

**ALBERTA TRANSPORTATION AND  
ECONOMIC CORRIDORS  
GEOHAZARD ASSESSMENT PROGRAM  
PEACE REGION (PEACE RIVER DISTRICT)  
2024 INSPECTION**



Site Number	Location	Name	Hwy	km
PH033	Judah Hill	CNR Slide	744:04	59.451
Legal Description		UTM Co-ordinates (NAD 83)		
NE¼ 29-083-21 W5M		11V E 482645	N 6231308	

	Date	PF	CF	Total
<b>Previous Inspection:</b>	May 17, 2023	17	4	68 (Slide Risk Rating)
<b>Current Inspection:</b>	May 28, 2024	17	4	68 (Slide Risk Rating)
<b>Road WAADT:</b>	630	<b>Year:</b>		2023
<b>Inspected By:</b>	Don Proudfoot, Tyler Clay, Cole Szakacs (Thurber). Rocky Wang, Robert Senior (TEC)			
<b>Report Attachments:</b>	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance			

<b>Primary Site Issue:</b>	Two rotational slides, one above the other, with the toe being eroded at the Heart River. Slide movement apparently occurring over an eroded bedrock surface, above river level. Crest of slide(s) has previously affected the highway and rail line near the level crossing. Pile walls and a large gravel toe berm were previously installed to protect the highway and rail line. The Heart River has shifted and is cutting into the slope behind the riprap installed to protect the toe of the toe berm slope.		
<b>Dimensions:</b>	80 m wide, 110 m long (plan view). Slide plane is estimated between 10 m to 15 m deep, with backscarp now about 6 m from S10-17.		
<b>Date of any remediation:</b>	None.		
<b>Maintenance:</b>	Highway was closed from May 2013 to January 2014 due to Sunshine Landslide. The inlet to the CNR Trunk downpipe was partially cleaned in 2016. The first void behind the pile wall at the road was filled with concrete in 2020 and the second was filled in 2022. Some ditch and embankment sideslope repairs were completed in 2022.		
<b>Observations:</b>	<b>Description:</b>	<b>Worsened?</b>	
		<b>Yes</b>	<b>No</b>
<input type="checkbox"/> Pavement	text	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	No obvious retrogression of upper main backscarp since 2008. Backscarp has vegetation growth. No obvious slope movement directly downslope from the wall, upslope of S10-17. (Photos 6, 9 and 11) Continued erosion along the northwest near-vertical flank and river erosion of the lower landslide toe but no major expansion from the 2023 condition. (Photo 10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<input checked="" type="checkbox"/> Erosion	<p>Previous sideslope erosion rills and gulying near km 59.55 and km 59.48 have been repaired and no new erosion damage was observed. There was increased grass growth since 2023. (Photo 7)</p> <p>Active erosion is occurring below the severed section of the CNR Trunk downslope drainpipe and vertical headwall has been formed. There has been retrogression and lateral expansion since 2023 (Photos 4 and 5).</p> <p>Repaired erosion voids (first observed in 2020 and 2022) were in good condition as viewed from the top of the pile wall and there were no visible signs of new void formation at the ground surface behind the wall. (Photos 1 and 2)</p> <p>East ditch (south from km 59.51) erosion was repaired in 2022 by regrading and installing TRM and ditch barriers. A minor erosion channel (first noted in 2023) has developed within the ditch bottom and the ditch barriers were partially undermined at some locations with increased depth relative to the 2023 condition. (Photo 8)</p> <p>A section between the ditch repair and drainpipe inlet is yet to be repaired (grading and riprap placement) due to ground disturbance agreements over the ACTO gas line. Drainpipe inlet had minor sand and gravel buildup (likely from upslope ditch erosion) but was not blocked and had no major change from the 2023 condition. (Photo 12)</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert	<p>The pipe conduit has completely failed immediately below the crest of the upper valley slope. As a result, a scour gully with vertical headwall is actively expanding in the slope below the breakage and sediment is accumulating in the intermediate plateau below (Photos 4 and 5).</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	<p>Increased concrete spalling and sloughing between the piles on the CNR retaining wall (noted in previous years). (Photos 1,3 and 13).</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**Instrumentation:**

Instruments were read on May 23, 2024, and the results are summarized below:

- SI10-16 (installed about 15 m downslope of the CNR pile wall) - Movement rate is consistent with historic trends (0 to 3 mm/yr) over 11.7 m to 13.5 m depth since 2010, and the total cumulative movement has been less than 20 mm.

