

**ALBERTA TRANSPORTATION  
GEOHAZARD ASSESSMENT PROGRAM  
NORTH CENTRAL REGION – ATHABASCA &  
FORT MCMURRAY DISTRICTS  
2022 INSPECTION**



Site Number	Location	Name	km
NC084	To the south of the King Street Interchange in Fort McMurray	Hwy 63:11 Beacon Hill Erosion	9.1
Legal Description		UTM Co-ordinates	
5-10-089-09 W4M		12U E 478509	N 6284231

	Date	PF	CF	Total
<b>Previous Inspection:</b>	June 24, 2021	16	4	64 (Ditch Erosion)
<b>Current Inspection:</b>	June 8, 2021	16	4	64 (Ditch Erosion)
<b>Road AADT:</b>	28,690	<b>Year:</b>	2022	
<b>Inspected By:</b>	José Pineda, Tarek Abdelaziz (Thurber) Arthur Kavulok, Rishi Adhikari, Amy Driessen (Alberta Transportation)			
<b>Report Attachments:</b>	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

<b>Primary Site Issue:</b>	Gullies and rills in the highway side slopes and west ditch
<b>Dimensions:</b>	Refer to attached drawings and notes below. The eroded area to the west side of Hwy 63 is about 1.0 km in length.
<b>History/Maintenance:</b>	<p>Available information from AT indicated the following:</p> <ul style="list-style-type: none"> <li>- Underground utility work took place in the highway ditch in 2014.</li> <li>- The highway ditch has had progressive development of erosion in the highway side slope and ditch.</li> <li>- The erosion became severe in June 2016.</li> <li>- A temporary repair was completed in late 2016, and included filling in the erosion gullies, track packing rilled slopes, and minor ditch grading. Existing grass around DS1 to the north of the interchange ramp bin wall was also cleared in 2016.</li> <li>- Maintenance completed by AT between the spring and the fall of 2017 included: (a) sediment removal from DS1, the area north of the culvert C4 outlet extending to the storm water pond, the outlets of culvert C3 and C4; digging a small channel between the outlet of C4 and the pond; removal of sediment to expose two gabion weirs located between the C4 and the pond; construction of a small berm to the south of the bin wall to diver ditch flow away from the highway.</li> <li>- Sediment removal from the pond and the area located between the pond and C4 culvert as well as slight regrading was completed by AT in the winter of 2019</li> <li>- Storm water pond and C3 and C4 culverts were cleaned, and an outflow discharge channel near the northern limit of the pond was dug in the fall of 2020 and 2021; willow stakes were planted between the pond and the top of bank of the river between 2019 and 2020</li> <li>- Replacement of Culvert C5a and C5b in 2021: Failed attempts to replace C5b culvert by Inline Contracting resulted in pavement distress/settlement (about 6 to 8 m wide zone) of the walking trail and the highway northbound lanes (about 10 mm dip) above the alignment of the C5b pipe. Open transverse cracks were also noted on the highway NBLs near the ends of the dip zone. Based on</li> </ul>

	<p>onsite discussions with TetraTech (i.e., consultant overseeing the work), it is understood that the ditch block to the north of the inlet of C5b culvert was removed so that the flow from the C5a pipe can be accommodated through the C5b liner and an existing 600 mm diameter culvert (below the NBLs) to the north of C5b pipe location.</p> <ul style="list-style-type: none"> <li>- In 2021, a 600 mm diameter liner was installed in the original C5b pipe; C5b replacement pipes were grouted; riprap was installed at the inlets and the outlets of the new C5a and C5b pipes; a channel lined with ECB Type C was installed at the outlet of the C5b pipe.</li> <li>- In fall 2021, AT cleaned the storm water pond, and removed the gabion weir at the outlet the 1200 mm diameter culvert; AT removed existing Jersey barriers between the bin wall; manholes 1 to 5 were cleaned in the early spring multiple times to prevent highway flooding issues.</li> <li>- Between 2021 and 2022, new light poles were installed in the highway ditch to replace the old ones, and hydrovac excavation was completed in the ditch by the utility company (based on information provided by AT).</li> <li>- After the June 8, 2022's site visit, AT re-installed the Jersey barriers between the bin wall and the highway.</li> </ul>	
<b>Observations:</b>	<b>Description</b>	<b>Worsened?</b>
<input type="checkbox"/> Pavement Distress		<input type="checkbox"/>
<input type="checkbox"/> Slope Movement		<input type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Erosion rills (50 to 700 mm wide and 50 to 300 mm deep) were noted on the highway west side slopes; severe erosion gullies up to 3 m wide and about 1 m deep in the ditch	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	Seepage from the backslope at multiple locations above the ditch alignment	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	CSP Culvert C6 inlet is damaged and buried with sand and gravel sediment; CSP culverts C3 and C4 outlets are almost free of sediment; DS1 is covered under at least 50 mm of sediment and DS2 could not be located	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Other	<p>Accumulated sediment on the highway shoulder along the bin; however, MH1 to MH5 were still exposed at the time visit. AT indicated after the site visit that MH1 to MH5 got buried under sediment after a major storm event in June 2022.</p> <p>New light poles were installed on the west highway ditch side slope within 1 to 2 m from the edge of road</p> <p>Erosion in the median ditch immediately downstream of C5b; sediment within the outlet of C5a and within the median ditch section between the outlet of C5a and the inlet of C5b</p> <p>Dip on the highway NBL and the paved trail in the vicinity of C5b alignment</p>	<input type="checkbox"/>

