CENTRAL REGION GRMP
SITE INSPECTION FORM

SITE NUMBER AND NAME: **C034 Abraham Lake Erosion**	HIGHWAY & KM: 11:04, 10.445 to 12.250	PREVIOUS INSPECTION DATE: June 27, 2023	INSPECTION DATE: **June 9, 2025**
LEGAL DESCRIPTION: 07-07-38-17 W5M	NAD 83 COORDINATES: UTM 11 Northing 5789173 Easting 539996	RISK ASSESSMENT: C034-1: PF: 1 CF: 4 TOTAL: 4 C034-2: PF: 1 CF: 4 TOTAL: 4 C034-3: PF: 10 CF: 2 TOTAL: 20	
HIGHWAY SERVICE CLASSIFICATION: 2		CONTRACT MAINTENANCE AREA (CMA): 514	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 395 (west) & 375 (east) (Ref No. 50110250)			

SUMMARY OF SITE INSTRUMENTATION:	INSPECTED BY:
There is no instrumentation at the C034 site. LAST READING DATE: N/A	Chris Gräpel (KCB) James Lyons (KCB) Tony Penney (TEC) Chris Newman (TEC)

PRIMARY SITE ISSUE: Erosion and retrogression of the highway embankment slope along the south (eastbound lane of Hwy 11:04 on the west side of Abraham Lake (a reservoir created by the Bighorn Dam (owned and operated by TransAlta Generation Partnership) on the North Saskatchewan River). The erosion is caused by precipitation, surface water runoff from the highway surface, and wave action when the reservoir level is high.

APPROXIMATE DIMENSIONS: The sites are approximately 110 m to 300 m long, slope is between approximately 6 m to 20 m high, and sloped between approximately near vertical to 2H:1V.

DATE OF ANY REMEDIAL ACTION: C034-1: July 2006 – slope reinforced with soil nails, steel mesh, and shotcrete; Spring 2017 – the highway was realigned to the north (upslope) towards the backslope, a 3-cable high-tension-cable barrier (HTCB) was installed, and an asphalt curb was installed to redirect pavement surface runoff away from the erosion gullies on the eroded slope. March 2018 – erosion gullies backfilled with gravel and asphalt curb partially removed. July 2019 – construction of a temporary rockfill berm at the toe of the eroding slope using coarse material raked from the beach. April to August 2020 – the slope was repaired by PME Inc. and construction was monitored by KCB. The repair consisted of rebuilding the embankment with rockfill (including a shear key and subdrains) with the bottom portion of the slope armoured with riprap. During the work a culvert at the north extent of the slope was extended, the guardrail was removed and replaced, and a washout south of the site was backfilled (near Hoodoo Creek). C034-2: January to April 2024 – the slope was buttressed with a rockfall embankment and armoured with Class 2 riprap (including a riprap key trench). The work was repaired by McKnight Enterprises Inc. and monitored by KCB. C034-3: N/A

ITEM	**CONDITION EXISTS**		**DESCRIPTION AND LOCATION**	**NOTICABLE CHANGE FROM LAST INSPECTION**	
	YES	NO		YES	NO
Pavement Distress		X	N/A – none observed during the 2025 inspection.		X
Slope Movement	X		C034-3: Minor slope movement attributed to erosion oversteepening the slope.	X	
Erosion	X		The eroding slopes at C034-1 and C034-2 were repaired in 2020 and 2024, respectively. The C034-2 slope was eroding due to precipitation and wave action from Abraham Lake during high water levels. The C034-3 site is eroding a near vertical bluff in the highway embankment at elevated water levels in the summer time, at other times the lake is eroding the beach.	X	

Seepage	X		C034-3: A high rate of seepage was observed on the beach slope downslope (south) of the eroding slope.	X	
Culvert Distress		X	N/A – none observed during the 2025 inspection.		X

COMMENTS

C034-1:

- The site was repaired by PME Inc., and the work was performed under Contract No. CON0019442. KCB monitored construction and our Final Details Report was issued to TEC on November 6, 2020.
- The crest of the slope, along the shoulder of Hwy 11:04, is well vegetated (Photo 1).
- The slope was not visually inspected in detail during the 2025 inspection. However, from visual observations made from the shoulder of the highway above the C034-1 site and the beach surface at the C034-2 site, the 2020 repair appeared to be performing well (Photo 2) and no pavement distress (cracking or settlement) was observed.
- The erosion rills at the crest of the slope have not worsened between the 2023 and 2025 inspections (Photo 3).

