

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (PEACE RIVER DISTRICT)
2022 INSPECTION**



Site Number	Location	Name	Hwy	km
PH012	Judah Hill	Heart River Slides	744:04	57.114
Legal Description		UTM Co-ordinates		
SE¼ 20-083-21 W5M		11V E 483284	N 6229209	

	Date	PF	CF	Total
Previous Inspection:	6-July-2021	15	7	105
Current Inspection(s):	24-May-2022	15	7	105
Road WAADT:	620		Year:	2021
Inspected By:	Tyler Clay, TEL Ed Szmata, TRANS Max Shannon, TRANS		Don Proudfoot, TEL Roger Skirrow, TRANS	
Report Attachments:	<input checked="" type="checkbox"/> Photographs		<input checked="" type="checkbox"/> Maintenance Items	
	<input checked="" type="checkbox"/> Plans			

Primary Site Issues:	<p>Prior to 2014, there were four slide features on the east side of Hwy 744, adjacent to a layby (brake check lane).</p> <p>Slide 1 was previously repaired in March 1998.</p> <p>Slides 2, 3 and 4 were active and had retrogressed into the northbound layby lane. During the summer of 2011, the northbound layby lane was closed, and the guardrail was moved to the edge of the northbound lane (NBL). In 2013 and the Spring of 2014, Slides 2, 3 and 4 continued to retrogress, coalescing into a larger single landslide feature with the resulting backscarp encroaching into the southbound lane (SBL) of Hwy 744:04.</p> <p>Slides 2, 3 and 4 were repaired by excavation and reconstruction with a uniaxial geogrid reinforced crushed gravel backfill under Contract 15153 during the summer of 2014 (Photos 4 to 8).</p> <p>New landslide scarps have appeared between the location of Slide 1 and the former Slide 2, referred to herein as Slide 1A, and to the south of the sheet pile repair at former Slide 2. The "Y" connector to the solid pipe below the sheet pile wall became disconnected between 2017/2018. The sheet pile wall has deflected from slide movement / earth flows and is no longer effectively retaining the slope at its north end. Mud flow scour channels have appeared and continue to grow at the bases of former slides 2, 3 and 4.</p>		
Dimensions:	Refer to attached Figures.		
Maintenance:	Concrete jersey barriers have been erected around the backscarp and a gravel detour has been constructed to the west of Slide 1A in 2020.		
Observations:	Description	Worsened?	
<input type="checkbox"/> Pavement Distress	Cracks have formed in the ACP behind the south side of Slide 1A (Photo 2).	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/> Slope Movement	Slide 1A (km 57+300) has ongoing retrogression and erosion. The largest	<input checked="" type="checkbox"/>	

	<p>increment of movement occurred around September 2020. The main scarp has encompassed the NBL and is just past the median by 0.3 m. Since the last major increment of main scarp retrogression there has been ongoing flank erosion, retrogression, and some minor retrogression at the main scarp. (Photos 1 to 3).</p> <p>Continued slide and shallow earth flow movements have occurred at the north end of the sheet pile wall and the structure has become deflected further downslope and outflanked (Photos 4 and 6). Retrogression was observed at two main scarps south of the sheetpile wall (former Slides 2 and 3). Shallow earth flows and seepage was observed below the former repairs (Photo 7).</p>	
<input checked="" type="checkbox"/> Erosion	<p>Scouring has been previously observed below the disconnected "Y" connector pipe below the sheet pile wall and is likely ongoing concurrently within disturbed slide materials and earth flow processes.</p> <p>An active scour channel is getting progressively deeper and retrogressing towards the road at the south end of the site, south of former Slide 4 (Photo 8).</p>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	<p>A wet layer was observed in the main scarp of Slides 1A in similar location to previous inspections. There was no ponded water at the top of the slide as has been observed previously.</p>	<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	<p>The solid "Y" connector pipe is disconnected below the sheet pile wall.</p> <p>Jersey Barriers were installed, and a gravel detour constructed in July 2020 around the Slide 1A scarp into the road. The pavement in the SBL within the detour was in ok condition with no major cracks or other signs of distress (Photo 11).</p>	<input checked="" type="checkbox"/>
<p>Instrumentation:</p> <p>No instruments are currently installed at the site.</p> <p>As part of the preliminary engineering assessment for Contract 15153, Thurber had previously installed five (5) standpipe piezometers in June 2013 at locations shown on Figure 1. Some of these piezometers were destroyed by landslide movement and the remainder were removed as part of the excavation work for the landslide repair.</p> <p>Seepage was encountered in all the test holes at about 5 m to 6 m below the existing ground surface during drilling in 2013.</p> <p>The last water level readings taken in the standpipe piezometers (Fall 2013) varied between 1.1 m to 4.9 m below ground surface in standpipes installed to 10 m depths (SP13-1A, SP13-2A and SP13-3) and from 23.3 m to 25.2 m in standpipes (SP13-1 and SP13-2), installed to depths of 26 m.</p>		

