ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (GRANDE PRAIRIE DISTRICT- NORTH)
2021 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
PH024	11 km W. Cleardale	Clear River East Hill-(Old Site 8)	64:02	24.2-25.5
Legal Description		**UTM Co-ordinates (NAD 83)**		
NE27/SE34-84-11-W6		11 N 6244830 E 336445		

	Date	PF	CF	Total
Previous Inspection:	June 16, 2020	12	4	48 (Risk Eros. Scale)
Current Inspection:	July 14, 2021	9	4	36 (Risk Eros. Scale)
Road AADT:	260		**Year:**	2020
Inspected By:	Don Proudfoot, Barry Meays (Thurber). Ed Szmata, Roger Skirrow, Rocky Wang, Ken Szmata, Max Shannon (AT)			
Report Attachments:	☑ Photographs ☑ Plans ☑ Maintenance Items			

Primary Site Issue:	Erosion of the highway south ditch and embankment shoulder (took place in 2013, 2018, 2019, and again in 2020 due to water backup/release overtop of the 1200 mm CSP culvert inlet which had iced up and was unable to handle all of the flow northwards beneath the highway from the spring melt. Also, gabion drop structure erosion along the north ditch channel.		
Dimensions:	South embankment/ditch/channel erosion ~900m long x <7m wide x <2m deep; North gabion erosion ~50m long x 20m wide x 5m deep.		
Date of any remediation:	1979 - North ditch gabion liner at select locations, channel shaping. 2008 - Slide excavation/subdrains/recompaction, erosion repair, drainage re-routing, 1200 CSP repair/extension, embankment fill and backslope flattening. 2020 – MC performed culvert maintenance, excavated out south hwy embankment & loose ditch erosion material, and lined the south ditch/embankment with 6-80 gravel along an upper ~7percent reach, Class 2 riprap along the middle ~9 percent reach, and left the lower reach unlined west of the 760 mm SWSP cross culvert.		
Maintenance:	August 2008 - Asphalt overlay. 2013, 2018 - Pitrun placed to infill major erosion locations along the south highway embankment immediately after the spring flow events. 2016 - WB lane ACP patch adjacent to SI. 2017 (Fall) - Chip seal. 2019 – Excavated south ditch erosion and backfilled with pitrun covered by TRM.	**Worsened?**	
Observations:	**Description**	**Yes**	**No**
☑ Pavement Distress	A 3m long crack observed in the WB shoulder directly below the creeping north backslope area at the east end of the site. Some erosion and undermining of the south (eastbound) shoulder, with a few cracks and vertical drop off along the edge of paved shoulder (repaired most recently in 2020).	☐	☑
☑ Slope Movement	Along the toe (~10 m high) of the natural south valley slope near the 1200 CSP inlet area due to softening from saturation and rapid drawdown. Also, creep movement in the north backslope area at the east end of the site.	☑	☐

☑ Erosion	The ditch along the south highway embankment became severely eroded from the spring, 2020 and 2019 flows, incising through the pitrun gravel placed in 2018 and 2019, and was carried down-gradient and deposited near the west end of the site (ditch/embankment was repaired in 2020). This erosion extended southwards into the bush due to the over-flow water along the south ditch. There was retrogressive slumping around two of the north ditch gabion drop structures (50 m long) downstream of the 760 mm dia. culvert outlet that were completely destroyed from previous flood events. Below the outlet of the 760 mm dia. SWSP (where riprap was added in 2020), a gully has formed along the west edge of the riprap and joined the gully around the gabion drop structure. 1 m deep scour holes across the north ditch channel exist (1 about midway between the 760 mm dia. and 810 mm dia. culvert outlets, and another below the 760 mm outlet). Also, some rilling outside the guardrail along the north highway embankment edge over a length of ~100 m, due to excess sanding gravel build-up (east half was graded in 2020, west half remains).	☑	☐
☑ Seepage	From subdrains in south ditch and Lookout slide.	☐	☑
☐ Bridge/Culvert Distress	The 1200 mm dia. culvert outlet has a slight oval shape beneath the settled area. The 810 CSP cross-culvert that was ½ full of sediment was flushed/cleaned in 2020. The pitrun covered inlet and outlet areas of the 760 mm dia. SWSP cross-culvert were flushed/cleaned and the pitrun removed in 2020.	☐	☑
☐ Other		☐	☐

Instrumentation:

Inclinometer SI08-1, last read June 4, 2011 – No discernable movement since the fall of 2009.