C034-2:

- Between 2022 and 2024, KCB performed a test pit investigation (six test pits along the toe of the slope), environmental and regulatory work, design work, and tendering for site.
- The site was repaired between January and April 2024 by McKnight Enterprise Inc. (McKnight) and the work was performed under Contract No. CON0023985). KCB monitored construction and our Final Details Report was issued to TEC on October 4, 2024.
- The repair consisted of buttressing the slope with a rockfill embankment that was armoured with Class 2 riprap. There was a riprap key trench (1 m deep, 1.5 m wide, with 1H:1V side slopes) constructed along the toe of the slope.
- The crest of the slope was relatively well vegetated (Photo 4) excluding area used for access during construction. Boulders were placed west of the access area/break in the guardrail to reduce vehicle traffic onto the crest of the repair and remain in place (Photo 6).
- The rockfill crest and riprap armoured slope (Class 2) were in good condition and the repair appeared to be performing well (Photo 4 and 5).
- Along the east extent of the repair, non-woven geotextile was visible along the crest of the repair between the riprap and existing ground (Photo 4). There was no erosion observed during the inspection. KCB believes there is a low risk of erosion, as the water level remains below the crest of the rockfill embankment most of the year and is only near full supply level in late-summer/early-fall for approximately one month.

C034-3 (site number to be confirmed):

- The C034-3 site is located approximately 650 m west of the C034-1 site (repaired in 2020) and 225 m west of the Abraham Lake Ice Bubbles viewpoint. There is easy access to the breach surface below the eroding slope from the west extent of the viewpoint parking lot (boulders placed to restrict vehicle access) (Photos 7 and 8).
- There is a TELUS monument on the north side of the access path near the east extent of the site (Photo 8).
- The site is approximately 110 m long and the eroded near vertical slope is approximately 3 m to 4 m tall. The highway embankment is approximately 10 m high. The slope is likely being eroded primarily due to wave action during high reservoir levels, similar to the C034-1 and -2 sites before they were repaired (Photos 9 through 11).

- The near-vertical erosion face is approximately 25 m south of the south (eastbound) guardrail measured along the slope surface.
- The beach slope downstream of the eroding slope is sloped at approximately 3H:1V to 4H:1V.
- The slope above and to the east and west of the eroding face is well vegetated with grass, shrubs, and trees.
- A zone of very high seepage was observed on the beach slope approximately 85 m downslope (south) of eroding slope and approximately 8 m below the highway elevation (Photo 13).
  - KCB estimated the rate of seepage between approximately 0.3 m^3/s to 0.5 m^3/s.
  - A second seepage zone appeared to be present just east of the seeping zone, however, it was dry during the 2025 inspection (Photo 14). TEC informed KCB on-site that it had been observed seeping during previous site visits.
- The highway surface and guardrail upslope of the eroding slope were in good condition (Photo 15).
- A bedrock outcrop is located north (upslope) of the site on the north side of the highway that likely underlies coarse till (Photo 16). However, there does not appear to be a valley on the upstream side of the highway that could concentrate flow and contribute to the seepage. The seepage may be caused by an infilled valley with a coarse seepage zone (e.g., alluvial fan) or a fault in the bedrock discharging through and/or into beach materials.
- During the 2025 inspection, the addition of a third subsite to the existing C034 site was discussed. The geohazard at the third (western) site was considered similar in type and failure mechanism to the C034-1 and C034-2 sites, specifically an eroding slope caused by precipitation and wave action from Abraham Lake.

Maintenance/Repair/Monitoring Recommendations:

- The site should be regularly inspected by TEC's Maintenance Contract Inspector (MCI), especially after significant precipitation events.
- The site should continue to be inspected every two years as part of the Central Region GRMP Section B inspections.
- KCB will prepare a proposal to prepare a repair design for the C034-3 (to be confirmed) site. Our proposal should include background review, retaining a surveying subcontractor to perform a topographic survey, perform a test pit investigation along the toe of the slope to assess if potential weak thin clay layers are present to support design work, environmental and regulatory work (including an Environmental Evaluation), design work, and tendering (preparing tender specifications, Environmental Risk Assessment, Issued for Tender drawings, C-estimate, and submission letter).