**Instrumentation:**

There are several geotechnical instruments, consisting of slope inclinometers and piezometers, installed for other project in the ditch and within the hill. The instruments installed within the 2016 slump are being read under AT's GRMP. The remaining instruments within the ditch and the hill (outside the 2016 slump location) are not read under the current GRMP.

**Assessment:**

The site condition appears to have deteriorated since the last inspection and in particular along the ditch alignment. The ongoing work in the ditch by the utility company appears to have aggravated the situation.

The ongoing cleanup work by AT has been effective in maintaining the capacity of the pond.

The erosion that has been occurring on the west side of Hwy 63 is due to high runoff flowing over bare side slopes and a steep unprotected undefined "ditch". The side slopes and ditch bottom are generally bare of vegetation for the most part of the alignment, possibly due to excessive salting and sanding of this section of the highway during wintertime. Ground water seepage from the marginally stable backslopes above the ditch have aggravated the situation. The highway backslope extending up to Beacon Hill Drive also appears to provide a source for excessive fine sediment accumulation behind the bin wall and in the area surrounding DS1.

The existing surface runoff management system at this site is not effective and continued to result in (a) development of erosion rills and gullies in the highway west ditch and side slope, (b) progressive accumulation of sediment downstream of the C4 pipe, within the pond, and blockage of the outlets of C3 and C4 culverts , and (c) progressive accumulation of sediment near the downstream end of the west ditch (along the south of the bin wall) to spill over the highway surface between MH#5 and MH#1.

Sediment accumulation along the bin wall between Manholes MH#1 and MH#5 will continue to provide poor driving conditions at the King Street Interchange west ramp. This may also result in flooding of the highway. Further sediment accumulation to the north of C4 pipe and within the pond may result in further loss of the pond's storage capacity and backing up of water towards the C3 and C4 culverts and the king street embankment. Ponding of water, if occurs, at the King Street Interchange west ramp may impact the integrity of the ramp.

Although the ongoing erosion does not appear to currently affect the highway surface, ongoing erosion along the side slopes could eventually undermine the integrity of the highway.

The severe erosion gullies developed near the edge of pavement constitutes a safety hazard to motorists.

C5b culvert is currently undersized, and this may result in future flooding of the highway or erosion of the median ditch.

**RECOMMENDATIONS****Ditch Erosion Issue:**

This frequency of the site inspection visits should be reduced to every second year.

Frequent maintenance of the ditch, highway side slopes, the storm water pond, DS1, culverts C3 and C4, and MHs 1 to 5 is required at this site. A long-term, maintenance free, option to remediate this site is not feasible since it is impossible to eliminate the source of sediment. Sand and salt accumulations will keep burying the ditch, and the five manholes, located on the king street ramp by the bin wall, will continue to collect sediment from the highway surface and convey it to the underground storm sewer pipe connected to DS1 and the pond area.

Following are our recommendations to maintain this site. This work should ideally be completed by the maintenance contractor after the installation of the new light poles is completed to avoid further disturbance of the ditch.

