CENTRAL REGION GRMP
SITE INSPECTION FORM

SITE NUMBER AND NAME: **C012 Hwy 841 Ditch Erosion**	HIGHWAY & KM: 841:02, 6.495	PREVIOUS INSPECTION DATE: June 27, 2023	INSPECTION DATE: **June 18, 2024**
LEGAL DESCRIPTION: 33-27-20-W4M	NAD 83 COORDINATES: UTM 12 Northing 5689847 Easting 377129	RISK ASSESSMENT: PF: 11 CF: 3 TOTAL: 33	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 80 (north) & 200 (south) (Ref No. 109220 & 108240)		CONTRACT MAINTENANCE AREA (CMA): 517	

SUMMARY OF SITE INSTRUMENTATION: There is no instrumentation at the C012 site. LAST READING DATE: N/A	INSPECTED BY: Chris Gräpel (KCB) James Lyons (KCB) Tony Penney (TEC) Rocky Wang (TEC)
PRIMARY SITE ISSUE: Erosion in the west (southbound) ditch of Hwy 841 in previously repaired areas. Ditch erosion upslope of the previously repaired areas is ongoing and is also eroding the toe of an approximately 25 m high natural slope on the west side of Hwy 841. Private land at the crest of the slope is being affected by slope movements.	
APPROXIMATE DIMENSIONS: The site is approximately 650 m long, and the highway embankment above the ditch is approximately 2 m to 3 m high sloped at approximately 4H:1V. Approximately 100 m to 150 m of the ditch has geocell armouring with gabion basket drop structures. The height of the natural slope west of Hwy 841 is estimated to be approximately 25 m.	
DATE OF ANY REMEDIAL ACTION: 2003 – A repair consisting of the installation of non-woven geotextile, geocell armouring, and two gabion basket drop structures was completed in two locations in the west (southbound) ditch.	

ITEM	**CONDITION EXISTS**		**DESCRIPTION AND LOCATION**	**NOTICABLE CHANGE FROM LAST INSPECTION**	
	YES	NO		YES	NO
Pavement Distress	X		Pavement settlement and cracking in west (southbound) lane near the north extent of the site.		X
Slope Movement	X		Ditch erosion has triggered a slope failure in the west highway embankment slope near the south extent of the site. Shallow movement in the tall natural slope west of the highway near the north extent of the site.		X
Erosion	X		Erosion in the east and west ditch bottom and at the toe of the natural slope west of the highway, near the north extent of the site	X	
Seepage		X	N/A – none observed during the 2024 inspection.		X
Culvert Distress		X	N/A – no culvert distress was observed during the 20234 N/A – none observed during the 2024 inspection		X

COMMENTS

General:

- The last inspection by KCB and TEC was in 2012 before TEC requested KCB complete a call-out inspection in 2020. A call-out inspection was completed by KCB in June 2020 and the final report was issued to TEC in January 2021.
- A corrugated-steel-pipe (CSP) culvert at the south extent of the site was extended in spring 2020. The culvert was extended by sleeving the existing culvert with a larger diameter CSP culvert, backfilling around the joint, and constructing a riprap apron at the culvert outlet. There was one sinkhole (approximately 0.3 m deep) observed in June 2020 (as part of the call-out inspection) and minor rill erosion above the culvert outlet was observed in June 2021. The culvert was in good condition during the 2023 inspection and was not inspected during the 2024 inspection.
- Erosion is occurring in the west (southbound) ditch bottom along Hwy 841 at the north and south extents of the site, where geotextile, geocell armouring, and two gabion basket drop structures were installed in 2003. Near the middle of the site, an erosion gully extends outside TEC's Right-of-Way (ROW) onto private land. Minor ditch erosion is ongoing is the east (northbound) ditch but is not as significant as the erosion in the east ditch.