This report is an instrument of service of Klohn Crippen Berger Ltd. (KCB). The report has been prepared for the exclusive use of Alberta Transportation and Economic Corridors (Client) for the specific application to the Central Region Geohazard Risk Management Program (Contract No. CON0022160) and it may not be relied upon by any other party without KCB's written consent.

KCB has prepared this report in a manner consistent with the level of care, skill, and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

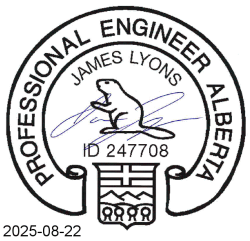
(i) The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.

(ii) The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.

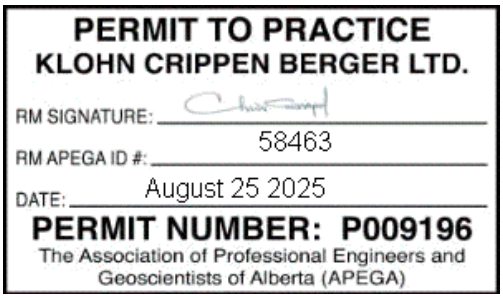
(iii) The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.

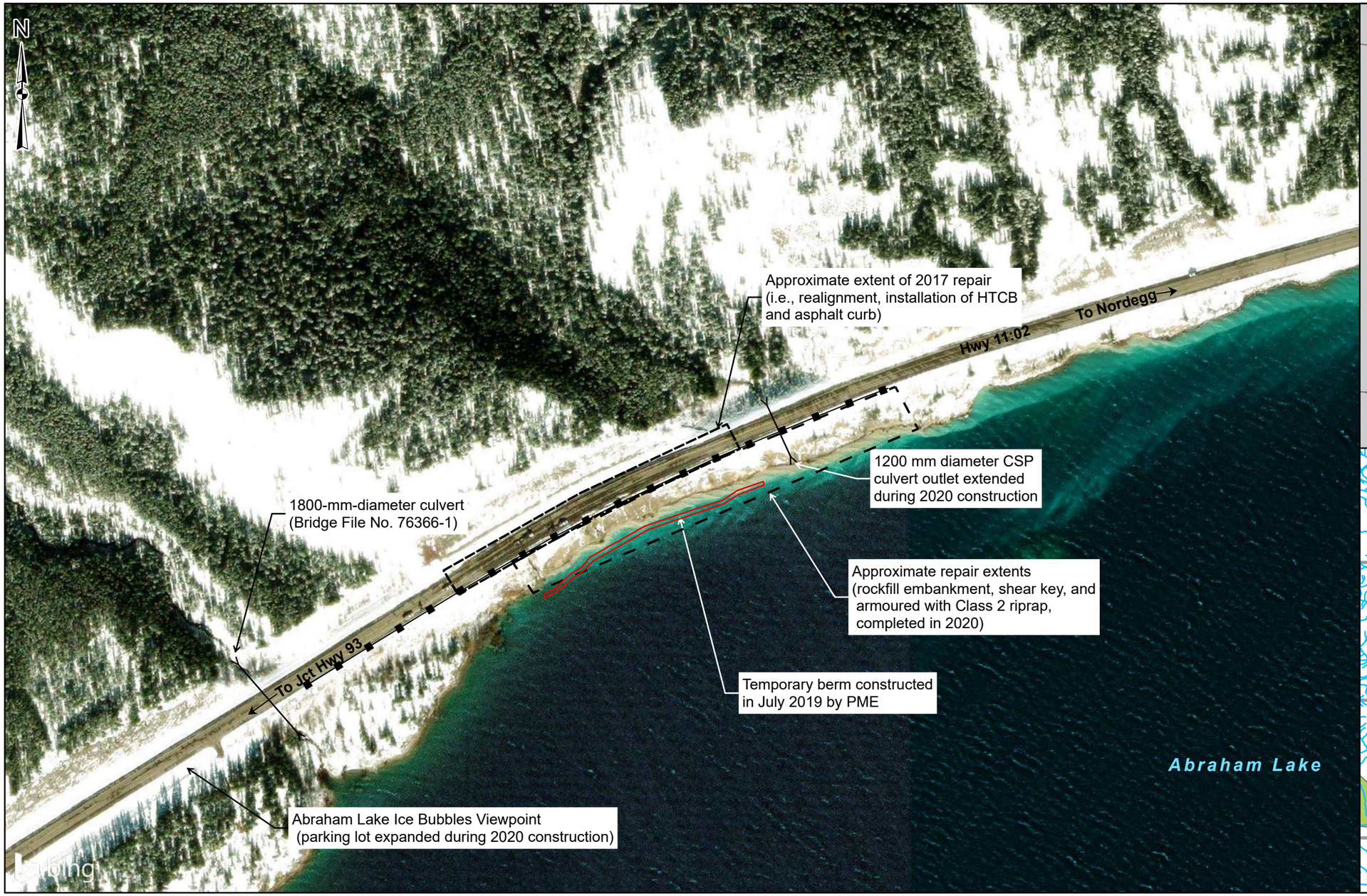
(iv) KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.