- .SI10-17 (installed about 6 m from the crest of the main backscarp) - Movement rate is consistent with historic trends (0 to 3 mm/yr) over 9.5 m to 11.3 m since 2010 and the total cumulative movement has been less than 15 mm.
- PN10-16 (near pile wall) - PN10-16 showed no change in groundwater level since the fall of 2023 readings. Ground level has shown a consistent trend since installation in 2010 with groundwater depth between 10 m to 12 m below ground surface.

**Assessment** (Refer to Drawing PH033-1-1):

Movement at the toe of the CNR slide is continuing, worsened by river erosion of failed material at the toe of the slide. Erosion at the toe of the slope, which started in 2007, is expected to continue, with consequent further slide movement and retrogression of the backscarp towards the rail line and highway. The pile wall along Hwy 744 was drilled to 20 m depth, and terminated above the expected rupture surface, so would be vulnerable to loss of toe support. Now that the river erosion has reached a hard bedrock face, the rate of lateral river erosion directly downslope of the pile wall has slowed.

The CNR drainage trunk pipe is broken immediately below the crest of the valley slope and both water and sediment are pouring directly onto the slope below. A large and active scour gully with vertical drop has formed immediately beneath the break in the pipe. We recommended that this be addressed as a matter of urgency, preferably by replacing the existing segmented CPP with a welded anchored pipe along a flatter alternate alignment in addition to re-profiling and armoring the inlet.

The repairs to the erosion voids (formed behind the pile wall in 2020 and 2022) appear to be performing as intended but there is still ongoing erosion and soil loss between the piles which will likely lead to future formation of voids that can reach the ground surface behind the wall with little to no visible indication. A structural (e.g., wire mesh facing) facing tied into the concrete and/or anchors on the downslope side of the piles to contain fill/grout and prevent future soil loss is recommended. Surface drainage should also be directed away from the area behind the pile wall to reduce erosion rates and future void formation.

**Recommendations:**

**Monitoring:**

Annual inspections should continue with the next inspection occurring in the Spring of 2025.

**Investigation:**

- Establish survey network around the pile wall, including benchmarks on 'stable' ground, and control points on the top and bottom of the wall. Conduct regular surveys every 1 – 2 years to detect movement / deflection of the wall, check for the length of exposed wall and movement of the ground around the wall.
- Assess the stability of the wall and ability to resist overturning based on the length of exposed wall and current ground anchorages. Assess the need for additional wall supports (anchors, piles, etc.) and/or a toe support wall. This work is currently underway and will be reported in a separate report when completed.
- Options to limit erosion by the Heart River at the toe of the slope should be assessed – this will require a review of river hydraulics and can be completed by Thurber's in-house hydraulic engineering support.

**Maintenance:**

- Consider a curb and gutter along the edge of asphalt, or a depressed swale, to channel water away from edge of pavement and to divert runoff away from the back of the piles.
- Fill any new rills around the guardrail posts with gravel covered with seeded topsoil.
- Regrade ditch where the check dams are undermined, line ditch bottom with granular fill and replace the TRM, replace / re-install check dams. Clean out drain inlet area and use material to fill

in ditch where required. Alternatively, extend planned rock riprap from inlet area to 100 m to the south.

**Short-term Measures:**

- Replace the wall parging with a more robust solution and fill the voids between piles. Install drainpipes through the new wall facing to avoid blocking seepage. Fill any voids behind the wall with grout or granular fill with non-woven geotextile filter. Options are currently being reviewed and will be presented in a future preliminary engineering report.
- Replace CPP drainpipe with a realigned anchored welded pipe. (\$300k - \$450k)

**Long-term Measures:**

- River training works such as rock vanes may be required in support of other repair options, or to limit further slope movement. (\$500k - \$750k)

**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.

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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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- 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.