Assessment (Refer to Figures PH024-1-1, -2, & -3)**:**

A surge of meltwater occurred during spring thaw in 2013 along the channel leading to the south embankment near the east end of this site, at the entrance of the 1200 mm dia. CSP culvert that drains northwards beneath the highway. It was likely joined by highway ditch runoff meltwater further east, which also drains down along the south embankment and outlets in front of the 1200 mm inlet via the 900 mm dia. SWSP. The volume of water was greater than the culvert could handle (it is also possible that ice was also restricting the culvert), causing the water to back up overtop the inlet/headwall. It backed up high enough (10 to 12 m of head) that the water flowed westwards along the toe of the south embankment, then along the south highway ditch, and finally southwest away from the highway through the bush (it was documented to have subsided by the next morning). In addition to eroding soil, it eroded the erosion control soil covers, and some of the buried subdrain that was installed in the south ditch in 2008. This scenario was forecast as part of the 2007 design measures, prior to the 2008 construction, where the culvert was estimated to only handle a 1 in 5-year design flood peak, which would result in a build-up of water for events greater than 1 in 5 years.

Similar occurrences took place during the spring flow events in 2018, again between April 1 to 3, 2019, and again in 2020. Ice build-up at the inlet of the CSP culvert was documented by the maintenance contractor LaPrairie as a cause of the 2019 event.

The pitrun gravel that was used to fill 2018's erosion event was eroded and washed downslope, filling the south ditch near the west end, and water also ran overtop the highway and down the north embankment at one location. LaPrairie used a backhoe to dig part of the ditch out and swept the excess pitrun off the road. Similar south ditch erosion occurred in spring, 2020 after the 2019 installation of pitrun with TRM cover. The 2020 repairs involved grading the south embankment with 6-80 gravel, and installing a south ditch liner consisting of: 6-80 gravel over a 130 m length where the gradient was ~7 percent; then Class 2 riprap along the bottom portion of the channel over a 110 m length extending up to the 760 mm SWSP culvert where the gradient was ~9 percent, as shown on Section D-D' on Drawings PH024-1-2 and -3; and left the ditch bottom unlined west of the 760 SWSP (where a modest ditch block was constructed), as shown on Section C-C'.

The 810 mm diameter culvert had been half full of sediment for several years. This culvert appears to have been originally installed to bring water from the south ditch across to the north side of the highway for discharge via the 1.04 m dia. SWSP centreline pipe down into the dissipation pool on the south side of the highway. It appeared that this pipe had not been allowing flow to the north side either due to lack of maintenance or after it was purposely blocked. This culvert was cleaned out in 2020, and the inlet was formed with a riprap covered inlet bowl and a downstream ditch block that grades downwards to the south which would appear to let flood water overflow to the west through the bush if this culvert backs up flow.

The backed-up water from the flood surges nearer the inlet of the 1200 mm dia. culvert saturated the native soil along the toe of the natural valley slope and combined with toe erosion from flowing water and a likely sudden drawdown scenario, caused toe slumping of the natural tree covered slope. This has gotten worse the last couple of years but is not currently affecting the functionality of the site, although some slide debris was observed beyond the toe of the slope in 2021.

On the north side of the highway, the 1200 mm dia. CSP flowing full was also likely combined with runoff from the area/slopes to the north, which caused damage to one of the steeper sloping gabion lined channel sections further west and created a scour hole in the channel further west of this. The channel was overgrown with trees which reduced the flow capacity causing water to flow around and erode the sides of the gabion structure. In the 2013 event, there was also an erosion scour around the outlet of the 760 mm dia. SWSP in the north ditch, resulting from runoff originating from the south ditch flowing beneath the highway, which may have also contributed to the large erosion feature around the gabions immediately west (downslope) of this outlet. Both the inlet and outlet of this pipe were covered with pitrun in 2019, but this culvert was flushed/cleaned in 2020. A runoff gully has since formed beyond this culvert outlet and joined the gully that exists around the channel gabion.

