could have resulted in the re-activation of the ancient landslide. In addition, it appears that fill placement at this location may have blocked natural drainage resulting in elevated ground water levels in the subject area.

The landslide has been very active as evidenced from widening and deepening of scarp cracks, development of larger sinkholes within the gravel trail, and ongoing deterioration of trail surface condition.

The surface water in the trail ditch flows below the separated 800 mm diameter culvert, resulting in the saturation and washout of trail fill and subgrade and possibly recharging of the landslide mass. It is likely that the uncontrolled discharge of surface water below the trail will result in the formation of additional sinkholes and potentially complete failure of the trail.

The existing sinkholes/subsidence along the trail alignment is anticipated to get worse over time until the landslide is repaired. The deterioration may take place quickly and this constitutes a safety hazard to the trail users.

The landslide continues to move at a very high rate, and this will eventually result in further failure of the trail surface, the retrogression of the landslide into the highway lanes due to continued loss of support at the toe of the slope, and potential damages to the fence line, Telus cable and the overhead power lines.

Recommendations:

This site should be visited again in the spring of 2022.

In the short term, we recommended the following:

- AT should contact the County, the trail owner, and utility companies to let them know about existing hazard.
- The local MCI should periodically monitor the head scarp crack for further opening or drop and measure the distance between the head scarp crack and the edge of the highway.
- Clear sedimentation and regrade the ground surface near culvert C1 outlet; inspect and maintain culverts C2 and C3 as needed to prevent further ponding of water in the highway west ditch and water flow under C3.

It is understood that AT has no obligation to maintain the trail. Hence, the long-term measure may include the construction of a pile wall between the head scarp crack and the west edge of the highway to shelter the highway from potential retrogression of the head scarp crack into the highway surface. The ballpark cost of this option, excluding engineering, would be in the range of \$850,000 for a steel pile wall and \$2.0 Million for a tangent cast-in-place cantilever pile wall. It should be noted that this option will not address the impact of future movements downslope of the wall on existing trail and utility lines within the landslide mass.

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 | Senior Geotechnical Engineer

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



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.

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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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- 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.

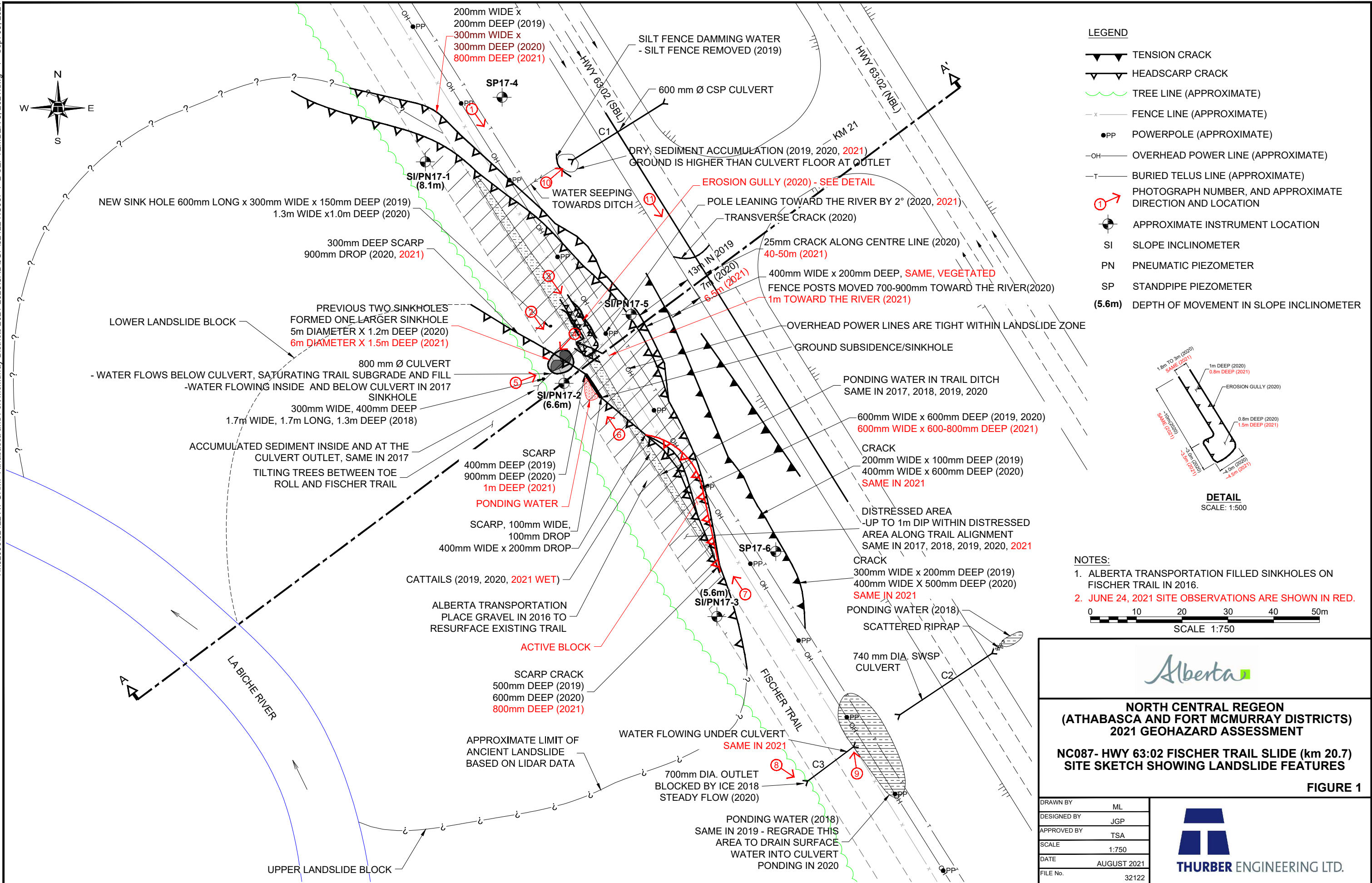
6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