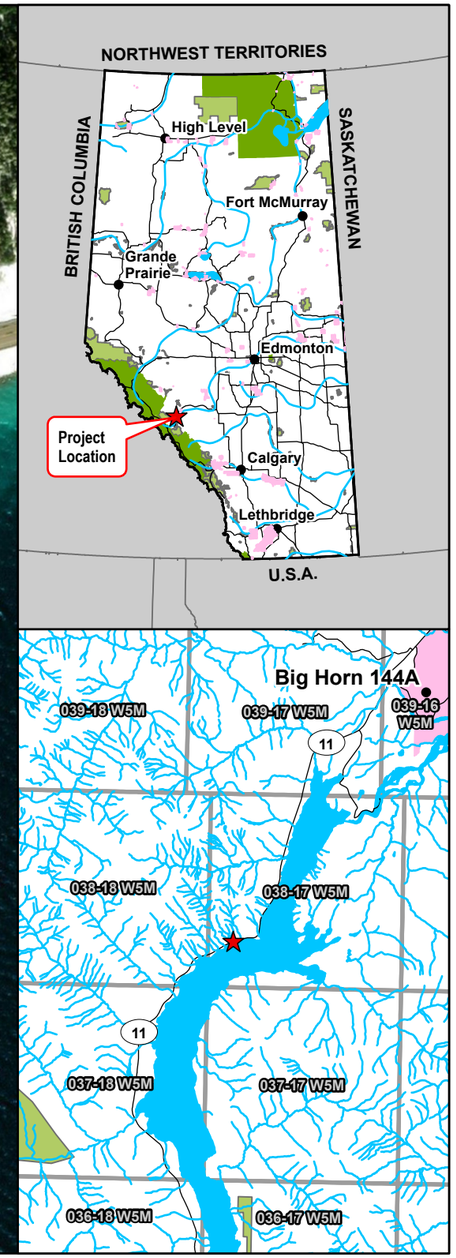
(v) This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.



James Lyons, P.Eng.
Civil Engineer







Legend

- Guardrail
- Repair Extent
- Culvert

0 100 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 11N
3. IMAGE SOURCE: 2025 MICROSOFT CORPORATION, 2025 MAXAR CNES, DISTRIBUTION AIRBUS DS

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C034-1 - Abraham Lake
Hwy 11:02, km 11.056