Ditch Erosion (south end of site):

- Portions of the west ditch have been previously repaired with geotextile and geocell armouring. Approximately 25 m to 50 m of the geocell reinforcement has failed (i.e., exposed and undermined). The erosion gullies up to approximately 3 m to 4 m deep. The degree of erosion appears similar between the 2023 and 2024 inspections (Photo 2).
    - The erosion has triggered a slope failure on the highway embankment slope that isn't impacting the west (southbound) lane of Hwy 841 (Photo 1 and 2). Flow in the ditch is bypassing the geocell armouring and is eroding the highway embankment (Photo 3).
    - The erosion will eventually impact a nearby power pole (approximately 2 m to 3 m away) located on the west side of the ditch (Photo 2).
- A sinkhole was observed on the east edge of the gabion basket drip structure (first observed in 2024) (Photo 4). The sinkhole is approximately 0.5 m in diameter and 0.5 m deep.
- A slide was observed on the natural slope west of the ditch, approximately 100 m north of the gabion basket drop structure (Photo 5). The slide mass has failed into the ditch bottom and flows are constricted along this section of ditch. The slide does not appear to have changed significantly between 2020 (call-out inspection) and 2024.
- Upstream (north) of the erosion gullies, the ditch bottom is well vegetated and is performing well.
- There is minor ditch erosion in the east (northbound) ditch, approximately 0.5 m to 1.0 m deep and 1 m to 2 m wide (Photo 6). The erosion has gotten worse since the 2023 inspection and is getting closer to the edge of pavement (within 1 m) near the midpoint of the site. The east ditch erosion is much less severe than the west ditch erosion.
- There is a well-vegetated area near the CSP culvert outlet and downstream of the west (southbound) ditch. The well-vegetated area appears to act as a sediment trap for the surface water flows out of the CSP culvert and west ditch, before discharging into an erosion gully (approximately 3 m wide and 3 m deep) at the southwest extent of the site.

Ditch Erosion (north end of site):

- The ditch erosion downstream of the gabion basket drop structure is approximately 2 m to 3 m deep and up to 4 m to 5 m wide (Photo 7). No significant change has occurred between the 2023 and 2024 inspections.
    - The previous non-woven geotextile and geocell repair is undermined and is hanging downstream of the gabion basket drop structure (Photo 8).

- The erosion gully extends off of TEC's ROW and into the upper portion of the well-vegetated area upslope of the lower erosion site.

- The ditch erosion upstream of the gabion basket drop structure appears the have increased (deeper and wider) between the 2023 and 2024 inspections (Photos 9 through 12). The erosion near the north extent of the site was noticeably worse during the 2024 inspection (Photos 10 through 12). The erosion is impacting the highway embankment and tall natural slope west of the highway. Near the north extent of the ditch erosion, it has retrogressed to the edge of the pavement (Photo 10 and 11). The vertical erosion scarp is approximately 3 m from the edge of the pavement. If not repaired the erosion will begin to undermine the southbound lane of Hwy 841:02.
- Ditch erosion at the toe of the steep and tall (estimated to be 2H:1V and 25 m tall, respectively) natural slope has either caused or exacerbated a natural slope failure approximately 125 m wide that extends to just below the crest of the slope. The erosion scarp above ditch bottom appears to be up to 3 m high (Photos 9, 11, and 12) above base of the eroded ditch bottom and has increased in severity between the 2023 and 2024 inspections. The ditch base appears to be eroded up to 1.5 m below original ditch grade.

Maintenance/Repair/Monitoring Recommendations:

General:

- TEC's Maintenance Contract Inspector (MCI) should complete regular inspections of the site, especially after significant precipitation events (spring freshet or heavy or prolonged rainfall).
- The site should continue to be inspected every two years as part of the Central Region Section B Inspections.

Short Term:

- Signage (sharp shoulder and speed reduction) and barricade should be installed along the shoulder of the highway where the ditch erosion is starting to encroach upon the shoulder of the west (southbound) lane, until the site can be repaired. TEC's Highway Maintenance Contractor (HMC) should repair as soon as possible by rebuilding the highway embankment/ditch side slope with compacted granular fill. An even shorter-term repair could be end dumping granular material (e.g., 300 mm minus) in areas where the erosion is close to the edge of pavement.