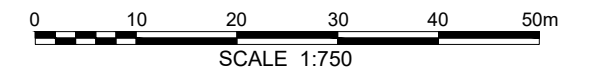
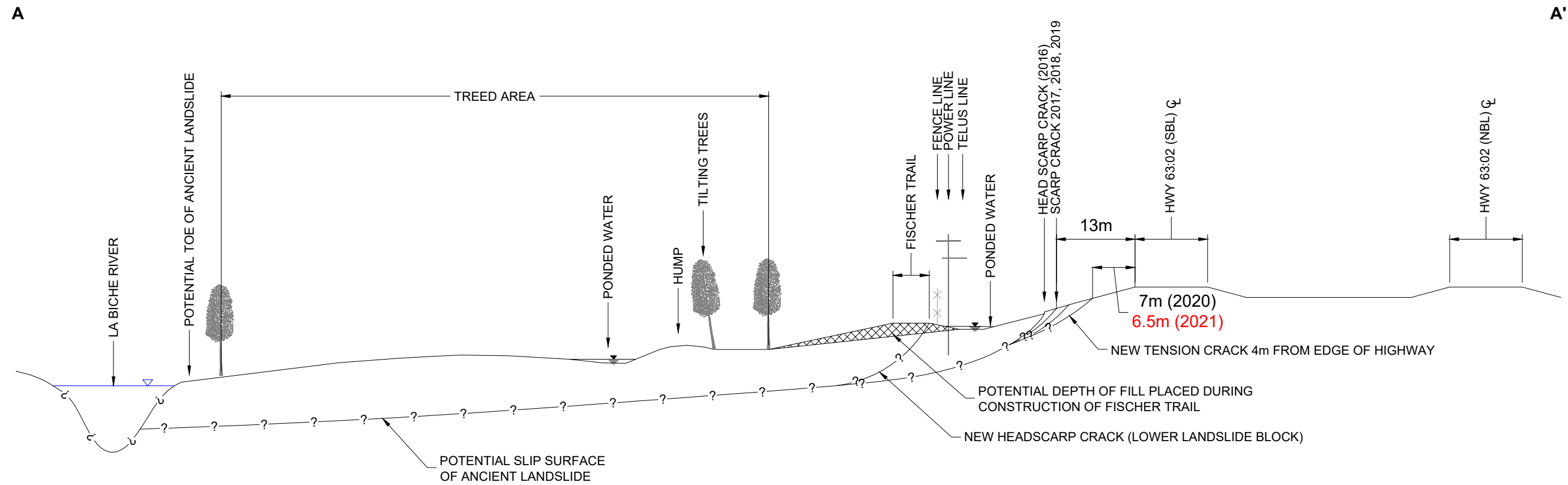
Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

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NOTE
 CROSS-SECTION A-A' IS BASED ON APPROXIMATE SIMPLE
 FIELD MEASUREMENTS AND MAY NOT REPRESENT THE
 ACTUAL PROFILE THROUGHOUT THE SLIDE AREA.




**NORTH CENTRAL REGEON
 (ATHABASCA AND FORT MCMURRAY DISTRICTS)
 2021 GEOHAZARD ASSESSMENT**

**NC087- HWY 63:02 FISCHER TRAIL SLIDE (km 20.7)
 CROSS-SECTION A-A'**

FIGURE 2

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	APPROX. 1:750
DATE	AUGUST 2021
FILE No.	32122



THURBER ENGINEERING LTD.



Photo No.1 – Head scarp crack of upper landslide block (Looking South)



Photo No.2 – Northern flank of lower landslide block (Looking South)



Photo No.3 – Erosion gully along Fischer Trail ditch (Looking South)



Photo No.4 – Sinkhole above the 800 mm diameter culvert; looking at the culvert separation area near the outlet location (6 m diameter x 1.5 m deep)



Photo No.5 – Looking at ruptured section of pipe at sinkhole location



Photo No.6 – Looking north at lower landslide block; water is ponding beside the 1 m deep head scarp crack



Photo No.7 – Southern flank of upper and lower landslide blocks (Looking North); note standing water within the flank and lateral shifting of existing fence



Photo No.8 – 700 mm diameter CSP culvert C3 outlet; note sediment accumulation inside the culvert; minor flow from the outlet of the culvert was noted in 2021



Photo No. 9 – 700 mm diameter CSP culvert C3 inlet; water is flowing under culvert



Photo No.10 – Outlet of 800 mm diameter culvert C1; note sediment at the culvert outlet; ground surface is a bit higher than the culvert invert at outlet



Photo No. 11 – Looking south at highway southbound lanes; landslide is not currently impacting the highway surface; head scarp crack is about 6.5 m away from the edge of pavement