In 2015, an erosion gully was observed overtop of the ditch block at the inlet to the 900 mm dia. SWSP in the north ditch, which was likely formed by surface runoff overtopping the 900 mm dia. SWSP entrance during a high flow event and became larger in 2019. The inlet of this SWSP also appeared to be getting jacked up into the air by frost action the last few years, as the void beneath was getting larger. In 2020, the erosion was repaired with 6-80 gravel fill, and the void was repaired with the addition of riprap, and both appear OK in 2021.

The average south ditch gradient was estimated to be in the order of 9 percent beginning about 90 m west of an approximate perpendicular line to the hwy extending from the 1200 mm diameter CSP culvert outlet in the north ditch; was about 7 percent over a 130 m length east of this (where the ditch is currently lined with 6-80 gravel); and about 6 percent further east of this to the slope break point. The 9 percent gradient is likely too steep, and flood surge flows too large, for these prior ditch liner repair attempts consisting only of 6-80 (pitrun) gravel. This section of the ditch bottom currently being lined with Class 2 riprap should be an improvement, but the riprap may have to be extended further eastwards.

It was also indicated by AT that it is planned to bore another cross-culvert across the hwy (between the existing 1200 mm CSP culvert inlet and the present gravel lined south ditch), and then

line the remaining segment with riprap west of this up to the current Class 2 riprap liner, to help pass more spring flood surge flows from the south ditch over to the north side of the hwy.

Recommendations: **Cost**

Maintenance:
The highway side of the south ditch erosion was backfilled with pitrun gravel in 2013 (~400 m^3), in 2018, in 2019, and again in 2020 as emergency measures to re-establish the eroded/undermined highway embankment. Additional gravel should be placed as required against the edge of asphalt to buttress the pavement and maintain hazard-free traffic safety.

The 1200 mm dia. CSP inlet should be inspected and steamed each spring (if required) to remove ice build-up with a backhoe and establish unrestricted flow. We recommend that this late winter/early spring check and steaming be formally added to the maintenance contractor's annual maintenance work requirements. **$5,000 annually**

Some of the rilling erosion had been graded/smoothened. Repair the remaining rill erosion outside the north edge of the guardrail and along the edge of the eroded ACP north shoulder by first grading the existing surface, then adding/track-packing/shaping a few loads of gravel infill (Photo 14), and then covering with topsoil and TRM. **$5,000**

Clean out future slide toe debris accumulations from in front of the 1200 culvert inlet area if required.

Short Term:
The damaged gabion structures on the north side of the highway need to be reconstructed to their original condition. The downstream end of the damaged gabion drop structure furthest west (Section A-A' on Drawings PH24-1-1 and -3) should have the sideslopes trimmed back flatter, and then use some of this material to build up the bed, before armouring the bottom and sideslopes. Consideration could be given to lining the replacement structures with Class 2 riprap instead of gabion mattress.
Ballpark Cost $100,000

The main 1200 mm dia. CSP should be inspected with a camera inserted along the pipe to see if it is restricted or damaged in any way, or if the joints are compromised which could lead to water leaking out and creating erosion around the outside of the pipe. To prevent future icing of the culvert inlet, perhaps a permanent heat system consisting of heat wires inside small metal tubing attached to the inside of the culvert inlet over a 10 m length and powered by a solar cell mounted on a post with a battery backup could be employed. **$75,000**

The 150 mm dia. and 150 m long CSP subdrain near the east end of the south ditch (installed as part of the 2008 repairs to intercept seepage and keep water levels lower above the former Lookout Slide) should be replaced and outlet it onto the ditch surface further west. **$50,000**

As a minimum, the ~330 m long segment of the currently unlined south ditch bottom extending west of the riprap lined segment up to the 810 CSP culvert, should be topsoiled, seeded, and covered with TRM. **$10,000**

The erosion gully between the outlet of the recently opened 760 mm diameter SWSP and north channel should be repaired by grading a trapezoidal channel and lining it with Class 1 riprap over non-woven geotextile. **Ballpark Cost $20,000**

