



THURBER ENGINEERING LTD.



August 15, 2017

File: 13351

Alberta Transportation
3rd Floor, Provincial Building
9621 – 96 Avenue
Peace River, Alberta
T8S 1T4

Attention: Mr. Ed Szmata

**GEOHAZARD ASSESSMENT PROGRAM
CALL-OUT INSPECTION
HWY 64:2 GOLF COURSE SLIDES – 6.1 km WEST OF CLEARDALE**

Dear Sir:

Under the GeoHazard Assessment Program, Thurber was requested by Ed Szmata of AT on July 26, 2017, to conduct a call-out inspection at the above noted landslide sites. The inspection was completed by Mr. Tamer Elshimi, P.Eng. and Mr. Don Proudfoot, P.Eng. of Thurber in the presence of Mr. Ed Szmata and AT's Maintenance Contractor, Mr. Pete Vandeligt of LaPrairie Group.

1. SITE CONDITIONS

Two landslides are affecting Hwy 64:02 about 6.1 km west of Cleardale Alberta. The first landslide, S1, is located in the sideslope of the highway on the north side of the intersection with Range Road 110. The second landslide, S2, is located about 30 m further to the west in the south sideslope of the highway. Figure 1 attached shows the approximate locations and limits of the landslides. Figure 2 shows approximate cross-section views through each landslide. Photographs of the site are also attached.

Landslide S1 is located beside the outlet of a smooth wall steel pipe (SWSP) culvert that drains water in an intermittent draw from a farm field into a wooded gully located north of the highway. The embankment is about 4.5 m high at the landslide location. The slide is about 18 m wide, has a backscarp drop of about 1 m and a toe roll of about 0.6 m in height. The slope has an overall inclination of about 5H:1V. The backscarp of S1 is located a short distance downslope of the edge of asphalt.

Landslide S2 is about 15 m in width and is currently affecting about an 8 m length of the paved shoulder of the highway. There are also tension cracks located in the EB Lane about 1.2 m from the white line. The backscarp of the slide is about 2.3 m deep and the toe roll is about 1.1 m high. The slide mass has blocked the ditch and covered the inlet of a 0.76 m diameter SWSP. It appears that the culvert drains the south highway ditch as well as a swale draining from the golf course.

High plastic clay is exposed in the lower part of the landslide backscarp. The pavement structure at the slide area consists of 0.3m of ACP over 0.6m of GBC. The overall slope inclination at the landslide location is about 4H:1V.

2. ASSESSMENT

The inferred slip surfaces of the landslides are shown on the attached cross-sections. These cross-sections are approximate, based on pacing and estimated heights.

The landslides appear to be based in high plastic clay. It is postulated that the failures are due to a gradual loss of cohesion due to weathering combined with high groundwater conditions, which has dropped the resisting forces below what is needed to maintain stability.

The assessed risk level for this site, based on AT's guidelines is 30, based on a Probability Factor of 10 (Active with moderate rate of movement) and a Consequence Factor of 3 (Moderate fills at/near culverts affecting use and safety of motorists, but not currently requiring closure of the roadway).

The landslides will continue to grow in size if not dealt with. In particular S2 has a tension crack located within the EBL which suggests that it could retrogress further into the lane in the near future. If this occurred the consequence factor would increase to a 4. Since the landslide is blocking the culvert inlet there is a potential for water to pond at the landslide mass and accelerate movements.

3. RECOMMENDATIONS

It is recommended that the repairs to the landslides, particularly S2, be carried out as soon as possible.

The following two options are recommended for mitigating S2:

Option a) – Excavate the slide and rebuild the slope with clay and a toe berm

Option b) – Over-excavate the slide and rebuild the slope with granular fill

For Option a):

- The slide mass would be excavated and stockpiled on stable ground near the site.
- An extension would be welded onto the inlet of the SWSP at an angle to daylight in the ditch to the west of the repair area and in line with the swale that drains from the golf course.
- A toe berm would be constructed over the culvert extension to span between the highway sideslope and the backslope
- The upper part of the sideslope would be reconstructed with additional clay fill

- The final surface of the embankment sideslope and toe berm would be topsoiled and seeded and riprap would be placed around the culvert inlet.