Assessment:

A combination of weathering, heavy precipitation, and active seepage beneath the old highway embankment fill, which was built through a slough, and surface water drainage in the ditch appears to have caused the retrogression of Slides 2, 3 and 4 before they were repaired. The previous repair at Slide 1 continues to perform well. No new cracking noted on the slope or pavement damage above these slide areas has been observed to date.

The main scarp of Slide 1A (formed between Slide 1 and the former Slide 2) has retrogressed to just past the highway centreline and will continue to retrogress towards the SBL. The rate of retrogression has reduced since September 2020; however, it is expected be highly dependent on groundwater and precipitation conditions. There is still risk the nearly vertical scarp at the highway could retrogress in sudden large increments by breaking off with relatively little warning. Signs of active seepage have been noted at the exposed scarp face and appear to be a driving factor in the loss of soil strength and rapid retrogression.

The sheet pile wall has been compromised from slope movements and is deflected and ineffective at its north end. Ongoing slide movement and loss of material upslope from the wall due to earth flows are expected in the following years. Loss of material here and further south of the sheetpile wall could begin to undermine the upslope repairs above former slides 2 and 3.

Scour in seepage zones in the till underlying the 2014-2015 repair from Contract CON0015153 continue to develop resulting in shallow earth flows on the colluvium slope below the locations of the former slides 2, 3 and 4.

Recommendations:

Ballpark Cost

Maintenance:

The concrete barriers may need to be rapidly shifted to the west if a significant increment of movement occurs at the Slide 1A main scarp. This would result in the narrowing of the current detour to one-lane traffic and temporary automated lights may be required for safe traffic control, or the detour will need to be widened. However, since the highway realignment is almost completed, this risk is relatively low.

Medium Term:

It is understood that a highway realignment design for this site has been completed and construction work is underway (Fall 2022). The new alignment will relocate the highway further from the landslide and closer towards the middle of the flat plateau area. The old highway will be removed. The grading will also remove the small wetland areas which are believed to be contributing to the seepage noted in the landslide backscarps. The highway realignment plan has been attached at the end of this report for reference. The new highway re-alignment should locate the road far enough away from the active landslides to significantly reduce the risk of it being affected by a landslide for several years. However, if nothing is done to curb the rate of slide retrogression, the slides will likely continue to eat into the plateau area and might eventually become a threat to the new alignment.

\$600k

Thurber has recommended that the backscarp of the Slide 1A area be cut back at the top and buttressed at the bottom with a gravel wedge to reduce retrogression of Slide 1A. However, AT has decided to defer that part of the work to a future date.

\$150k

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.

Don Proudfoot, P.Eng.
Principal | Senior Geotechnical Engineer

Tyler Clay, P.Eng.
Geological 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.

2. COMPLETE REPORT

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.

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. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

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.