Long Term:

- A design should be completed for the repair of the ditch erosion and reinforcing the toe of the tall natural slope. The repair design could consist of:
  - **Ditch erosion** – (i) where the geocell reinforcement is intact and well vegetated, no repair is required. (ii) The portions of the ditch where there is little to no vegetation, the geocells should be backfilled with granular material or fine-grained material that will promote rapid revegetation. The side slopes should not be disturbed to maintain vegetation cover, since the soil at the site is highly erodible. (iii) Where the geocell reinforcement has been undermined and bypassed by gullying, existing geocell and geotextile should be removed, gullies should be backfilled, and new non-woven geotextile and geocell armouring should be installed and maintain a defined channel shape (i.e., armouring along the ditch base and side slopes, with sufficient freeboard for the design flow). Disturbed areas should be hydro mulched with a seed mix suitable for badlands soil. (iv) Where the failed material has been deposited into the ditch, the slide material should be removed with impacting the toe of the natural slope. New geocell armouring should be installed, as per bullet point (iii), or a culvert could be installed to convey flows along this section of the ditch, since geocell armouring would be damaged if additional material was deposited into the ditch.
  - **Erosion along toe of tall natural slope** – A gabion basket retaining wall (at least 3 m tall and 125 m long) should be built along the portion of the natural slope being impacted by the ditch erosion, to stabilize the slope and reduce erosion. The ditch bottom should be graded with well compacted fill to replace eroded material, armoured with gabion mattress or geocell (to be confirmed with hydrotechnical assessment of ditch flows) and establish positive drainage away from the slope.

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(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.

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(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.