Medium Term:
The erosion along the toe of the south highway embankment and ditch is currently the biggest threat to the highway and although some repairs were performed in 2020, supplementary repairs are needed. This eroded section next to the highway is about 550 m long in total. A Class 2 riprap south ditch bottom segment ~110 m long was installed in 2020, and it should extend over the entire ditch that has a ~9 percent gradient (to the 810 CSP inlet at the west end) and may also need to be extended further east over the present 130 m long gravelled ditch segment (also installed in 2020). If the current riprap lined and gravel lined ditch bottoms, and unlined ditch bottom further west, become eroded during the next flood surge, it could be repaired using the following methodology:

1) Remove all loose fill by excavation down to the base of the erosion gully but a minimum of 1 m depth, separating the clay and gravel while rolling it back along the sideslopes (cutting into the backslope should be discouraged).

2) Re-build the bottom of the ditch by compacting the excavated clay back into the erosion channel in thin lifts using a sheepsfoot compactor, supplementing with imported clay from a borrow source where required, and use well compacted gravel to rebuild the sideslopes.

3) Grade the surface, forming a neatly contoured, flat-bottomed (min. 2 m wide) ditch before covering the surface with "Type C" non-woven geotextile.

4) Line the bottom and sides of the ditch with 0.3 m thick gabion mattress. Gabion basket ditch check weirs underlain with non-woven geotextile should also be incorporated into the liner stepped at maximum 10 m intervals along the ditch.

Ballpark Cost $550,000

a) The 150 m length of the south ditch away from the highway in the bush near the west end, should also be repaired. Even if the now cleaned and flushed 810 mm and 760 mm diameter centreline culverts (and a proposed new centerline bore, discussed below) take some flow to the north there may still be some flow extending down the south bank through this eroded area. A more durable fix for this section would be to infill the eroded areas with clay compacted in thin lifts using a sheepsfoot compactor, grading the surface and then covering it with gabion mattress all the way down to the stilling pool.

Ballpark Cost $150,000

OR ALTERNATIVELY,

b) A cheaper stop gap approach for the 150 m length away from the highway would be to fill the eroded areas with class 1 riprap placed over non-woven geotextile in the upper slope area and construct a riprap lined drop structure on the lower 20^0 slope above the 1040 mm SWSP outlet (1.9 m headscarp area) to dissipate flows upslope of the stilling basin.

Ballpark Cost $80,000

Long Term

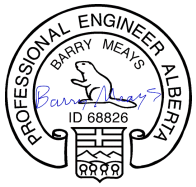
As mentioned in the assessment section of this report, it is planned to bore another cross-culvert across the hwy (somewhere between the existing 1200 mm CSP culvert inlet and the present gravel lined south ditch), and then line the remaining segment with riprap west of this up to the current Class 2 riprap liner, to help pass more spring flood surge flows from the south ditch over to the north side of the hwy (assumed 200 m long x <10 m deep).

Ballpark Cost $700,000

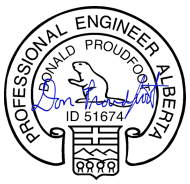
CLOSURE

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



October 6, 2021



October 7, 2021

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: October 7, 2021
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Barry Meays, P.Eng.
Senior Geotechnical Engineer

THURBER

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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.

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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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H:\32000\32123 AT GRMP Grande Prairie District North 2021-2025\CAD\BDM\32123 PH024-1-1~3.dwg - 1 - Oct. 04, 2021

FAILED GABION
- VERY THICK WILLOW AND POPLAR GROWTH
-TREES TILTED AND BASKETS DISTURBED
-BOTTOM QUARTER HAS SPLIT OPEN, ERODING DOWN CENTER AND OUTSIDE OF MATS (WORSE IN 2021)

SMALL SLUMP
- REPAIR WITH RIPRAP

1200 CSP OUTLET
INV. 540.564

SUBDRAIN OUTLET OF LOOKOUT SLIDE

760mm Ø SWSP CULVERT OUTLET, RIPRAP ADDED BELOW OUTLET
NOW FLOW HAS ERODED A GULLY THAT CONNECTS TO THE EROSION GULLY AROUND THE FAILED DROP STRUCTURE