SCALE	PROJECT No.	FIG No.
1:3,000	A05116A02	1

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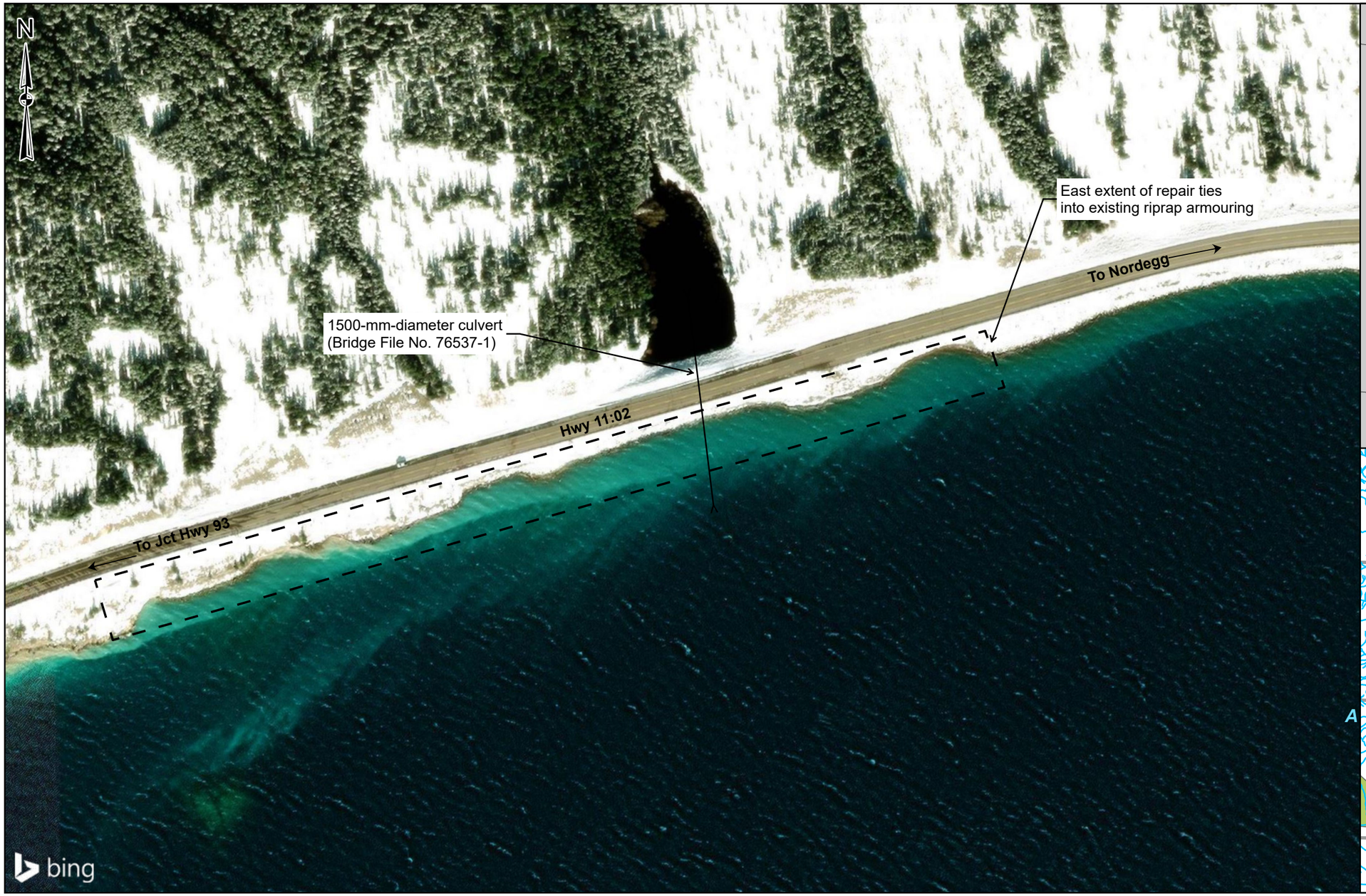