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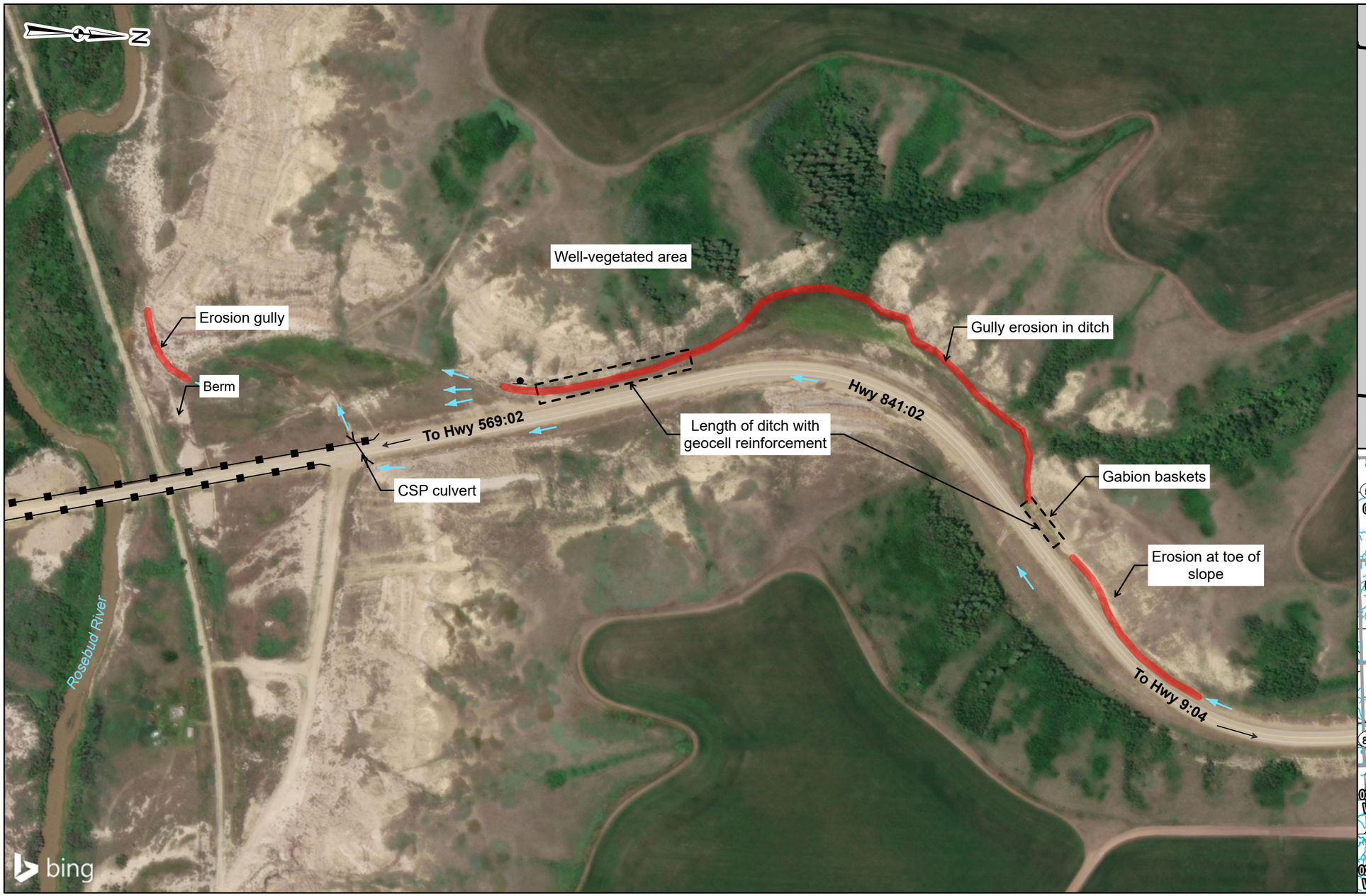
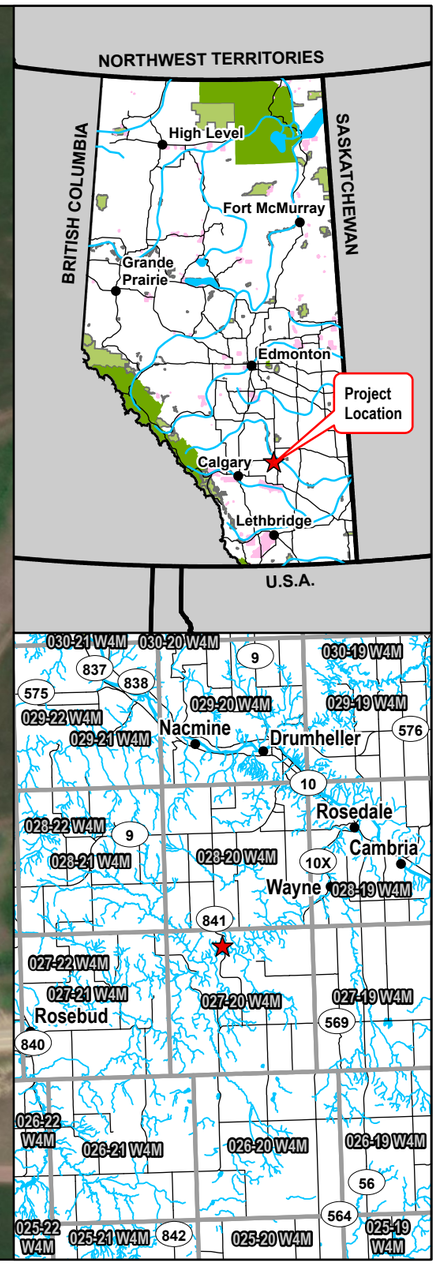
James Lyons, P.Eng.
Civil Engineer

PERMIT TO PRACTICE
KLOHN CRIPPEN BERGER LTD.
RM SIGNATURE: Pamela Jones
RM APEGA ID #: 187607
DATE: 26 Sep. 2024
PERMIT NUMBER: P009196
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)





Legend

- Powerpole
- Flow Direction
- Culvert
- Guardrail
- Erosion

0 150 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: 2024 MICROSOFT CORPORATION, MAXAR, CNES DISTRIBUTION AIRBUS DS.