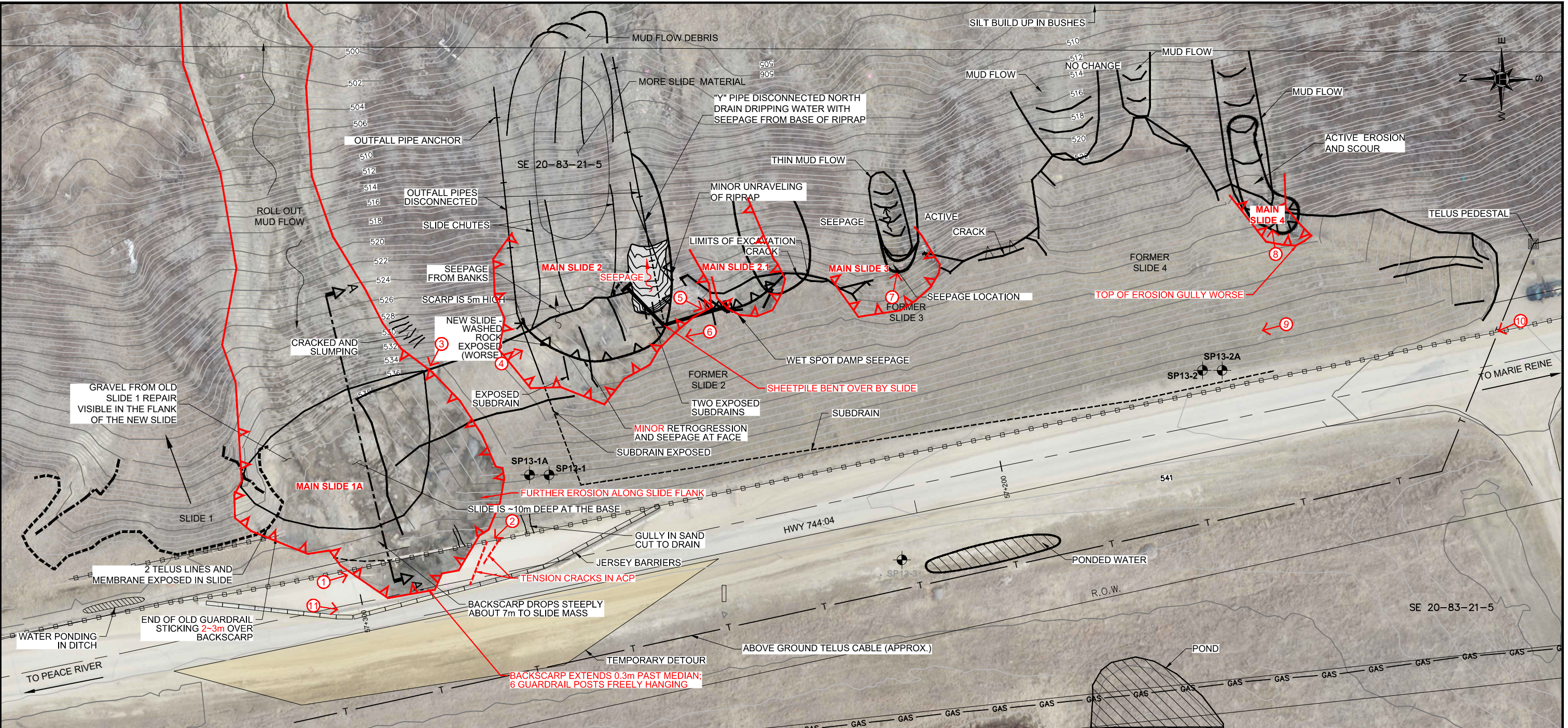
6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

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.

7. 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 others 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.

H:\32000\32121 AT GRMP Peace River District 2021-2025\CAD\2022 GEOHAZARD\TTC\32121-PH012-1-1.dwg - 1 - Oct. 17, 2022

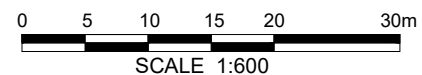


LEGEND

- 150mm Ø PERFORATED SUBDRAIN
- 150mm Ø OUTFALL PIPE
- EXISTING GUARD RAIL
- T—T— APPROXIMATE LOCATION OF RELOCATED ABOVE GROUND TELUS CABLE
- TELUS PEDESTAL
- ⊕ 2013 TEST HOLE (INSTRUMENTS NO LONGER ACTIVE)
- ① → DIRECTION AND NUMBER OF PHOTO

NOTES:

1. LOCATION DATA RECORDED USING HAND HELD GPS RECEIVER. ALL LOCATIONS ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.
2. MAY 2022 OBSERVATIONS SHOWN IN RED
3. BASE IMAGERY COLLECTED BY DRONE SURVEY ON MAY 24, 2022 AND PROVIDED BY MCINTOSH PERRY



PEACE REGION (PEACE RIVER DISTRICT)

**PH012-1 JUDAH HILL HEART RIVER SLIDES
2022 SITE INSPECTION PLAN**

DWG No. 32121-PH012-1-1

DRAWN BY	ML
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:600
DATE	OCTOBER 2022
FILE No.	32121





Photo 1.