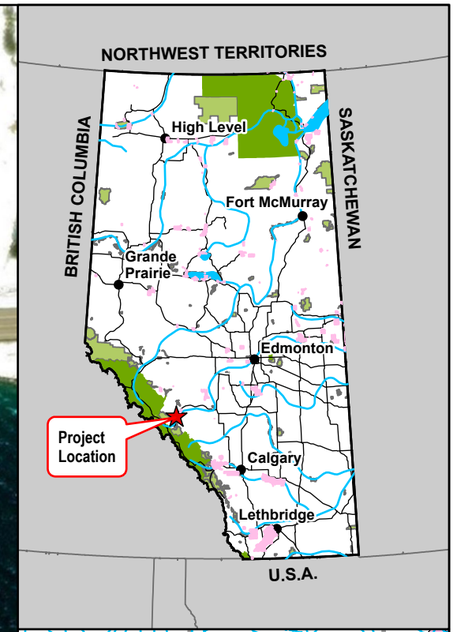

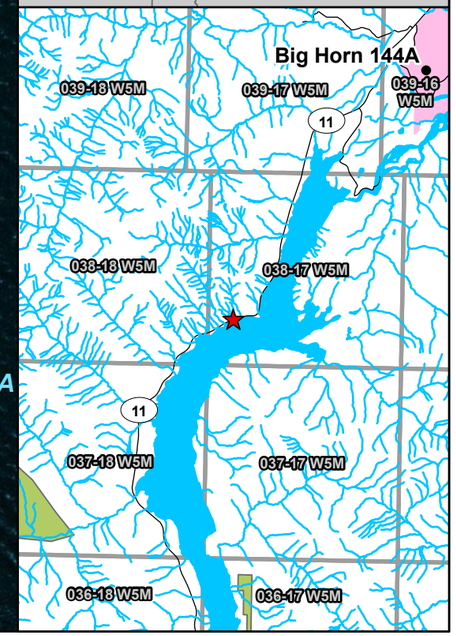

Legend

- Repair Extent (completed in 2024)
- Culvert

0 50 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 11N
3. IMAGE SOURCE: 2025 MICROSOFT CORPORATION, 2025 MAXAR CNES, DISTRIBUTION AIRBUS DS

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C034-2 - Abraham Lake
Hwy 11:02, km 12.250

SCALE	PROJECT No.	FIG No.
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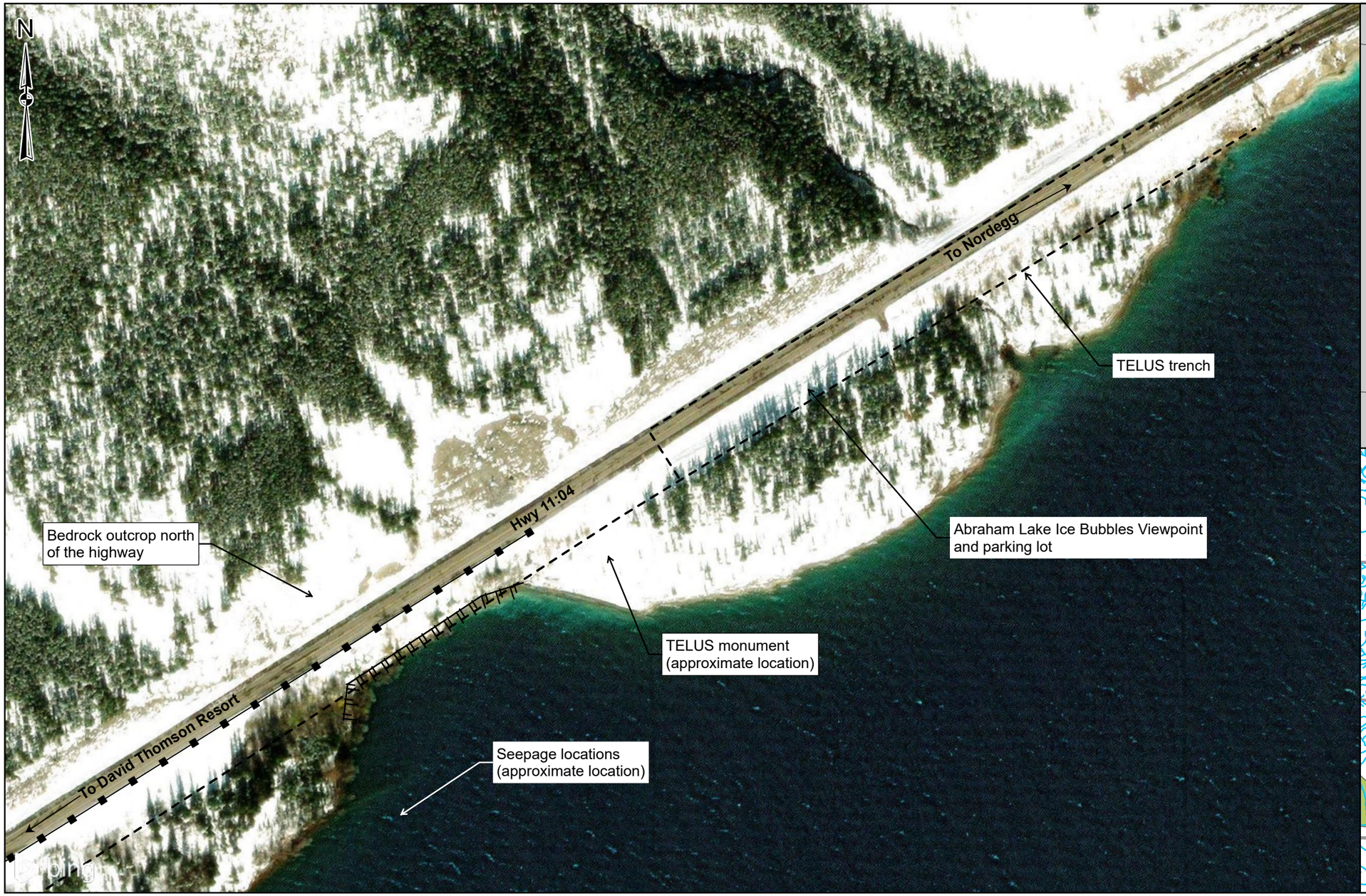

