

**ALBERTA TRANSPORTATION AND  
ECONOMIC CORRIDORS  
GEOHAZARD RISK MANAGEMENT PROGRAM  
PEACE REGION (PEACE RIVER DISTRICT)  
2025 INSPECTION**



Site Number	Location	Name	Hwy	km
SH004-1	South of Little Smoky River	Little Smoky River (South of Bridge)	49:12	2.3-2.6
<b>Legal Description</b>		<b>UTM Co-ordinates</b>		
W33-074-21-W5M		11 E 489,224	N	6,145,128

	Date	PF	CF	Total
<b>Previous Inspection:</b>	3-Jun-2024	13	6	78
<b>Current Inspection:</b>	26-May-2025	13	6	78
<b>Road AADT:</b>	1460		<b>Year:</b>	2024
<b>Inspected By:</b>	Kristen Tappenden, TEC Mark Gallego, Thurber Roger Skirrow, Thurber			
<b>Report Attachments:</b>	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

<b>Primary Site Issue:</b>	The highway traverses the 120 m deep Little Smoky River valley over a 35 m deep-seated retrogressive landslide moving eastward. The slide is moving as a set of blocks which creates a sequence of slide scarps that the highway crosses. There are persistent widespread creep movements over most of the entire valley slope. The movements are partly due to erosion at the bottom of the valley by the Little Smoky River. This site is related to Geohazard sites SH003 and SH016.
<b>Dimensions:</b>	Approx. 1.3 km of the highway crosses this unstable west valley slope. At least 300 m length of highway severely affected by several intersecting scarps that diagonally cross the highway resulting in an uneven pavement surface.
<b>Date of Remediation:</b>	1960's: Surface drainage improvements intended to drain sag ponds. 1972: Minor road realignment to accommodate new climbing lane. 1987: Subdrain installed in backslope ditch. 1998: Overlay including building up downslope shoulder with gravel fill buttress and raising of the guardrail. 2006: Repair of erosion damage and installation of surface drains to nearby sag pond.
<b>Maintenance:</b>	There is a repeated cycle of patching and milling and guardrail adjustments that extends to the original construction of the highway at this location. 2016: Patch placed in August, milled in late September 2017: Patch and milled in August/September 2018: Milling removed up to about 60 mm of asphalt Fall 2019: Milling both sides of valley for about \$172,000 2020: Pavement overlay and guardrail replacement 2022: Milling 2023: Milling 2024: Patching

Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Cracking and uneven roadway surface requires ongoing patching and milling especially at the landslide scarp cracks.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Overall slope movement continues resulting in cracks at scarps and sags in the graben blocks.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Rilling between riprap channel and beyond P01-6. Lesser rilling near north end of patch.	<input type="checkbox"/>