FRESH SLUMPING

760mm CULVERT CLEANED OUT BY MAINTENANCE CONTRACTOR AND DITCH BLOCK ADDED ALONG WEST SIDE IN 2020

50m LONG x 5m DEEP x 20m WIDE EROSION WASHED OUT GABION DROP STRUCTURES
COMPLETELY DESTROYED BY SPRING, 2018 RUNOFF
LARGE 1m DEEP EROSION SCOUR HOLE & WATER FALL GOT WORSE- NEEDS EROSION PROTECTION

EQUIPMENT RUTS

SCOUR HOLE & CLUMPS OF WILLOWS OBSTRUCTING THE GABIONS

SOME TEARING OF GABION BASKETS & SHOVING OF ROCKS

GRASS WASHED ON WILLOWS, EVIDENCE OF A LARGE RUNOFF

RIPRAP

SOUTH DITCH CHANNEL (~9%)
LINED WITH CLASS 2 RIPRAP
SAME

SOUTH DITCH CH
LINED WITH 6-
SAME

UNLINED DITCH
WEST OF 760m

810mm Ø CSP OUTLET,

CHANNEL GRASSED OVER

1.04m Ø SWSP INLET

SOME EROSION

HIGHWAY 64:02

DITCH BLOCK

810mm CULVERT CLEANED OUT BY (SAME)
MAINTENANCE CONTRACTOR

SLUMP EROSION 1.2m DEEP x
<10m WIDE x12m LONG
(SCARP 6.7m FROM GUARDRAIL)

EDGE OF ACP ERODED,
0.3m DROP OFF

DITCH BLOCK ON WESTSIDE RIPRAPPED, &
GRADED TO ALLOW OVER FLOW ON SOUTH END

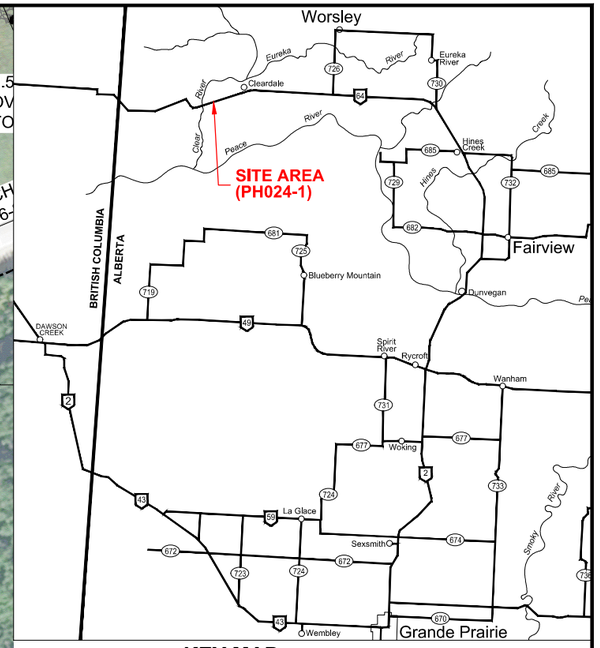
CULVERT GROUT PIPE

SCOUR BOWLS

1.04m Ø SWSP OUTLET,
WITH EROSION ON CROWN

FRESH SLUMP

RIP RAP SETTLING POND



KEY MAP - SCALE 1:1,500,000

LEGEND :

- PHOTO & DIRECTION
- SLOPE INCLINOMETERS

NOTES :

1. JULY 14, 2021 OBSERVATIONS SHOWN IN RED

0 25 50 75 100 125 150m
SCALE 1:2500

SATELLITE IMAGE FROM ESRI WORLD IMAGERY (DOWNLOADED 2019-06-17)

Alberta

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH024: HWY 64:02 CLEAR RIVER EAST HILL SLIDE

PH024 INSPECTION

FIGURE PH024-1

DRAWN BY	ML
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:2500
DATE	JULY 14, 2021
FILE No.	32123

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H:\32000\32123 AT GRMP Grande Prairie District North 2021-2025\CAD\BDM\32123 PH024-1-1-3.dwg - 2 - Oct. 04, 2021