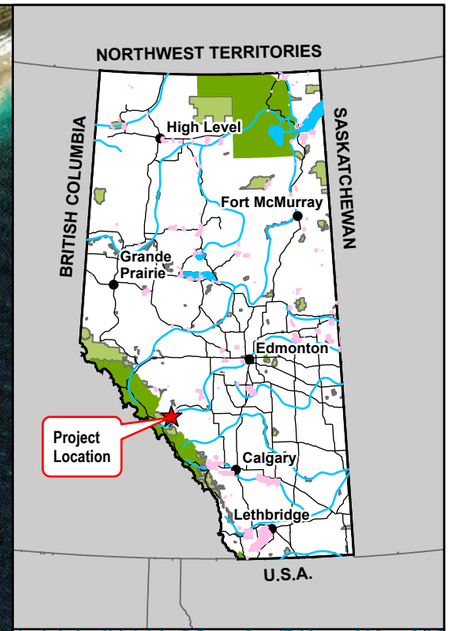

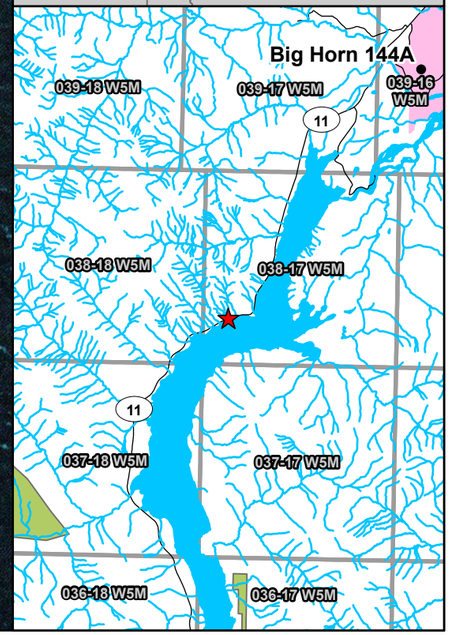

Legend

- Erosion Scarp
- Guardrail
- TELUS Trench

0 50 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 11N
3. IMAGE SOURCE: 2025 MICROSOFT CORPORATION, 2025 MAXAR CNES, DISTRIBUTION AIRBUS DS

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C034-3 - Abraham Lake
Hwy 11:04, km 10.445

SCALE	PROJECT No.	FIG No.
1:2,500	A05116A02	3

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Inspection Photographs

Photo 1 **The crest of the slope along C034-1 is well vegetated and in good condition. Photo taken June 9, 2025 facing west.**

Photo 2 **The repaired slope along C034-1 appears to be in good condition and is performing well. Photo taken June 9, 2025 facing west.**

Photo 3 **Minor rill erosion observed along the crest of C034-1. Photo taken June 9, 2025 facing northeast.**