<input checked="" type="checkbox"/> Seepage	Evidence of seepage observed near culvert outlet at north end of site.	<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert	Separation of plastic culvert.	<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
<b>Instrumentation (Spring 2025):</b>		
VW07-2, VW07-2A, VW07-3, VW07-3A	Relatively stable and slightly decreasing over the last three years.	
Destroyed/Lost	VW07-2B and -3B (damaged Fall 2014); SI4A, SI01-6, SI01-7, SI01-2, SI07-3B, SI01-9, SI07-2B, PZ01-6, PZ01-2 (discontinued)	
<p><b>Assessment:</b></p> <p>The west and east valley slopes are prime examples of large scale, deep-seated retrogressive translational landslides. The overall west valley slope is moving as several separate slide blocks with numerous intermediate and main scarps, sag ponds, and differential movement zones. The highway alignment intersects these features which results in well established cracks crossing the highway and associated an uneven and tilted highway surface. The driving mechanism appears to be toe erosion by the Little Smoky River; a high ground water table may also be contributing. Based on GPS survey of the InSAR points conducted by Alberta Geological Survey (AGS Open Report 2013-14), this portion of the highway is located on landslide blocks moving relatively slower (5 mm to 40 mm per year) as compared to the eastside (SH003) or the bridge site (SH016). Drawing 32121-SH004-1-1 shows some of the local slide features that have been interpreted from the 2008 LiDAR imagery. Regrading of the slopes at this site has obscured the scarps of the larger slide blocks that are likely present beneath the highway alignment.</p> <p>The ongoing movement of the valley slope results in continued deformation of the highway surface that requires frequent widespread patching. An overlay was placed in the summer of 2020 to maintain the smoothness of the highway. Reportedly, the crack pattern in the highway started reflecting through the overlay in less than 24 hours. As the crack pattern became fully established, the increasing differential across the cracks required milling in 2021, 2022, and 2023. Patching was required in 2024 and, as shown on the Drawings, the crack pattern quickly became re-established. Similarly during the 2025 inspection, cracks started to reflect through recent patches. There are three main sets of scarp cracks crossing the highway on a NW-SE orientation and likely represent retrogressive movements of the valley-scale landslide blocks.</p> <p>The areas of rilling have slowly stabilized over the last two years. The erosion gully that formed at the south end of the site at the end of guardrail in 2023 has widened since.</p> <p>There is a break in the plastic culvert that handles downslope ditch flow from the south that is creating a sinkhole. The sinkhole has not changed in size significantly in the last few years. A second gap at a culvert joint was observed in 2019 about 25 m further north. Both of these gaps in the culvert were slightly wider in 2023 and 2024. The gaps have not changed during the 2025 inspection.</p> <p>The slope below an approach located at the south end of the site started to deteriorate in 2019. There was increased displacement and extension of the tension and scarp cracks on this slope and the gully in the centre of the feature continued to deepen. This area seems to have stabilized in 2023 and 2024. This area warrants continued monitoring as retrogression of the features toward the highway could occur relatively rapidly.</p> <p>UAV photos revealed minor scarps downslope and north of the east guardrail. During the 2025 inspection, these scarps were very faint on site, being mostly obscured by the vegetation present. The slope inclinations at these locations are not very steep but warrant monitoring if they continue to progress.</p>		

**Recommendations:****Short-term:**

- Road maintenance consisting of milling and patching should continue as necessary (once or twice annually) to maintain the roadway surface in a safe condition. Crack sealing of the ACP should be done to limit infiltration of rain fall and snow melt into the extensive crack network. The bare areas on the downslope side of the highway to the north of the riprap apron have the potential to deteriorate further. This area could be regraded, topsoiled, seeded, and further secured with an erosion control blanket or seed-impregnated compost blanket. The second rill area near the north end of the site and the new gully at the south end of the guardrail could be repaired at the same time with the same methodology.
- The break in the culvert should be repaired to limit infiltration into the slope which could potentially result in slope movement or significant erosion. Alternatively, this culvert could be replaced with a more robust welded steel pipe, or a well anchored above-ground half-culvert.

**Long-Term:**

The two alternatives for this location are: realign the highway using the existing bridge, or; construct a new alignment and bridge on more stable ground. If the existing bridge location option is preferred, additional extensive riverbank protection could be installed to control river erosion at the toe of the slope. This would augment the effectiveness and life of the existing bridge alignment option. It is understood that AMEC (now WSP) prepared a report under the 2013 High Water Related Mitigation Works program providing recommendations for erosion control at the toe and drainage measures on the slope to reduce the number and size of the sag ponds. In a previous study, Thurber identified a more-stable road alignment option straight west off the end of the bridge. This alignment would require a considerably deep cut in the valley slope and extensive road realignment at the top of the valley.

**Ongoing Investigation:**

- It is recommended that the annual Geohazard inspection and twice-annual instrumentation readings should continue as scheduled.
- This is a large and complex slide area with limited spatial distribution of slope indication data. Since there are no longer any operable SI's on site, consideration should be given to adding two to three slope deep inclinometers if there are other investigation projects in the area such that drilling costs could be shared so that the rate of creep can be monitored.
- Consideration should also be given to re-surveying the InSAR (interferometric synthetic aperture radar) targets, perhaps annually, to supplement the work done by the AGS as this will provide an overall view of ground movements. Restoration of the InSAR study could be undertaken as most of the InSAR targets are still in-place.
- It is understood that a Geocube-based ground surface movement monitoring system has been installed at SH016 and SH004. It is recommended to continue monitoring this installation for at least two years to acquire more movement data. Furthermore, it is understood that a conventional terrestrial survey program is being considered for the west abutment of the bridge and this site could be included for minimal additional cost. Additional GPS real-time ground movement systems (SparkFun or Geocube based), may be an option worth considering at this site particularly for identifying lower-movement rate zones for potential realignment in areas not covered by the Geocube system.

