GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA
2017 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
NC017A	North of Fort McMurray	**Hwy 63 Backslope Failures**	63:12	2.2 to 2.9
Legal Description		**UTM Co-ordinates (NAD 83)**		
NW7 and SW18-90-09-W4M		12 N 6295275 E 473365		

	Date	PF	CF	Total
Previous Inspection	August 25, 2016	13	3	39(NC017A-2)
Current Inspection:	May 18, 2017	13	3	39
Road AADT:	16,100		**Year:**	2015
Inspected By:	Tarek Abdelaziz and José Pineda (Thurber) Roger Skirrow, Arthur Kavulok, Margaret Boeske, Sola Akapo (TRANS)			
Report Attachments:	☑ Photographs ☑ Plans ☐ Maintenance Items			

Primary Site Issue:	Active landslides are present in the back slope west of the SBL at Borrow Pits A (NC017A-2, km 2.7) and B (NC017A-1, km 2.4). The toe of a lower back slope lump at Borrow Pit A location is pushing into the highway ditch and side slopes.
Dimensions:	At Borrow Pit A, the highway lower back slope slide is about 100 m in width and extends into the offloaded area behind the crest of the back slope and toes into the highway ditch. There have been also two slumps in the backslope of the upper offloaded area that are now merging. The combined width of the north and south slumps is about 100 m. The head scarps cracks have been retrogressing and currently extend about 300 m back from the highway. At Borrow Pit B the slump in the highway back slope is about 100 m wide, and extends to the top of the highway backslope.
Date of any remediation:	N/A
Maintenance / History:	**Km 2.4:** Pavement patching to smooth out the highway combined with some minor re-grading to remove humps in the highway west ditch (2007); in fall 2009, ditch was cleaned up, dirt pushed back into the west side of the ditch, and ACP overlay was placed on the highway surface; in fall 2011, ditch was cleaned up, dirt pushed back into the west side of the ditch, lower slump mass re-graded; Wavy highway surface was milled by 40 to 150 mm in 2013. In 2015, the highway south bound lanes were shifted to the east of the original location during the construction of the Parsons Creek Interchange. The new lanes were located to the east of the toe of the landslide, which heaved up the former southbound lanes. In addition, it is understood that a small toe berm (approximately 2 m in height above the ditch grade) was placed at the original highway location to buttress the lower back slope area in an attempt to stabilize the landslide. **Km 2.7:** Minor re-grading of lower backslope landslide mass to seal up cracks and smooth out dips, slight contouring of the toe by pushing dirt back towards the west side to enhance drainage in the ditch (2011). In 2015, a 600 mm CSP culvert was constructed by others in the former highway ditch below the toe of the lower back slope landslide to allow the drainage of the ditch water which had been blocked by the landslide activity at this location. Sediment noted in the 2016 inspection at this culvert was cleaned in the summer/fall of 2016. Existing culvert between the two landslide areas appeared to have been abandoned during the construction of the highway new lanes.

Observations:	Description	Worse?
☐ Pavement Distress		☐
☑ Slope Movement	**Km 2.7**: The toe roll of the lower backslope landslide is blocking the highway ditch and is pushing against the new highway southbound lanes shoulder; slight retrogression of the lower landslide head scarp crack; head scarp cracks of the upper backslope slumps are now connected **Km 2.4**: Not addressed in 2017	☐
☑ Erosion	**Km 2.7:** Minor erosion at the outlet of the of the existing 600 mm diameter CSP culvert in the ditch	☐
☑ Seepage	**Km 2.7:** Water ponding within the sag ponds in the lower backslope landslide mass near PB09-2; fast seepage near the northern flank of the upper backslope north slump; seepage within the toe rolls of the upper backslope slumps	☐
☑ Bridge/Culvert Distress	**Km 2.7:** Water slowly flowing from the culvert outlet; ponding water inside the culvert	☐
☑ Other	New highway side slopes and ditches are still bare of vegetation; ponding water in the highway ditch and between the highway and the toe of the lower backslope landslide	☐

Instrumentation: (1SI)

Km 2.4: Instruments are either sheared off or damaged and unrepairable.

Km 2.7: SI99-2 displayed a rate of movement over 20.6 to 22.4 m depth to a current rate of 2.2 mm/yr since the fall 2016 reading. The instruments installed within the lower back slope slump were sheared off quickly in the past.

All other slope inclinometers have sheared off due to the landslide movements.