- As a minimum, and where severe erosion gullies developed in the highway side slope and the ditch, the gullies should be backfilled with well compacted crushed gravel. Backfilling gullies near the edge of the road should be the priority to eliminate existing safety hazard to motorists.

- Consideration should be given to blading and track packing rilled and bare side slopes of the highway and interchange ramp in a direction perpendicular to the flow direction (i.e., up and down the side slope surface to deal with side slope rills). Minor contouring should be undertaken to re-establish ditch grade and profile. The ditch should have at least 1 m wide flat bottom, 4H:1V side slopes and provided with a minimum height of 300 mm. Grading work should be carefully undertaken particularly where the toe of the valley is abutting the highway surface to avoid slope instability issues. The re-constructed ditch should be connected to the inlet drop structure located to the north of the interchange west ramp bin wall through the construction of a narrow/shallow channel by the tree line behind the bin wall.
- Locate and plug the inlets of C6 and DS2.
- A temporary small berm should be constructed to the south of the bin wall to divert the ditch flow towards the small channel by the tree line and prevent sediment from spilling on the highway surface, and accordingly plugging of existing manholes.
- Accumulated sediment around the drop structure DS1 should be cleared.
- If funds are available, it is recommended that the new ditch/channel be lined with either heavy rick riprap over a non-woven geotextile fabric or a High Performance TRM. This should reduce the frequency of future ditch maintenance work.
- Consideration should be given to adding silt fences along the tree line, extending from DS1 location to the south of the bin wall. The silt fences aim to retain sediment from the backslope. The silt fences should be cleaned and maintained periodically.
- The C5a culvert should be cleaned of accumulated sediment, and the erosion developed in the median ditch immediately downstream of the inlet of C5b should be repaired before it becomes bigger in size.

**Other Issues:**

- A hydrotechnical study should be conducted to assess the impact of the reduced capacity of C6b on the storm water management system in this area. The median ditch and the highway surface should be monitored by the local MCI after a prolonged heavy rainfall event.
- The local MCI should continue to monitor the dips developed on the highway NBL and the paved walking trail in the vicinity of the C6b pipe alignment. If the dips become severe to constitute safety concerns to users, consideration should be given to placing ACP patches within the impacted areas.

**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.  
Associate | 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.

### 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.

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### 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

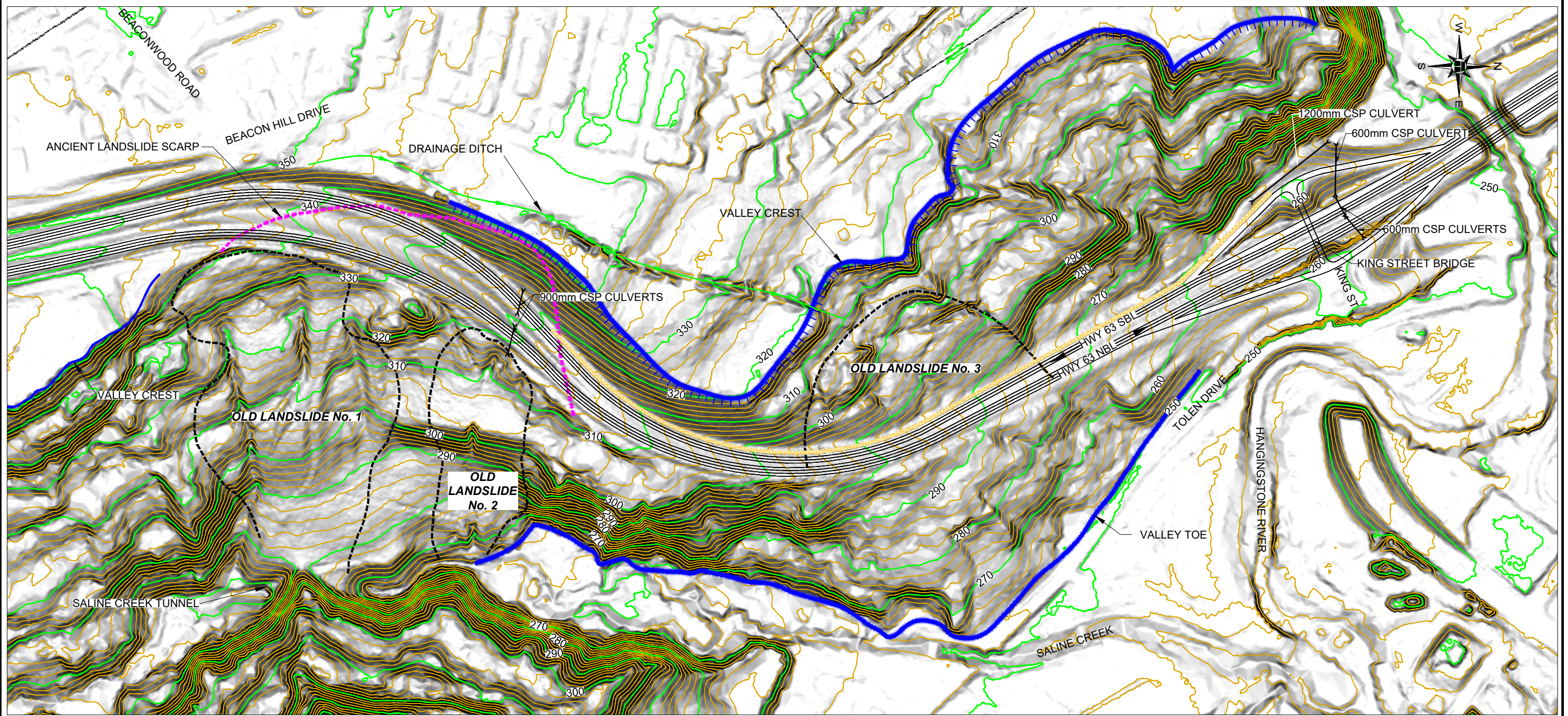
Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, 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.