**Closure**

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement for Use and Interpretation of Report.

Roger Skirrow, P.Eng.  
Senior Geotechnical Engineer

Mark Gallego, P.Eng.  
Geotechnical Engineer

## STATEMENT FOR USE AND INTERPRETATION OF REPORT

### 1. STANDARD OF CARE

This Report has been prepared in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances at the same time and in the same or similar locality and in compliance with all applicable laws.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment, including this Statement For Use and Interpretation of Report, 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, AS DESCRIBED ABOVE. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE OF THE 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.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client for the development, design objectives, and/or purposes described to Thurber by the Client. **NO OTHER PARTY MAY USE OR RELY ON THE REPORT OR ANY PORTION THEREOF FOR OTHER THAN THE CLIENT'S BENEFIT IN CONNECTION WITH THE PURPOSES DESCRIBED IN THE REPORT.** Any use which a third party makes of the Report is the sole responsibility of such third party and is always subject to this Statement for Use and Interpretation of Report. Thurber accepts no liability or responsibility for damages suffered by any third party resulting from use of the Report for purposes outside the reasonable contemplation of Thurber at the time it was prepared or in any manner unintended by Thurber.

### 5. INTERPRETATION OF THE REPORT

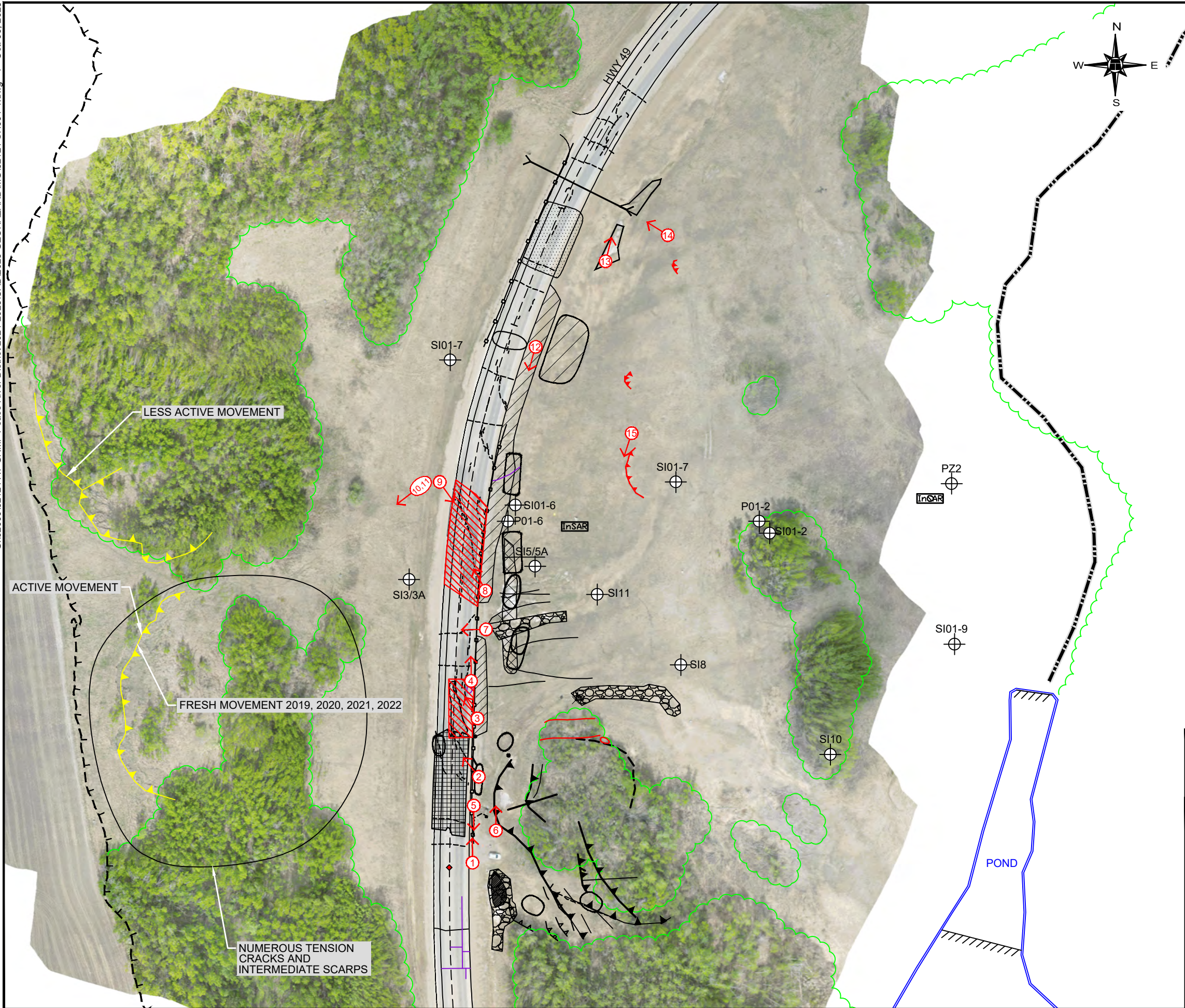
- a) **Nature and Exactness of Soil and Contaminant Description:** Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors is inherently judgement-based. 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 parties making use of such documents or records with or without our express written consent need to 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 parties. Some conditions are subject to change over time and those making use of the Report need to be aware of this possibility and understand that the Report only presents the interpreted conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client must 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 based on conditions in evidence at the time of site inspections and based on 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 resulting from misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other parties 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 is recommended to 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 need to 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 to confirm and document that the site conditions do not materially differ from those 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. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or other parties who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes, but is not limited to, decisions made to develop, purchase, or sell land, unless such decisions expressly form part of the stated purpose of the Report as described in Paragraph 3.