Assessment (Refer to attached Figure)**:**

The existing lower landslide and upper backslope slumps occurred due to the progressive failure of the steep back slope cuts in the weak colluvium deposits.

Erosion issues may develop in the highway side slopes and ditches due to the absence of vegetation.

The ditch does not appear to have enough gradient to the north and the south of the culvert location to handle surface runoff.

Km 2.4: The highway was shifted away from the toe of the landslide and hence it is not currently impacted by the landslide movement.

Km 2.7: The upper back slope slumps and lower landslide are still active and will continue to move over time. It is likely that the lower landslide debris will keep pushing against the culvert and the highway shoulder. Although the landslide is not currently affecting the highway condition, the landslide debris are within the highway clear zone, which constitutes a safety hazard to motorists. In addition, the landslide debris may encroach into the highway surface in response to future accelerated movements.

The ditch culvert is not currently damaged but appears to be sagging as it is not draining properly and the water continues ponding inside and beyond the outlet of the culvert. Impedance of surface drainage in the ditch could result in accelerated landslide movement and instability of the highway embankment side slopes. In addition, the culvert may get damaged/distorted in response to future accelerated movements.

Recommendations:

The highway side slopes and ditches should be topsoiled and seeded, as needed, to promote vegetation and reduce erosion potential.

Km 2.7: In the short-term, the lower landslide should be visually monitored by the local MCI, particularly after heavy rainfall events, to check if the landslide debris encroaches into the highway lanes in response to an accelerated movement. The ditch to the north and the south of the culvert will need to be slightly contoured to enhance surface drainage and additional riprap protection should be provided at the outlet of the culvert. The area located between the highway and the toe of the lower backslope landslide should also be touched, without significantly changing grades, to drain ponded water into the existing ditch.

In addition, the local MCI should periodically inspect the culvert to ensure it is not damaged or separated. Consideration should be given for replacing or lining the existing culvert with a more robust pipe (e.g. a smooth wall steel pipe) to sustain ongoing landslide movements.

The long-term remedial measure may include the installation of a gravity wall in the highway ditch to retain the toe of the landslide.

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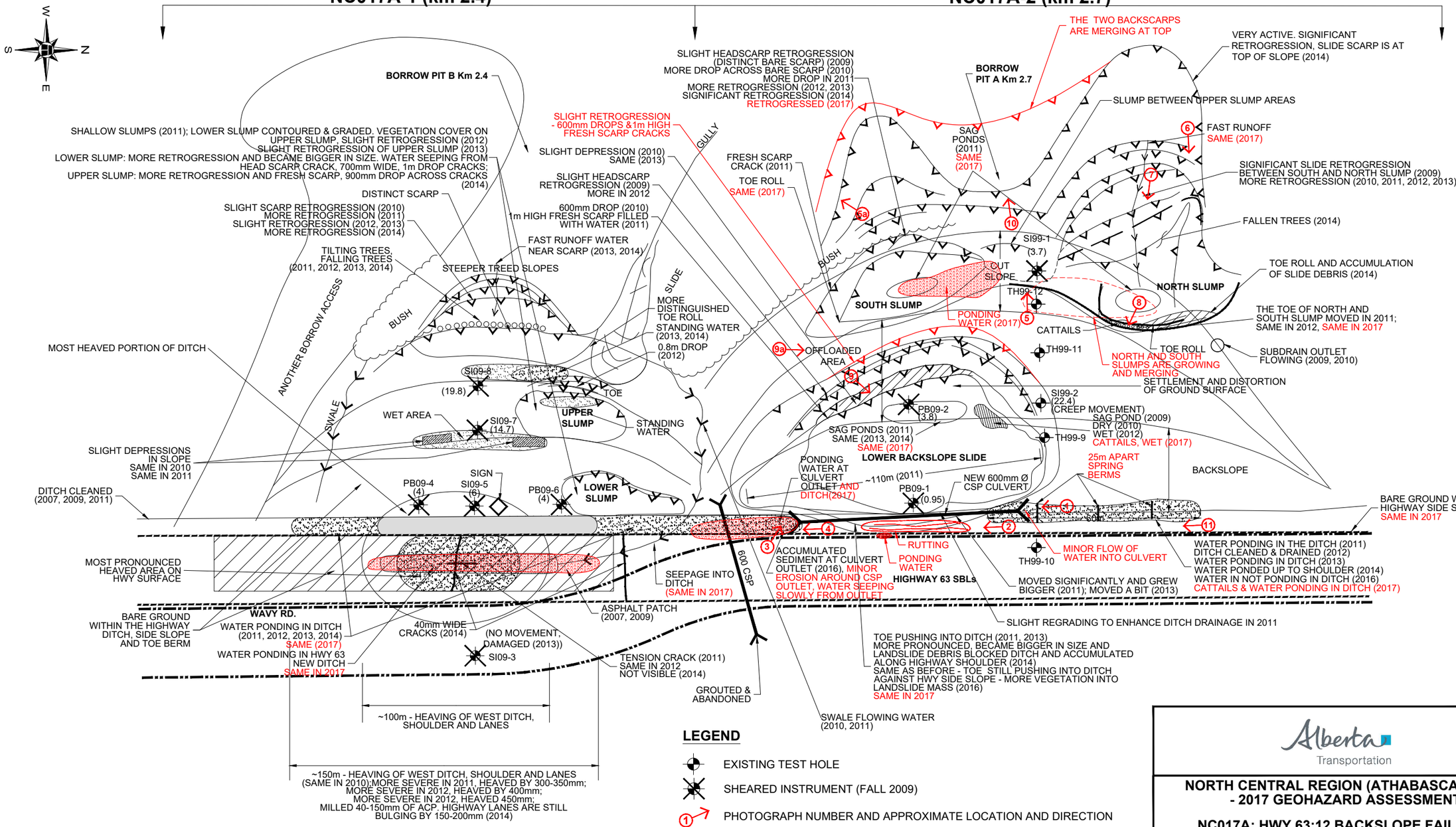
NC017A-1 (km 2.4)