Looking south from south end of Slide 1 from the NBL shoulder of Hwy 744:04 towards the top of the Slide 1A bowl (57+300). The main scarp of the slide has retrogressed entirely into the NBL: and has reached just past the median strip. Gravel detour has been constructed to expand the SBL.



Photo 2.

Looking north towards the Slide 1A flank and main scarp south of Slide 1. New tension cracks had formed in the pavement above the south flank since the 2021 inspection.



Photo 3.
Looking upslope towards the west at the main scarp of Slide 1A from the lower south flank.



Photo 4.
Looking southeast from north end of Heart River Landslide repair excavation (Former Slide 2). Ongoing downslope movement but no significant retrogression of the main scarp or further deflection of the sheet pile wall.



Photo 5.
Looking south at the slide south of the sheet pile wall with recent retrogression visible.



Photo 6.
Looking north at the former Slide 2 area with ongoing slide movement and erosion damage. Some retrogression of the main scarp since 2021.



Photo 7.
Looking east at mud flow at the location of former Slide 3, which has been more active since 2021. Decreased vegetation since previous inspection indicative of active soil movement.



Photo 8.
Looking south at the scour that has formed south of the former Slide 4. Ongoing erosion since 2021.



Photo 9.
Looking northwest from south of the location of former Slide 4. Overall repairs from 2014 are performing well in this area. Overall slope is well vegetated and there are no apparent slumps in the granular backfill slope.

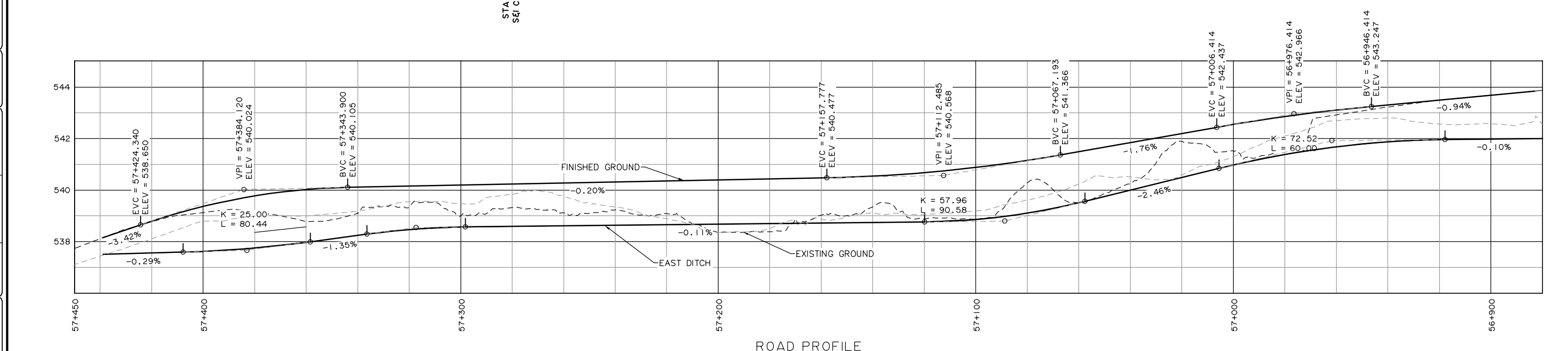
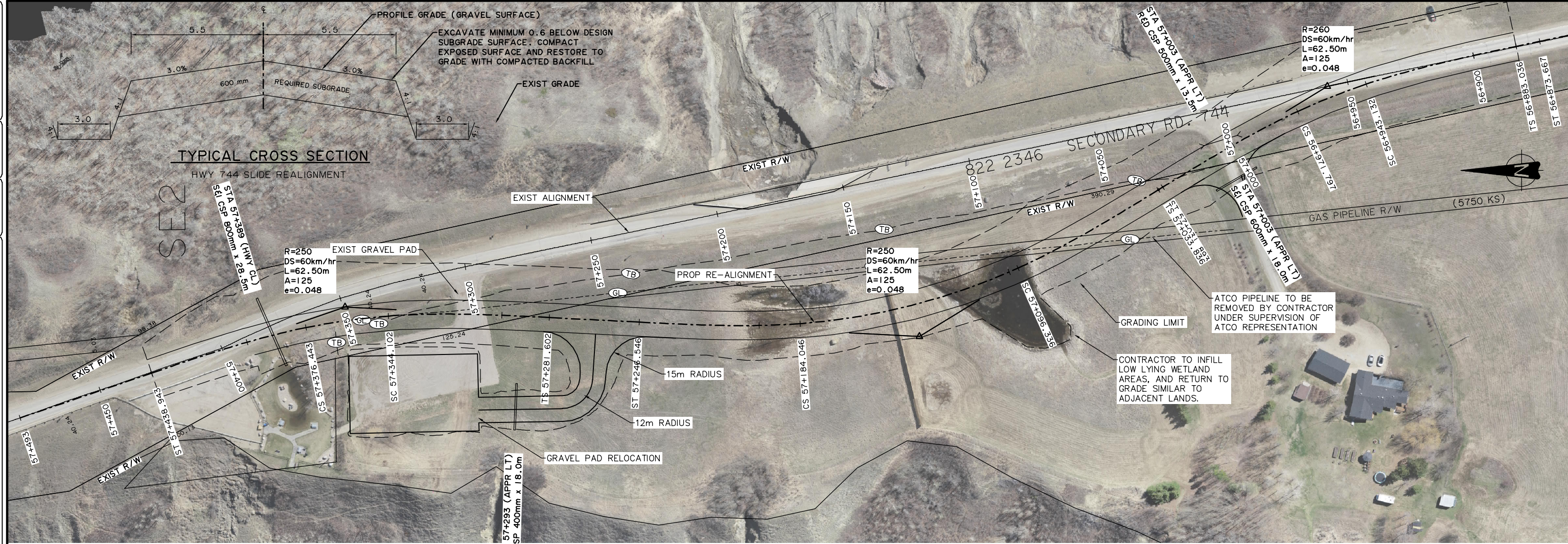