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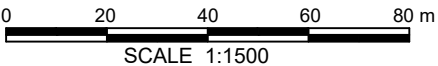


LEGEND

- APPROXIMATE INSTRUMENT LOCATION
- SI SLOPE INCLINOMETER
- P PNEUMATIC PIEZOMETER
- INSAR INSAR CORNER REFLECTOR
- MAJOR SCARP
- VALLEY CREST
- TREE LINE
- GUARDRAIL
- LANDSLIDE SCARP CRACKS
- RIPRAP APRON
- PAVEMENT OR TENSION CRACK
- MILLING AREA
- RED TEMPORARY HAZARD SIGN
- DRAINAGE GULLY
- DIRECTION AND NUMBER OF PHOTO

NOTES

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. SOME HISTORICAL OBSERVATIONS FROM AMEC FIGURE 1, PROJECT EG10030, PROVIDED BY ALBERTA TRANSPORTATION.
3. MAY 2025 OBSERVATIONS SHOWN IN RED.
4. SITE OVERLAID IN 2020. CRACK PATTERN REDRAWN USING UAV IMAGERY ACQUIRED BY THURBER IN MAY 2022 AND UPDATED FROM NEW IMAGERY ACQUIRED MAY 2024.
5. UAV IMAGERY ACQUIRED BY THURBER IN MAY 2025



PEACE REGION (PEACE RIVER DISTRICT)