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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.



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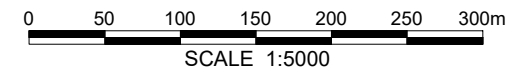


**LEGEND**

-  APPROXIMATE HIGHWAY ALIGNMENT
-  BARE GROUND
-  VALLEY CREST
-  VALLEY TOE
-  OLD LANDSLIDE NO.1

**NOTES:**

1. OLD LANDSLIDES 1, 2, 3 WERE ACTIVE LOCAL LANDSLIDES THAT WERE REPAIRED IN THE PAST.
2. GROUND SURFACE CONTOURS HAVE BEEN ESTIMATED FROM THE 2008 LIDAR DATA.
3. SITE FEATURES ARE BASED ON SIMPLE MEASUREMENTS MADE DURING THE SITE VISIT AND THE ACTUAL EXTENT OF FEATURES MAY DEVIATE FROM WHAT IS PRESENTED ON THE DRAWINGS.
4. **JUNE 8, 2022 OBSERVATIONS SHOWN IN RED.**



**NORTH CENTRAL REGION  
(ATHABASCA AND FORT MCMURRAY DISTRICTS)  
2022 GEOHAZARD ASSESSMENT  
NC084: HWY 63:11 BEACON HILL EROSION ISSUES  
(km 9.1)  
LIDAR IMAGE SHOWING SITE FEATURES**