30mm TO 60mm DEEP RUTTING IN EASTBOUND LANE

~3.9:1

~4:1

~4.2:1

~4.6:1

~4.6:1

0.23m GABION DITCH LINERS

~4.5:1

2.2m HIGH SCARP

~4.8:1

~4.4:1

SCARP CRACK - 0.8 TO 0.4m HIGH SCARP (SAME)

CRACK AND SUBSIDENCE EXTENDS 15m BACK FROM THE TOP CROWN EDGE OF CULVERT, AND IS 6m WIDE (ie. 2.5m SOUTH OF THE SINKHOLE, 3.5m NORTH OF THE SINKHOLE AND 5m EAST OF THE SINKHOLE). (SAME IN 2021 - LOOKS OK)

CULVERT PIPE BELOW SINK HOLE SLIGHTLY OVAL SHAPED WITH SOME SILT & GRAVEL IN BOTTOM ~0.1m

FILTER SOXX

1m DEEP SINKHOLE AT SUBDRAIN OUTLET

PERMANENT RECP (TRM)

TREE LINE

HIGHWAY 64:02

13

900mm SWSP INV. 590.667

~4.6:1

12

3m LONG CRACK IN (SAME) WESTBOUND SHOULDER

OUTLET AREA LINED WITH 0.5m GABIONS SURROUNDED BY RIPRAP

GABION MATRESS WIRE TORN OVER 3m LONG

AS-BUILT TIE IN 1200mm CSP INVERT 541.75m

AS-BUILT TIE IN 1200mm CSP INVERT 642.495m

~6.7:1

EROSION RILLING STILL EXISTING 0.5m WIDE x 0.3m DEEP

14

RILLS

~5.4:1

900 SWSP OUTLET INV. 556.088

RIPRAP

CHANNEL LINED WITH 0.3m GABION MATTRESS

22

CRACKS IN PAVEMENT (10m LONG NORTH & 20m LONG SOUTH)

~6.7:1

~6.7:1

GOOD GRASS GROWTH

EAST END OF GUARDRAIL

~5.5:1

SLIGHT EROSION ALONGSIDE EAST EDGE OF CULVERT HEADWALL (SAME)

900mm DROP PIPE GABION OUTLET STRUCTURE

CLASS 2 RIPRAP APRON

SMALL SLUMP - REPAIR WITH RIPRAP

21

1200 CSP OUTLET INV. 540.564

1m DIA. SINK HOLE SI08-1 (~0.3m DEEP)

~6.8:1

2.5m DIA. EROSION HOLE OVERTOP SUBDRAIN (6m FROM TOP OF CULVERT BARREL)

~DITCH GRADE BREAK POINT

9

~5.6:1

1200 CSP INLET INV. 554.107 AT HEADWALL

AS-BUILT TIE IN 1200mm CSP INVERT 552.1m

10

SLIGHT EROSION ALONGSIDE WEST EDGE OF LOWER GABION BASKET (SAME)

20

SUBDRAIN OUTLET OF LOOKOUT SLIDE

~7.3:1

ACP PATCH IN WESTBOUND LANE (2017)

~5.5:1

6%

FRESH EROSION <1.3m DEEP x ~3.0m WIDE AGAINST BUSH LINE

11

SOME SHEET ICE ALONG CHANNEL BOTTOM UP SLOPE OF INLET

60mm CULVERT CLEANED OUT BY MAINTENANCE CONTRACTOR AND DITCH BLOCK ADDED ALONG WEST SIDE IN 2020

SOUTH DITCH CHANNEL(~7%) LINED WITH 6-80 GRAVEL SAME

8

MORE EROSION FORMED A SCOUR BOWL < 1.8m DEEP x 4m WIDE AGAINST BUSHLINE

PERMANENT RECP (TRM)

SOUTH DITCH CHANNEL (~9%) LINED WITH CLASS 2 RIPRAP SAME

7

3m LONG CRACK ON CENTERLINE SAME AS DURING 2009 CALLOUT

150mm Ø CSP SUBDRAIN EROSION WASHED OUT 2008 SUBDRAIN PIPE

SLIDE IN TREE COVERED RIVER BANK EXTENDS ~30m UP BACKSLOPE FACE -TREES BENDING & SLIDING DOWNSLOPE WITH SOIL GOT MUCH LARGER - RAPID DRAWDOWN FAILURE FROM SPRING 2019 AND 2020 RUNOFF FLOOD EVENTS