Photo 10.
Looking north along the highway from the south end of the site. No apparent pavement changes south of Slide 1A. Note detour signage at Slide 1A.



Photo 11.
Looking south along
the highway at the
gravel detour

DRAWING REALIGNMENT OPTION 'A'
 HIGHWAY 744.04
 CONTRACT -
 DESCRIPTION HWY 744:04 JUDAH HILL SLIDE REALIGNMENT
 PHOTO
 DATE 2022-05-17
 BY MCINTOSH PERRY
 SURVEYED
 DEPARTMENT BAR CODE



LEGEND

EXISTING CENTRELINE	--- --	PROPOSED R/W	-----	SIGNAL LIGHT	⊕
PROPOSED CENTRELINE	--- --	BROKEN LANE LINE	- - - -	EXISTING POWER POLE	⊕
EXISTING EOP	---	SOLID LANE LINE	=====	EXISTING LIGHT STANDARD	⊕
PROPOSED EOP	---	WATER VALVE	⊕	PROPOSED LIGHT STANDARD	⊕
EXISTING R/W	---	OBLITERATION	⊕	EXISTING CULVERT	⊕
		EXISTING SIGNAGE	⊕	PROPOSED CULVERT	⊕
				TEST HOLE	⊕

NOTES:
 1. ALL DIMENSIONS ARE METERS AND DECIMALS OF A METER.

HORIZONTAL SCALE: 1:1000
 VERTICAL SCALE: 1:100

CONSULTANT	DESIGNER	CHECKER	DATE	LOCATION	SITE	CONTRACT	HIGHWAY	SHEET	DRAWING
McINTOSH PERRY			2022-09-14	JUDAH HILL	N/A	-	744.04	2 OF 2	REALIGNMENT OPTION 'A'
230817									

Alberta Transportation
 HWY 744:04
 JUDAH HILL SLIDE REALIGNMENT
 STA. 56+878 TO STA. 57+493

C:\Users\ve_elcomba\McIntosh Perry\Western Canada Infrastructure - Peace River Office\Private Clients\Thurber\230817 - Hwy 744 - Judah Hill Slide Re-Alignment Design\Hwy 744 Slide Re-Alignment Option 2.dwg