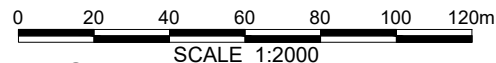
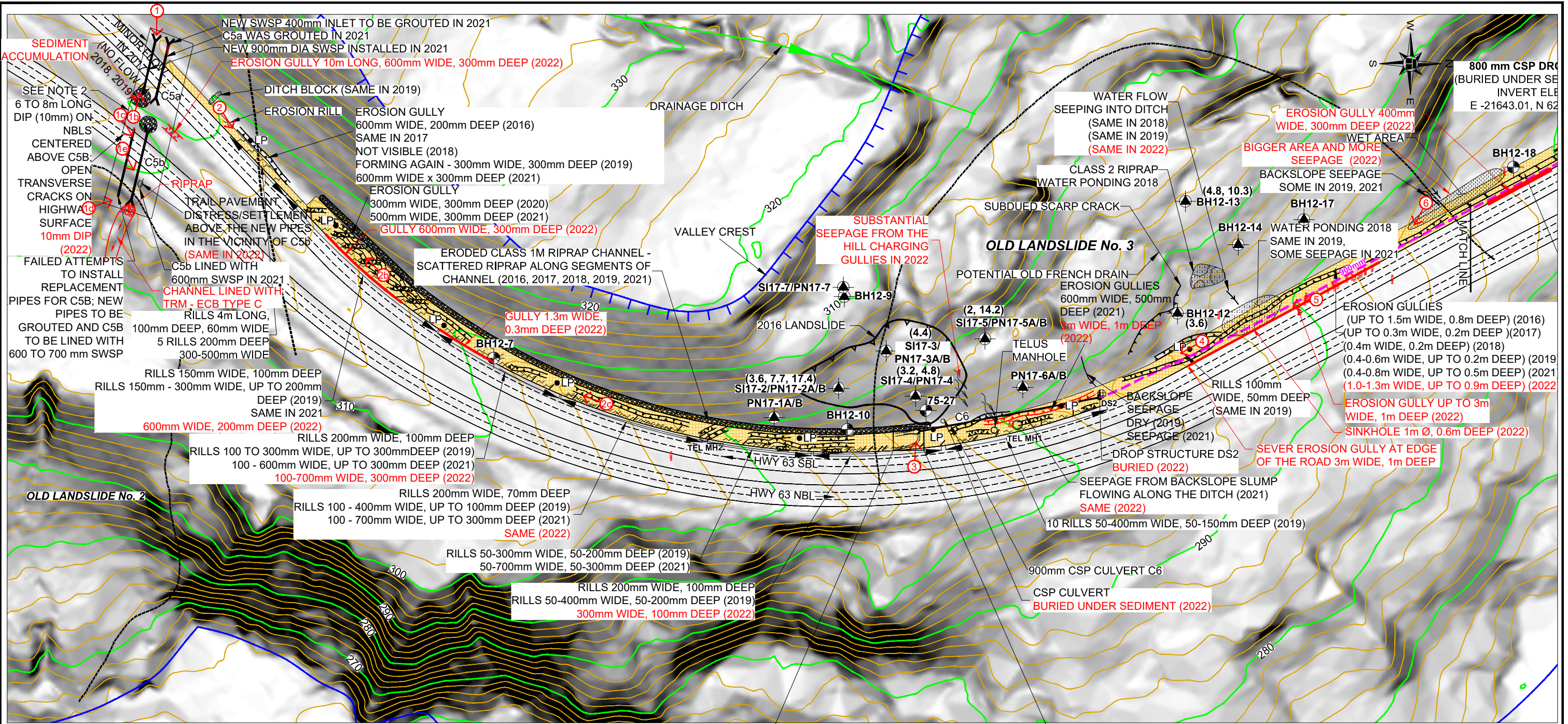
**FIGURE 1**

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:5000
DATE	JULY 2022
FILE No.	32122





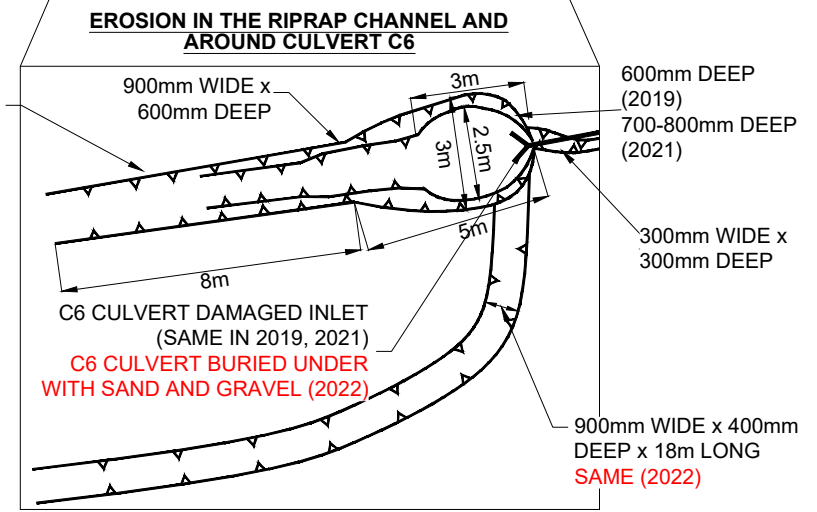
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LEGEND