NC017A-2 (km 2.7)



LEGEND

- EXISTING TEST HOLE
- SHEARED INSTRUMENT (FALL 2009)
- (1) PHOTOGRAPH NUMBER AND APPROXIMATE LOCATION AND DIRECTION
- ( ) DEPTH OF MOVEMENT IN METERS
- SI = SLOPE INCLINOMETER / PNEUMATIC PIEZOMETER
- PB = POORBOY / STANDPIPE PIEZOMETER
- APPROXIMATE ALIGNMENT OF NEW HWY 63 SOUTHBOUND LANES
- APPROXIMATE ALIGNMENT OF OLD HWY 63 SOUTHBOUND LANES

NOTES

1. PREVIOUS OBSERVATIONS ARE SHOWN IN BLACK.
2. HWY 63 SOUTH BOUND LANE WAS RELOCATED TO THE EAST OF ITS ORIGINAL LOCATION (km 2.4) DURING THE CONSTRUCTION OF THE PARSONS CREEK INTERCHANGE IN 2015 - A SMALL TOE BERM WAS PLACED BY OTHERS AGAINST THE HILL AT km 2.4 SLIDE LOCATION. A SLUMP WAS NOTED IN THE BERM SIDE SLOPE IN 2016.
3. MAY 18, 2017 OBSERVATIONS ARE SHOWN IN RED

Alberta Transportation

NORTH CENTRAL REGION (ATHABASCA AREA) - 2017 GEOHAZARD ASSESSMENT

NC017A: HWY 63:12 BACKSLOPE FAILURES (km 2.4 AND km 2.7) SITE PLAN

FIGURE NC017A-1

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	N. T. S.
DATE	JULY 2017
FILE No.	13357

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Photo 1 – Looking at the inlet of the culvert installed in the highway ditch below the lower landslide toe roll

Photo 2 – Ponding water between the highway and the toe of the landslide (Looking South); note that the highway side slopes are bare of vegetation

Photo 3 – Minor erosion and standing water around culvert outlet

Photo 4 – Water ponding at the culvert outlet and along the ditch (Looking South)

Photo 5 – Looking at the upper backslope slump areas and toe rolls

Photo 5a – Looking at the flank of the upper backslope south slump

Photo 6 – Looking at the flank of the upper backslope north slump

Photo 7 – Fast seepage near the northern flank of the upper backslope north slump (Looking East)

Photo 8 – Ponding water near the toe of the north slump (Looking East)

Photo 9 – Sag Ponds around PB09-2 within the lower backslope landslide mass (looking north); note that cattail vegetation has grown in one of the sag ponds

Photo 9a – Looking north at a relatively fresh head scarp crack of the lower backslope landslide

Photo 10 – Looking at a scarp crack connecting the head scarps of the upper backslope north and south slumps

Photo 11 – Water ponding in the ditch (Looking South)