SH004-1: HWY 49:12 LITTLE SMOKY RIVER  
SOUTH OF BRIDGE  
2025 SITE INSPECTION PLAN - OVERALL

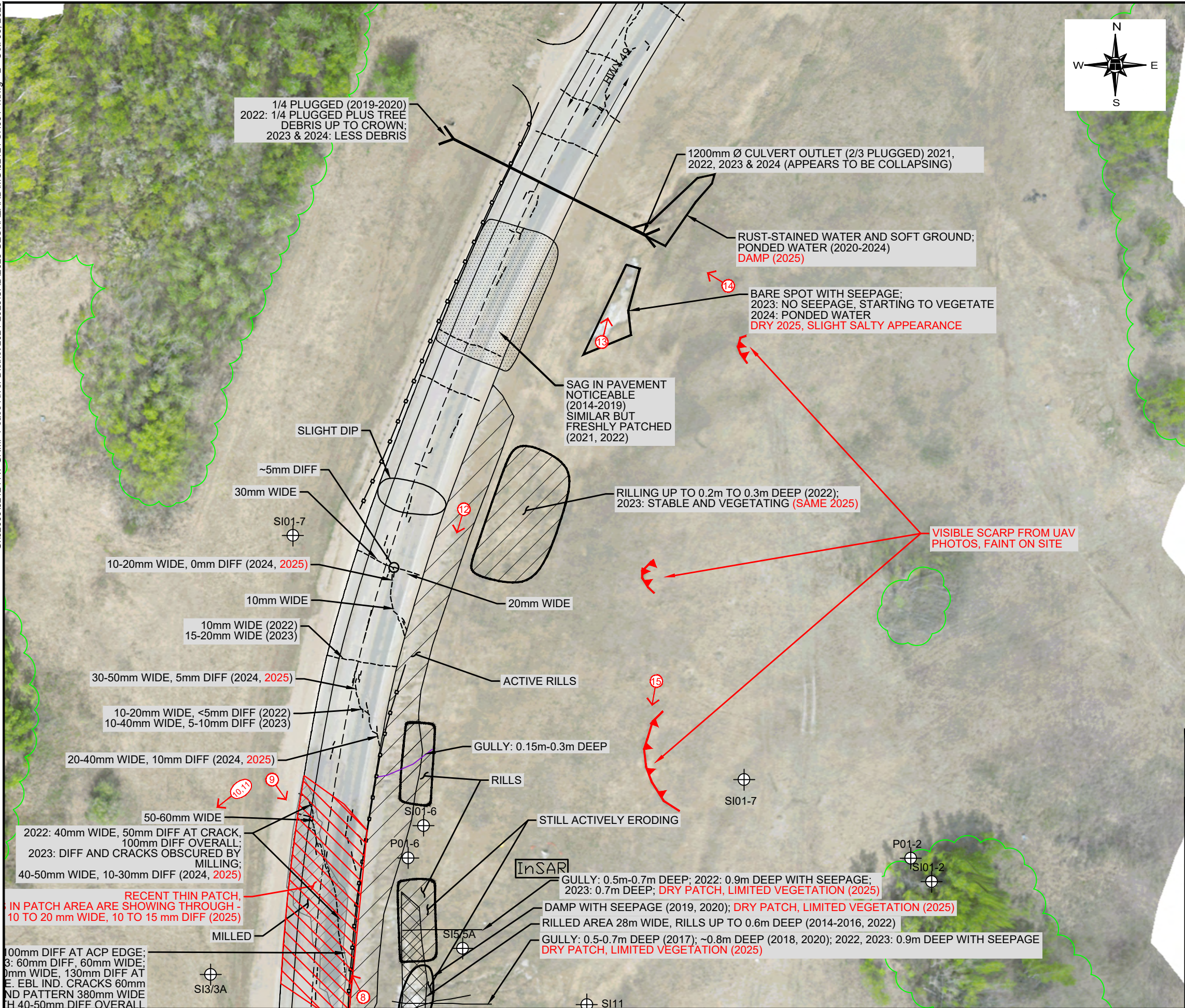
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DESIGNED BY	MG
APPROVED BY	RKS
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FILE No.	32121





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0 10 20 30 40 50m  
SCALE 1:750



PEACE REGION (PEACE RIVER DISTRICT)