The ballpark cost for Option a) would be \$175,000.

For Option b):

- The slide mass and additional clay extending back to the highway centreline would be excavated out to a level below the highway ditch.
- A gravel filled shear key would be constructed below the highway ditch.
- The embankment would be reconstructed with granular fill (Des. 6 Cl. 80) and the outer surface of the embankment would be capped with clay and seeded topsoil.
- Riprap would be placed around the culvert inlet.

A ball park cost for Option b) is \$250,000.

Similar options could be considered for S1 however extra right of way would be needed for Option a). The prices are expected to be of a similar magnitude as for S2. Hence, the total cost to fix both landslides at the same time could vary from about \$350,000 to \$500,000.

Other considerations include the presence of Telus cables that would need to be surveyed and possibly relocated. Overhead power lines are also present near both sites and the contractor would need to confirm adequate clearance from these lines for his equipment.

4. CLOSURE

We trust this is the information you require at this time. If you have any questions, or if you require further information or recommendations, please contact us at your convenience.

Yours very truly,
Thurber Engineering Ltd.
Don Proudfoot, M.Eng., P. Eng.
Review Principal

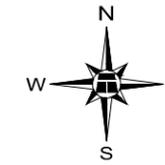
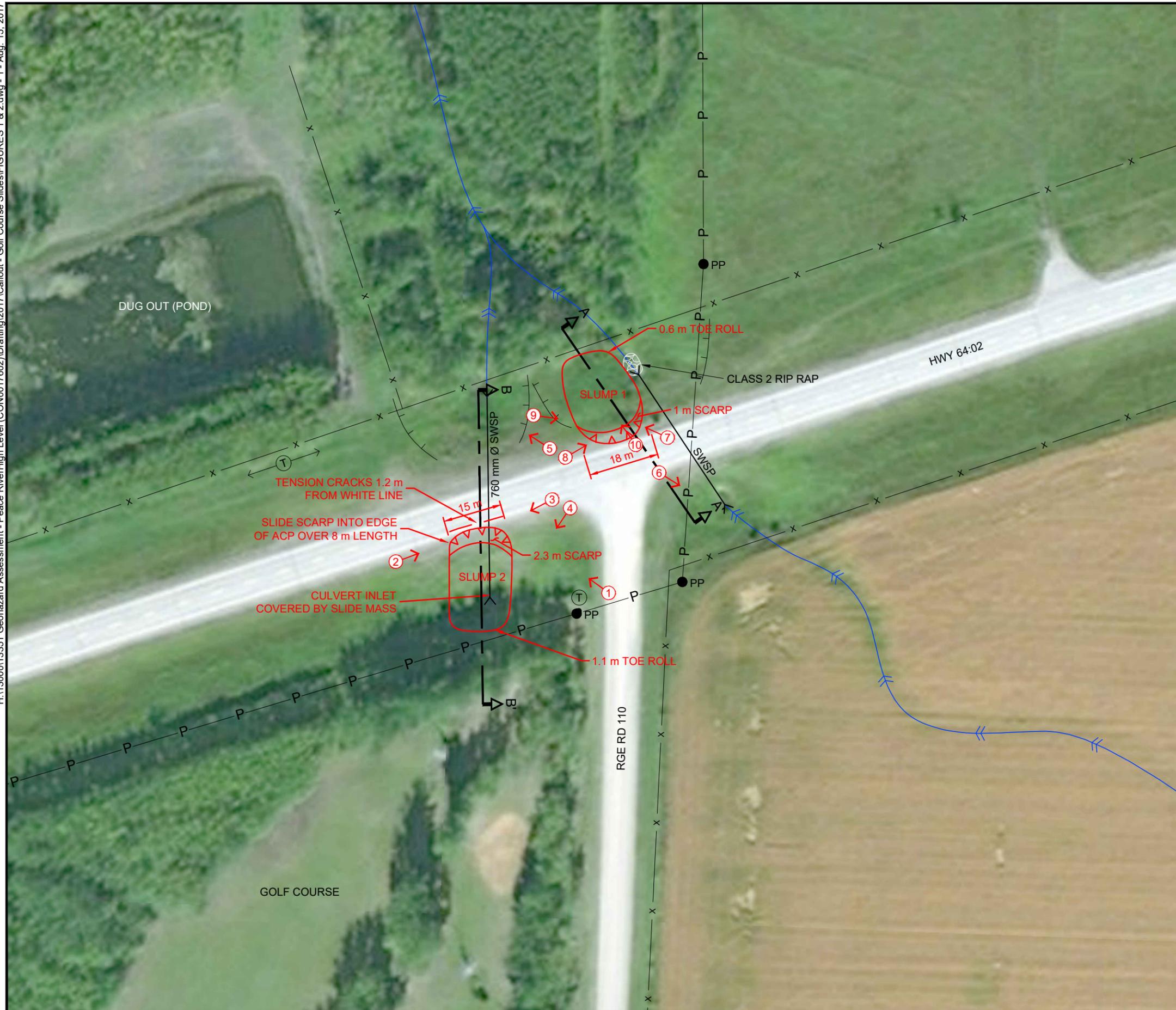