5

LEGEND :

- ← 1 PHOTO & DIRECTION
- SLOPE INCLINOMETERS
- SLIDE SCARP

NOTES :

1. JULY 14, 2021 OBSERVATIONS SHOWN IN RED

0 25 50 75 100 125 150m

SCALE 1:2500

SATELLITE IMAGE FROM ESRI WORLD IMAGERY (DOWNLOADED 2019-06-17)

Alberta

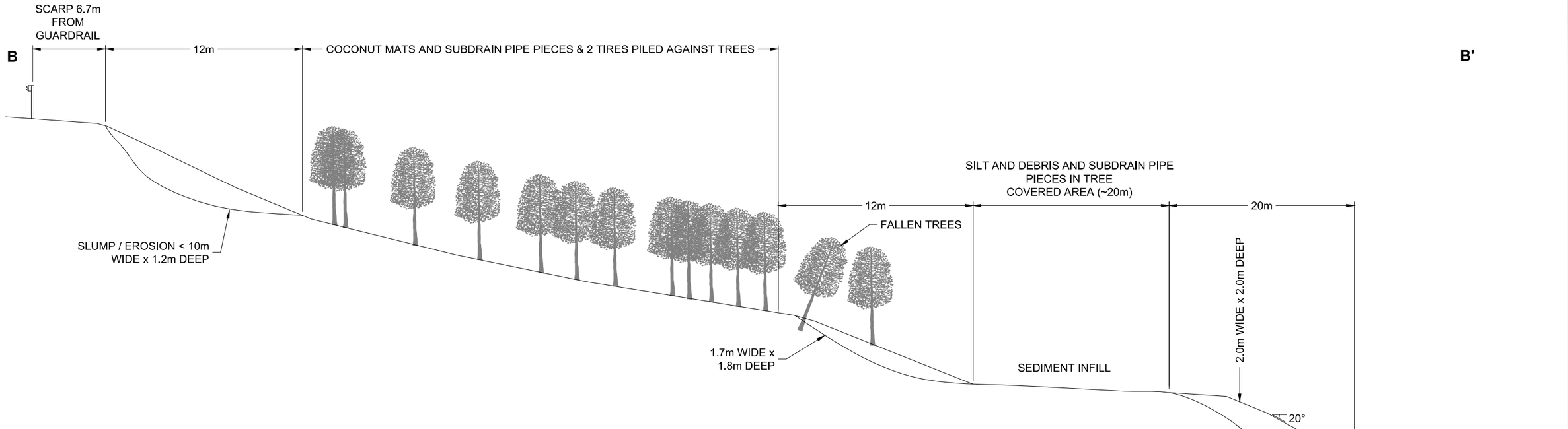
PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH024: HWY 64:02 CLEAR RIVER EAST HILL SLIDE