- EROSION GULLY / RUTTING
- EROSION RILL
- LIGHT POLE
- GROUND SURFACE CONTOUR (CONTOUR INTERVAL = 2m)
- APPROXIMATE HIGHWAY ALIGNMENT
- PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION
- BARE GROUND
- VALLEY CREST
- VALLEY TOE
- OLD LANDSLIDE NO.1
- PREVIOUS SLOPE INCLINOMETER LOCATION
- PREVIOUS BOREHOLE LOCATION
- SLOPE INCLINOMETER
- PNEUMATIC PIEZOMETER
- BORE HOLE
- DEPTH OF MOVEMENT IN SLOPE INCLINOMETRE IN METERS

NOTES:  
 1. JUNE 8, 2022 OBSERVATIONS SHOWN IN RED.  
 2. INLINE CONTRACTING WAS WORKING ON THE REPLACEMENT OF CULVERT C5a AND C5b; TETRA TECH WAS THE CONSULTANT OVERSEEING THE CULVERT REPLACEMENT WORK. TERRA TECH INDICATED THAT THE CONTRACTOR HAD MULTIPLE UNSUCCESSFUL ATTEMPTS TO REPLACE THE C5b CULVERT.

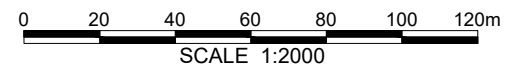
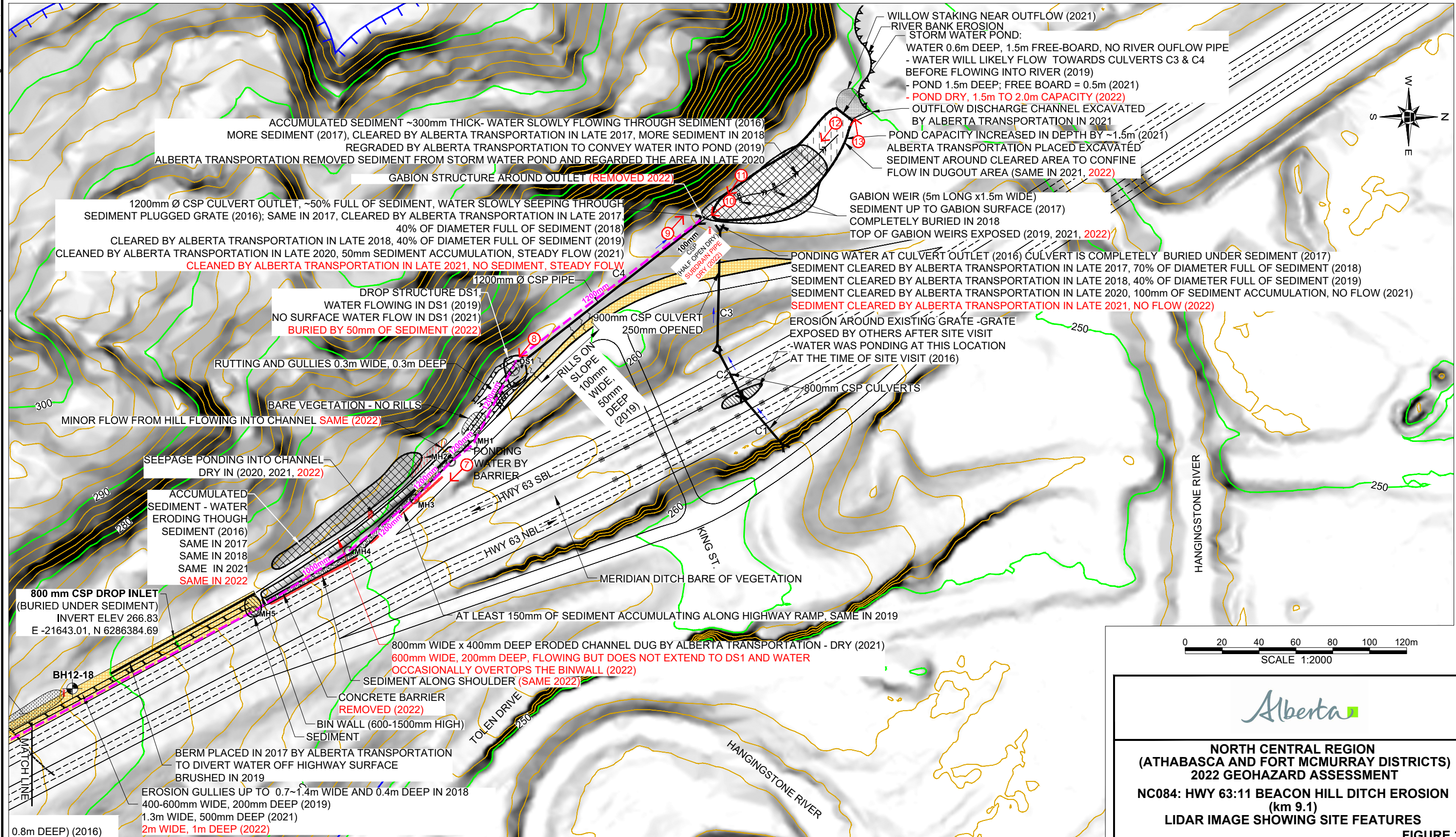