Tamer Elshimi, Ph.D., P. Eng.
Project Engineer
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Attachments:

- Photos
- Figures

H:\13000\13351 Geohazard Assessment - Peace River\High Level (CON0017602)\Drafting\2017\Callout - Golf Course Slides\FIGURES 1 & 2.dwg - 1 - Aug. 15, 2017



LEGEND

- SLIDE SCARP
- EDGE OF DEPRESSION
- SMOOTH WALL STEEL PIPE (SWSP) CULVERT
- FENCE
- OVERHEAD POWER LINE
- POWER POLE
- DRAINAGE SWALE
- TELUS LINE
- DIRECTION AND NUMBER OF PHOTO

NOTES :

1. SITE FEATURES ARE APPROXIMATE
2. JULY 26, 2017 OBSERVATIONS SHOWN IN RED

SATELLITE IMAGE FROM ESRI WORLD IMAGERY DOWNLOADED 2017-08-15



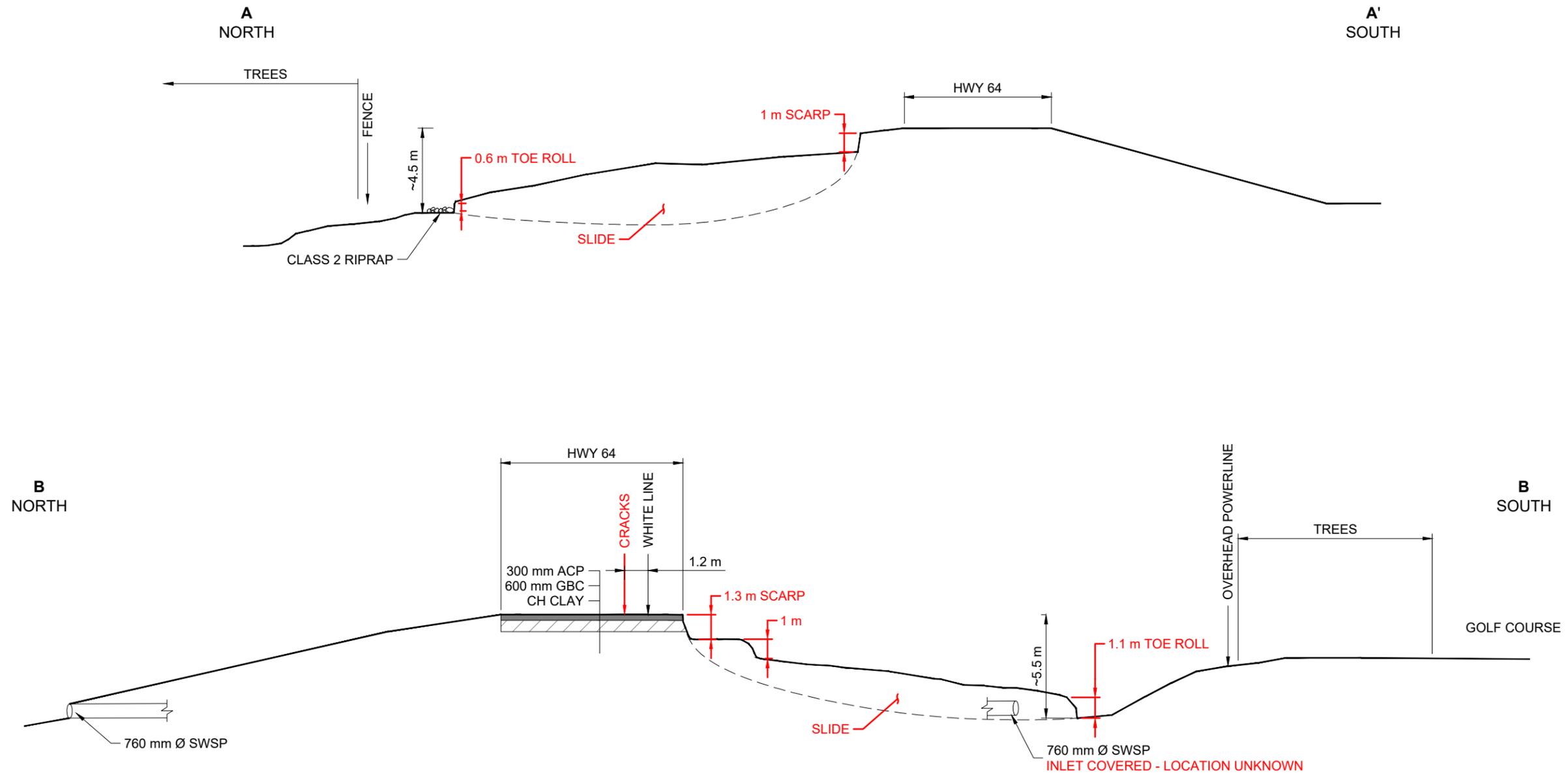
**HWY 64:02 GOLF COURSE SLIDES
6.1 km WEST OF CLEARDALE**

JULY 26, 2017 CALLOUT INSPECTION PLAN

FIGURE 1

DRAWN BY	KLW
DESIGNED BY	TME
APPROVED BY	DWP
SCALE	1:1000
DATE	AUGUST 2017
FILE No.	13351





NOTES :

1. SITE FEATURES ARE APPROXIMATE
2. JULY 26, 2017 OBSERVATIONS SHOWN IN RED

 Alberta Transportation	
HWY 64:02 GOLF COURSE SLIDES 6.1 km WEST OF CLEARDALE	
JULY 26, 2017 CALLOUT CROSS-SECTIONS A-A' & B-B'	
FIGURE 2	
DRAWN BY: K LW DESIGNED BY: T ME APPROVED BY: D WP SCALE: 1:250 DATE: AUGUST 2017 FILE No.: 13351	 THURBER ENGINEERING LTD.



Photo 1: Slide 2 (S2) looking NW.



AT Photo 2: S2 looking east at backscarp



Photo 3: S2 looking west



Photo 4: S2 looking SW at gully that leads to culvert from golf course



Photo 5: Looking NW at gully that S2 culvert drains into. A dugout pond is present NW of the gully



Photo 6: Looking SE at drainage swale that drains into culvert near S1.



Photo 7: Looking east at Slide 1 (S1)



Photo 8: Looking west at S1.



Photo 9: Looking SE at S1



Photo 10: Looking north down S1 to gully into which the culvert drains