SH004-1: HWY 49:12 LITTLE SMOKY RIVER  
SOUTH OF BRIDGE  
2025 SITE INSPECTION PLAN - NORTH PORTION

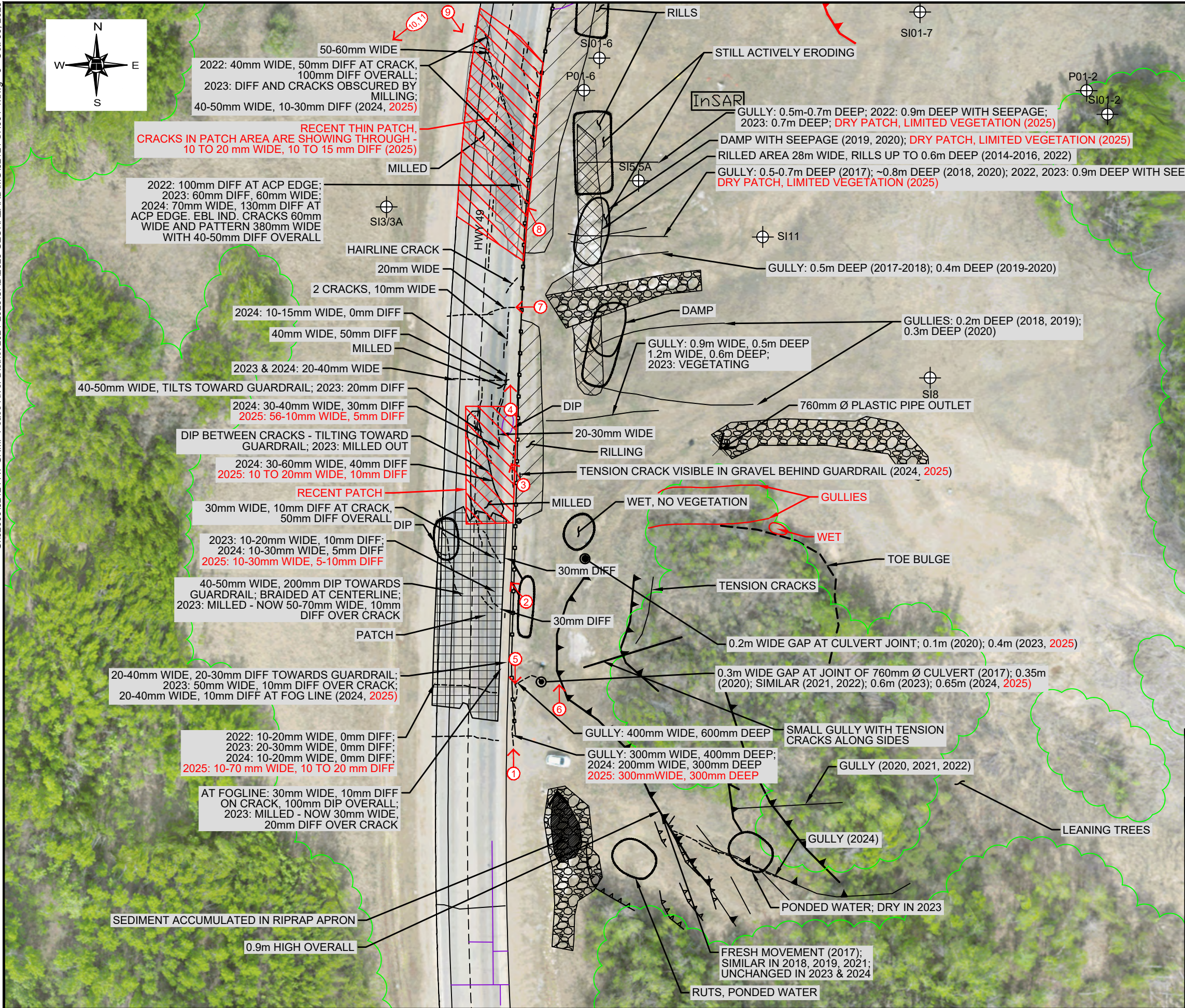
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APPROVED BY	RKS
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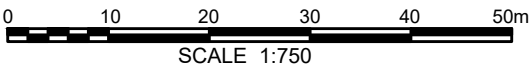


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PEACE REGION (PEACE RIVER DISTRICT)