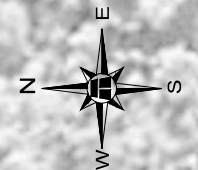
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### 7. INDEPENDENT JUDGEMENTS OF CLIENT

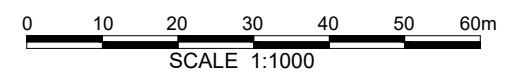
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G:\32000\32121 AT GRMP Peace River District 2021-2025\CAD\2024\TTC\32121-PH033-1, PH033-2 october 15, 2024.dwg - PH033-1 CNR SLIDE - Oct. 15, 2024



LEGEND:  
SLOPE INDICATOR  
DIRECTION AND NUMBER OF PHOTO

NOTES:  
1 LOCATION DATA RECORDED USING HANDHELD GPS RECEIVER. ALL LOCATIONS ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.  
2 MAY 28, 2024 OBSERVATIONS SHOWN IN RED.



2023-05-29 AIR PHOTO FROM MP



PEACE REGION (PEACE RIVER DISTRICT)

PH033-1 JUDAH HILL - CNR SLIDE  
2024 SITE INSPECTION PLAN

DWG No. 32121-PH033-1-1

DRAWN BY	ML
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:1000
DATE	OCTOBER 2024
FILE No.	32121





**Photo 1.**  
Looking southeast from the north end of the CNR pile wall. Grout / lean concrete overflow from the 2022 repair of the void behind the wall is visible at the toe of the wall.



**Photo 2.**  
View of the repaired area behind the pile wall where erosion voids formed in 2020 and 2022. The repair involved geotextile supported by wood cribbing and backfilled with grout/lean concrete. The voids were a result of soil loss between the piles, and over 5 m in depth prior to repair. The repairs appeared to be working as intended during the 2024 inspection and no visible signs of void formation were identified along the ground surface behind the wall.





**Photo 3.**  
Looking south at the soil loss between the northernmost piles (1 to 5) of the CNR pile wall north of Hwy 744:04 at km 59.61. Increased buildup of soil spalling between the piles since 2023. Note wood cribbing set behind the piles to help contain the grout backfill for the void repair; however, some grout still did flow through and has set along the toe of the piles.



**Photo 4.**  
Looking northeast at break in CNR CPP Trunk pipe and erosion gully at crest of the Heart River valley slope. More pipe segments have fallen into the gully since the 2023 inspection.



**Photo 5.**  
Looking southwest from below the scour gully headwall caused by the breakage in the CNR CPP Trunk pipe. There has been some retrogression and lateral expansion at the gully headwall since 2023.



**Photo 6.**  
Looking southeast from the north side of the lower slide main scarp. No major changes observed in the slope area directly below the pile wall since 2023.



**Photo 7.**  
Looking east at previous embankment area with erosion gullies and rill erosion that was repaired in 2022. Sideslope repairs appeared effective and similar to the 2023 conditions.



**Photo 8.**  
Looking north towards the east ditch with previous erosion damage that was repaired in 2022 (regraded, with TRM and ditch barriers). Vegetation was not well established and there was a minor erosion channel starting to develop within the ditch bottom and some barriers were partially undermined.



**Photo 9.**  
Looking west at the slide lower slide mass. There was some increased erosion along the slide flank relative to the 2023 condition but no major expansion.



**Photo 10.**  
Looking south towards the base of the lower slide and bedrock exposure at the river. Some minor lower slide activity and active erosion of slide materials entering over the bank. No major change from the 2023 condition.



**Photo 11.**  
View towards the lower slope area downslope from the base of the pile wall and immediately upslope of the main slide scarp monitored by S110-17. No visible indications of landslide movement were observed in this area and conditions were similar to 2023 inspection.



**Photo 12.**  
Buildup of eroded ditch sediment (sand and gravel) at the down pipe trunk inlet.



**Photo 13.**  
Looking towards the southeast at the base of the pile wall with spalling concrete between the piles.