**NORTH CENTRAL REGION  
 (ATHABASCA AND FORT MCMURRAY DISTRICTS)  
 2022 GEOHAZARD ASSESSMENT  
 NC084: HWY 63:11 BEACON HILL DITCH EROSION  
 (km 9.1)  
 LIDAR IMAGE SHOWING SITE FEATURES  
 FIGURE 2**

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:2000
DATE	OCTOBER 2022
FILE No.	32122

**THURBER ENGINEERING LTD.**





*Alberta*

**NORTH CENTRAL REGION  
(ATHABASCA AND FORT McMURRAY DISTRICTS)  
2022 GEOHAZARD ASSESSMENT**

**NC084: HWY 63:11 BEACON HILL DITCH EROSION  
(km 9.1)  
LIDAR IMAGE SHOWING SITE FEATURES**

**FIGURE 3**

**LEGEND**

- EROSION GULLY / RUTTING
- ~~~~~ EROSION RILL
- GROUND SURFACE CONTOUR (CONTOUR INTERVAL = 2m)
- APPROXIMATE HIGHWAY ALIGNMENT
- ① PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION
- BARE SLOPE WITH EROSION GULLY / RILLS
- APPROXIMATE GUARDRAIL LOCATION

- VALLEY CREST
- VALLEY TOE
- ← WATER FLOW

**NOTES:**  
 1. MH2 TO MH5 ARE BURIED UNDER SEDIMENT.  
 2. JUNE 8, 2022 OBSERVATIONS SHOWN IN RED.

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:2000
DATE	OCTOBER 2022
FILE No.	32122







Photo 1 – Looking at the inlet of a new 900 mm diameter SWSP culvert (C5a replacement).



Photo 1b – Looking at the outlet of a new 900 mm diameter SWSP culvert (C5a replacement); Note the presence of sediment at the outlet of the new pipe; sediment covers a portion of the median ditch between the outlet of C5a and the inlet of C5b.





Photo 1c - 600 mm diameter SWSP culvert inlet (C5b; liner installed within the original C3b pipe).



Photo 1d –Looking at the outlet of the C5b liner.





Photo 1e –Asphalt walking trail settlement/distress in response to the failed attempts to replace C5b.



Photo 2 – Bare side slopes with erosion rills (looking north).





Photo 2b – Bare side slopes and erosion rills.



Photo 2c – Bare side slopes and erosion rills.





Photo 3 – Erosion developed on the highway side slope. Culvert C6 inlet buried under sediment.



Photo 4 – Erosion, bare slopes. Drop structure DS2 completely buried under sediment.





Photo 5 – Sinkhole 1m diameter by 0.6m deep and gully 3m wide by 1m deep.



Photo 6 – Some seepage from the colluvium backslope flowing into eroded ditch.





Photo 7 – Sediment accumulation on the highway by the Jersey barriers buried Manholes MH#1 and MH#5 (Photo received from AT after the June 8, 2022's site visit).



Photo 8 – Drop Structure DS1; note sediment accumulation around drop structure.





Photo 9 –AT cleaned the pond in the fall of 2021; substantial sediment removed to increase pond capacity.



Photo 10 – Culvert C4 (1200 mm outlet); scour under the culvert; steady flow from the outlet.





Photo 11 – Culvert C3 and C4 outlets; no flow from C3.



Photo 12 – Looking south from the north end of the pond. Note dry conditions in 2022.





Photo 13 – Willow staking within the vegetation buffer zone between the pond and the river.