SH004-1: HWY 49:12 LITTLE SMOKY RIVER  
SOUTH OF BRIDGE  
2025 SITE INSPECTION PLAN - SOUTH PORTION

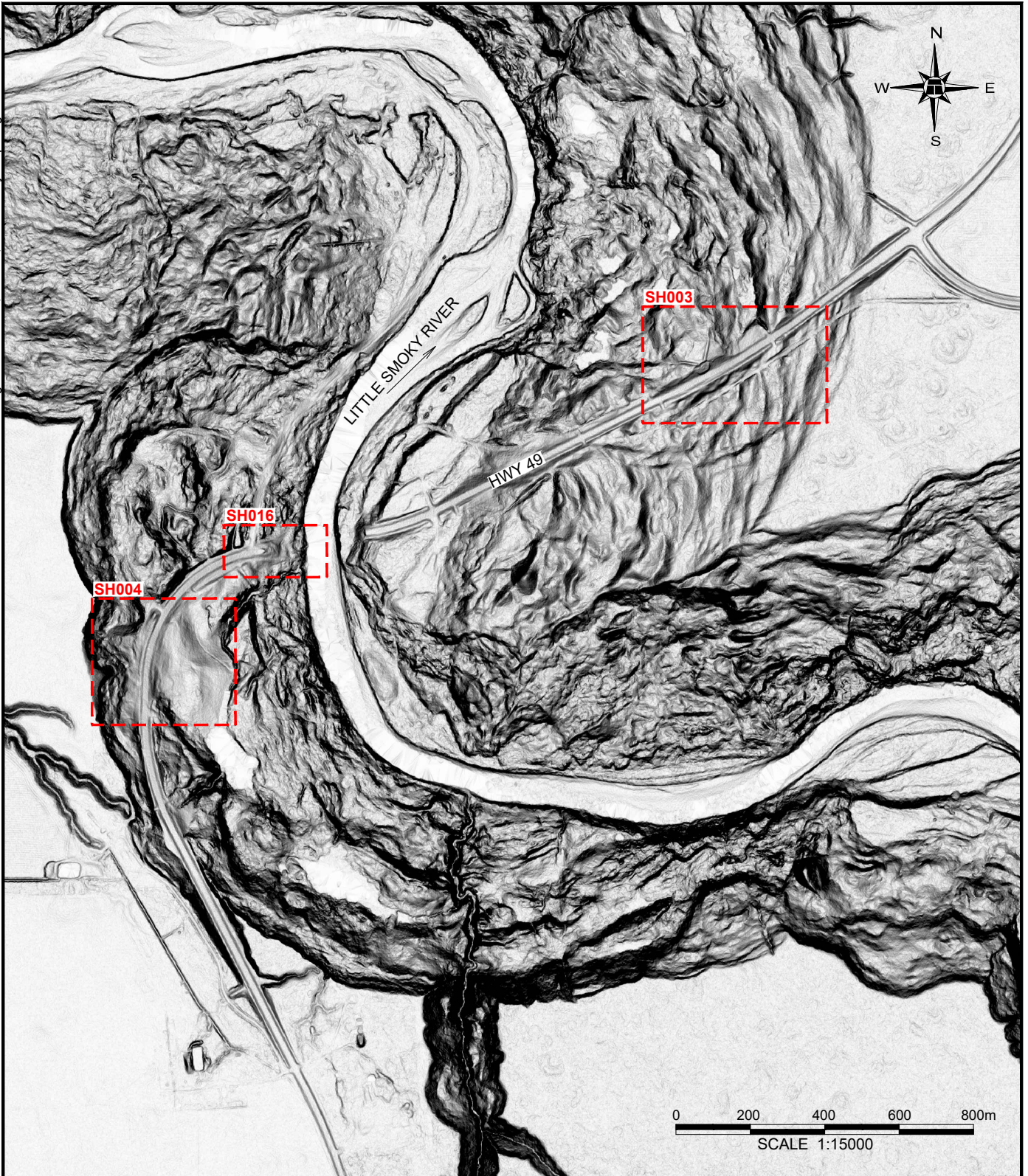
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2008 LIDAR PROVIDED BY ALBERTA TRANSPORTATION.

## PEACE REGION (PEACE RIVER DISTRICT)

### SH003-1, SH004-1, SH016-1 KEY MAP

FIGURE 1

Alberta

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DESIGNED BY	MG
APPROVED BY	RKS
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**THURBER**





**Photo 1 – Looking north at an erosion gully that extends past south end of the guardrail.**



**Photo 2 – Looking north at the first set of scarp cracks at south end of the site.**





**Photo 3 – Looking north at second set of scarp cracks just north of Photo 2.**



**Photo 4 – Looking north at extensions of cracks just north of Photo 3. Note small voids present on shoulder adjacent to guardrail.**





**Photo 5 – Looking south at an erosion gully present at the south end of the guardrail.**



**Photo 6 – Looking north at sideslope of highway at south end of site. The south culvert joint separation is on the left side of the photo.**





**Photo 7 – Looking west at cracks present outside of patched areas.**



**Photo 8 – Looking north at third set of scarp cracks near the north end of the east guardrail.**





**Photo 9 – Looking south at third set of scarp cracks from north end of east guardrail.**





**Photo 10, 11 – Looking at the southwest slide movement in the backslope above the highway.**





**Photo 12 – Looking south at downslope side of highway from the north end of the site.**



**Photo 13 – Looking north at bare area on sideslope with previously observed seepage. Area was observed to be dry in 2025.**





**Photo 14 – Looking west at culvert outlet with observed rust-stained area and soft ground.**



**Photo 15 – Looking south at faint scarps observed downslope of highway.**