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C012 - Hwy 841 Ditch Erosion
Hwy 841:02, km 6.71

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

File: Z:\AIED\MA\05116A02 ABT Central Region GRMP-400 Drawings\GIS\02_ProFiles\2024\Section B\AT_CentralRegion_SectionB_240627\AT_CentralRegion_SectionB_240627.aprx Date: Time: Creator: : EQuine

Photo 1 **The slide in the west (southbound) highway embankment slope appears to have expanded since the 2023 inspection. Photo taken June 18, 2024, facing north-northeast.**

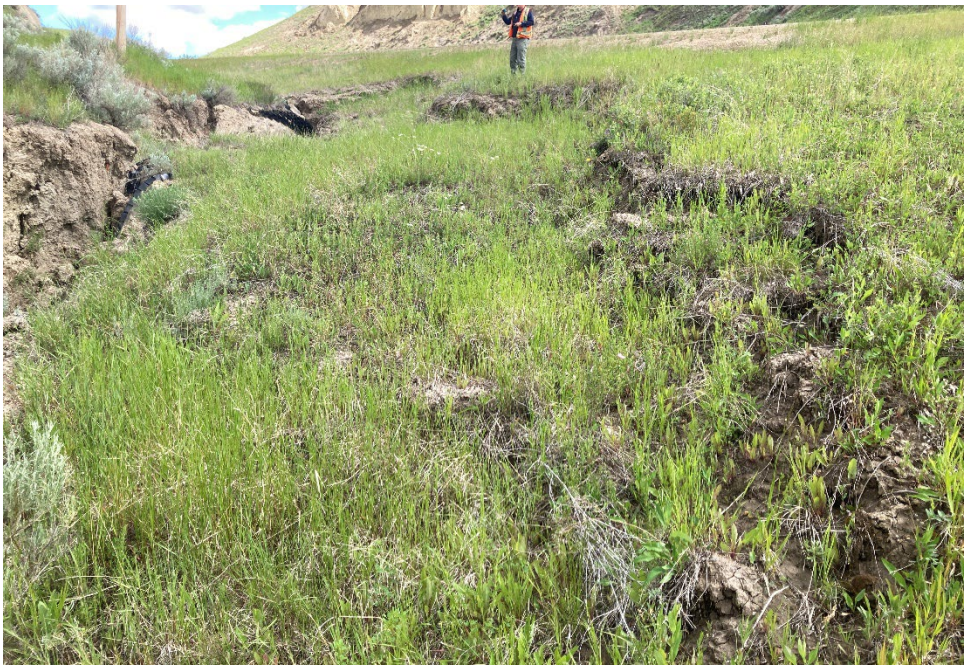


Photo 2 **The geocell armouring at the south extent of the site has failed and is being undermined. The degree of erosion appears similar as during the 2023 inspection. Photo taken June 18,2024, facing north.**

Photo 3 **Flows have bypassed the geocell armouring near the south extent of the site and is eroding the highway embankment. Photo taken June 18, 2024, facing south.**

Photo 4 **The gabion basket drop structure near the south extent of the site appears to be in good condition. A sinkhole (approximately 0.5 m in diameter and 0.5 m deep, location indicated by red arrow) was observed near the east (left) edge of the drop structure. Photo taken June 18, 2024, facing north.**

Photo 5 **A slide has been observed on the north natural slope upslope (west) of the gabion basket drop structure. Failed material has slumped into the ditch and is constricting flow. Photo taken June 18, 2024, facing west.**

Photo 6 **Erosion in the east (northbound) lane ditch near the midpoint of the site appears to have expanded between the 2023 and 2024 inspections and is less than 1 m from the edge of pavement. Photo taken June 18,2024, facing south.**

Photo 7 **The erosion gully downstream of the gabion basket drop structure has not changed significantly between the 2023 and 2024 inspections. Photo taken June 18, 2024, facing southwest.**

Photo 8 **The geocell armouring in the west (southbound) ditch is undermined and a vertical erosion face is approximately 5 m downstream of the gabion basket drop structure. Photo taken June 18, 2024, facing northeast.**

Photo 9 **The toe of the tall natural slope west of the highway is eroding and the erosion face is up to approximately 3 m tall. Photo taken June 18, 2024, facing northeast.**

Photo 10 **Erosion in the west (southbound) ditch is eroding the highway embankment slope and has reached the edge of the pavement. Photo taken June 18, 2024, facing northeast.**

Photo 11 **Erosion in the west (southbound) ditch is eroding the highway embankment slope and has reached the edge of the pavement. Photo taken June 18, 2024, facing southwest.**

Photo 12 **Ditch erosion at the north extent of the site along the toe of the natural slope. Photo taken June 18, 2024, facing southwest.**