Photo 4 **The repaired slope along C034-2 appears to be in good condition and is performing well. Photo taken June 9, 2025 facing west.**

Photo 5 **The repaired slope along C034-2 appears to be in good condition and is performing well. Photo taken June 9, 2025 facing northeast.**

Photo 6 **Boulders (indicated by red arrows) placed near the break in the guardrail in an attempt to reduce traffic along the crest of the C034-2 repair. Photo taken June 9, 2025 facing northwest.**

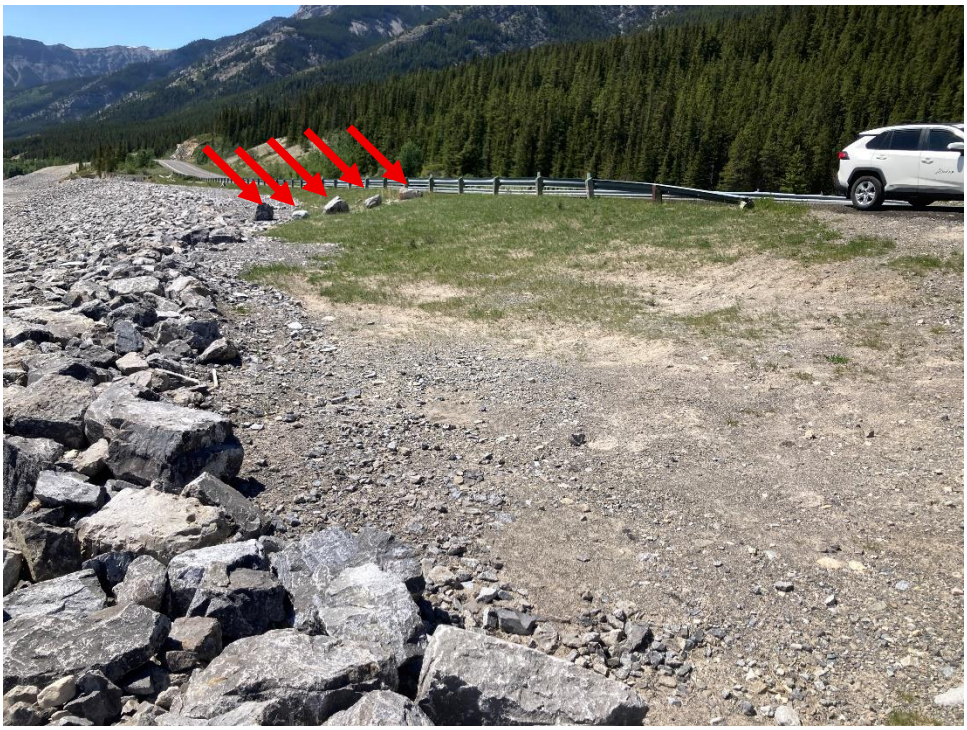

Photo 7 **Pedestrian trail down to the west shoreline of Abraham Lake east of the C034-3 site. Photo taken June 9, 2025 facing west-southwest.**

Photo 8 **TELUS monument located on the north side of the access trail east of the C034-3 site. Photo taken June 9, 2025 facing south.**

Photo 9 **East extent of the C034-3 site and the beach surface. Photo taken June 9, 2025 facing west.**

Photo 10 **The eroding slope along the C034-3 is approximately 110 m long and 3 m to 4 m tall. Photo taken June 9, 2025 facing west.**

Photo 11 **Eroding slope near the midpoint of C034-3. Cobbles and boulders are located along the toe of the slope. Photo taken June 9, 2025 facing northwest.**

Photo 12 **Trees and driftwood near the west extent of the C034-3 site. Photo taken June 9, 2025 facing north-northeast.**

Photo 13 **Active seepage located approximately 85 m downslope (south) of the eroding slope. Photo taken June 9, 2025 facing northwest.**

Photo 14 **Inactive (dry) seepage zone approximately 10 m to 15 m east of the active seepage zone. Photo taken June 9, 2025 facing north.**

Photo 15 **Pavement and guardrail and in good condition upslope of C034-3. Photo taken June 9, 2025 facing east.**

Photo 16 **Bedrock outcrop in the north highway backslope upslope of the C034-3 site. Photo taken June 9, 2025 facing north.**