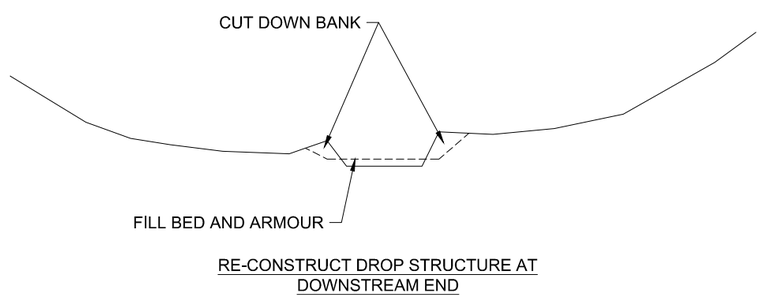
PH024 INSPECTION

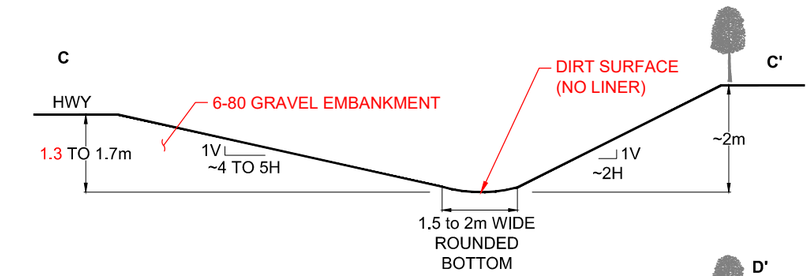
FIGURE PH024-2

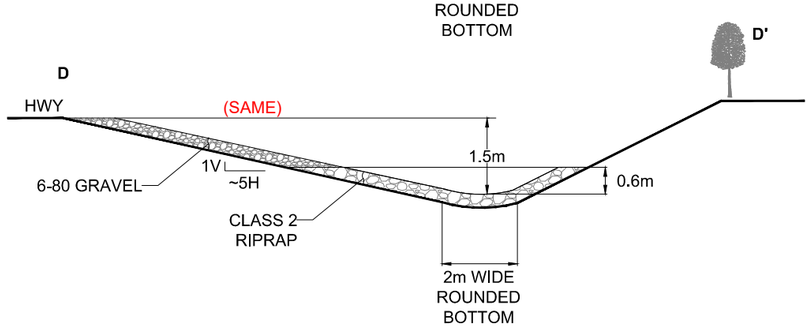
DRAWN BY	ML
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:2500
DATE	JULY 14, 2021
FILE No.	32123

THURBER ENGINEERING LTD.









NOTES :

1. JULY 14, 2021 OBSERVATIONS SHOWN IN RED

Alberta

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH024: HWY 64:02 CLEAR RIVER EAST HILL SLIDE

PH024 CROSS-SECTIONS A-A' & B-B'

FIGURE PH024-3

DRAWN BY	ML
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	N.T.S.
DATE	JULY 14, 2021
FILE No.	32123

THURBER ENGINEERING LTD.

Photo 1 – Looking north at the inlet of the 810 CSP on the south side of the hwy embankment.

Photo 2 – Looking west along the unlined south ditch from near the west end, at the 2020 grading that took place along the south highway embankment and ditch.

Photo 3 – Looking west along the south ditch and hwy embankment.

Photo 4 – Looking west along the unlined south highway ditch from the inlet of the 760 mm dia. SWSP.

Photo 5 – Looking north at the inlet of the clean 760 mm dia. SWSP.

Photo 6 – Looking east from the ditch block along the riprapped south ditch channel from the inlet of the 760 mm dia. SWSP.

Photo 7 - Looking west along the recently lined south ditch channel and highway embankment, at the point where the riprap (west) and gravel (east) merge.

Photo 8 – Looking east along the south ditch channel and hwy embankment that was lined with 6-80 gravel.

Photo 9 – Looking northwest at the erosion that formed in 2020 along the boundary of the south embankment fill and the bush line.

Photo 10 - Looking north at the 900 SWSP outlet and gabion outlet structure.

Photo 11 – Looking west at the 1200 mm CSP inlet headwall.

Photo 12 – Looking south at the valley slope slumping above the 1200 culvert inlet and gabion outlet area, caused by rapid drawdown of built-up floodwater.

Photo 13 – Looking west at the repaired erosion area around the north 900 mm SWSP entrance.

Photo 14 – Looking west at the rilling adjacent to the north guardrail (just west of the repaired rilling on the north embankment).

Photo 15 - Looking south at the 810 CSP outlet along the north ditch channel that was cleaned in 2020. Note the erosion scour bowl forming.

Photo 16 - Looking west (downstream) along the north ditch channel just upstream of the 810 CSP outlet and 1040 SWSP inlet. Note the gabions are still intact here.

Photo 17 – Looking west along the north ditch channel.

Photo 18 – Looking east (upstream) along the north ditch channel at the ongoing erosion and eroded gabion liner between the 760 SWSP and 810 CSP outlets.

Photo 19 - Looking south at the 760 mm SWSP outlet. Note the erosion gully along the west side of the riprap that was added downslope of the culvert in 2020.

Photo 20 - Looking west at the erosion in the north ditch channel at the completely eroded gabion liner east (upslope) of the 760 SWSP outlet.

Photo 21 - Looking east at the 1200 CSP outlet area in the north channel.

Photo 22 – Close-up view of culvert outlet, looking west.