THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

ALBERTA TRANSPORTATION
LANDSLIDE RISK ASSESSMENT

SECTION A: GEOTECHNICAL FILE REVIEW

NORTH CENTRAL REGION

SITE NC37: SOUTH OF WHITECOURT, KM 34.58

LEGAL LOCATION:	NW27-59-12-W5M
NEAREST LANDMARK:	1.4 km South of Highway 43
HIGHWAY CONTROL SECTION	HWY 32:10 km 34.58
DATE OF INITIAL OBSERVATION:	2004
DATE OF LAST INSPECTION:	June 2008
LAST INSPECTED BY:	Thurber Engineering Ltd.
INSTRUMENTS INSTALLED:	5 Standpipe Piezometers (2005) 3 Slope Inclinometers (2005)
INSTRUMENTS OPERATIONAL:	5 Standpipe Piezometers 1 Slope Inclinometer
RISK ASSESSMENT:	PF(13) CF(4) = **52** (2008)
LAST UPDATED:	April 2009, Thurber Engineering Ltd.

1. LOCATION

The site is located on Highway 32:10 about 1.4 km south of the junction at Highway 43 on the west side of Whitecourt and the Macleod River bridge. Since the original observation, a second area of distress has developed about 250 m to the east (about 1.15 km from the junction).

2. GENERAL DESCRIPTION OF DISTRESS

The site is located in the westbound lanes (traveling and passing lanes) of the highway in an area constructed with sidehill cut/fill. A geotechnical investigation was undertaken by UMA in 2000 for the proposed grade widening and climbing lane addition. The report noted a backslope failure at about Sta. 34+700 (corrected from Sta. 35+300 in the report) and wet sandy soil was encountered during test pitting in the backslope. It was believed that the slumping was shallow resulting from high groundwater levels and not due to deep-seated movement. It was recommended to regrade the slope and cover with a gravel drainage blanket and potentially install a toe drain in the ditch. Drawings from the contract documents for the grade widening (6314/02) showed the layout for a perforated subdrain system (collection pipe and finger drains) between Sta. 34+580 and Sta. 35+040 in the south ditch. It is not known if this subdrain system was installed.

Grade widening was undertaken in 2003 and raised the gradeline approximately 1 m at this location. A backslope failure occurred during construction just east of the area of distress. That failure was rebuilt with a gravel shear key, 3 m wide bench, and a subdrain for the shear key. The subdrain outlet was reported to be at the inlet of the culvert at Sta. 34+679. A review of as-built information determined that a perforated subdrain pipe was installed in the south ditch between Sta. 34+620 and Sta. 34+980 but no drain rock was placed around the pipe.

Cracking was first noted in November 2003 in the vicinity of Sta. 34+620. At the time of the call-out in June 2004, the tension cracking extended for 66 m in length with crack widths up to 40 mm and height differential up to 20 mm. There was no sign of toe bulging of the sideslope or at the embankment toe. The natural slope of the highway at this location extends down through a treed area to the north of the highway to a cut slope for an old gravel operation. Some minor seepage and sloughing was observed in the backslope between Sta. 34+620 and Sta. 34+685 up to a height of 1.5 m above the ditch bottom. The exposed soils consisted of silt and sand. There was no flow observed from the subdrain outlet at Sta. 34+679.

A geotechnical investigation and preliminary design was undertaken by Thurber in 2005. From the drill results of the instrumentation installed at that time, it appeared that the failure plane was occurring in a high plastic clay layer about 4.5 m to 9.5 m below ground surface. It also appeared that there is a perched water table above this clay layer. The preliminary design presented three possible remedial options. The recommended option was to construct two toe berms with one at midslope to support the highway and the second at the slope toe in the gravel pit to reduce the likelihood of failure in the lower slope. The alternative options were to install a two-level dewatering system or install a pile wall along the north edge of the highway.

During the initial visit in 2005 at the site as part of the GeoHazard Assessment program, additional cracks were observed at Sta. 34+900 underneath the power line crossing located about 250 m to the east. These cracks have slowly developed since that time with a significant changes observed at the time of the 2008 inspection. A review of AT files did not encounter any information or prior history of distress at this location.

3. GEOLOGICAL/GEOTECHNICAL CONDITIONS

Physiographic Region: Eastern Alberta Plains of the Interior Plains (1969, Atlas of Alberta, University and Government of Alberta).

Bedrock Geology: The bedrock at the site is non-marine shale, sandstone, conglomerate, and coal with localized tuff and bentonite of the Paskapoo Formation (2948f). Bedrock elevation is about 685 m (Map 63) which is about 55 m below ground surface. The bedrock dips northeast toward a regional low coincident with Chip Lake.

Surficial Geology: Larger-scale (1:250,000) surficial geology map (Map 1367A) indicates that the site is located in an area of colluvial or alluvial deposits overlying bedrock with an eroded topography.

Hydrogeology: The sandstone of the Paskapoo Formation bedrock has an estimated yield of 2 L/s to 8 L/s groundwater flow with lower flows (0.1 L/s to 0.4 L/s) expected from the overlying sediments. The elevation of the regional groundwater table is at approximate elevation 725 m. The site is located close to the divide between regional groundwater flow north toward the Athabasca River and southeast toward the Macleod River. Based on the topography, flow at the site is expected to be toward the north. Published accounts of artesian flow conditions were not noted in the vicinity.

Stratigraphy: Five test holes were drilled during the 2005 geotechnical investigation (previously included in Section G). The test holes were drilled along a cross-section at approximate Sta. 34+620 from the backslope ditch to the toe of the overall slope in the gravel pit at the bottom of the hill. The stratigraphy beneath the highway fill typically consisted of silt, sand, clay, and sand overlying sandstone and clay shale bedrock. Layer thicknesses and continuity varied depending on the location as would be expected in a stratigraphy formed predominantly through colluvial or alluvial processes. Bedrock was encountered in three of the test holes at 13.5 m to 15 m below ground surface at the highway level and at about 6.5 m at the toe of the slope.

4. CHRONOLOGY

2000

A geotechnical investigation was undertaken by UMA as part of the planning stages for grade widening of Hwy 32:10. A subdrain was recommended to lower the groundwater table and control backslope slumping.

Seepage and icing/frost heave had been experienced in the general area.

2003

Grade widening construction through this area. The north shoulder was built out to accommodate a west-bound climbing lane. Backslope to the east of NC37 failed during construction and had to be rebuilt.

Cracks in the vicinity of Sta. 34+620 were first observed in November.

2004

Call-out undertaken by Thurber in June.

2005

The site was first inspected under the annual GeoHazard Assessment program. At this time, the second area of distress about 250 m to the east underneath the powerline crossing was noted.

5. REFERENCES

1. University and Government of Alberta, 1969. "Atlas of Alberta."

2. Tokarsky, O. 1977. "Hydrogeological Map, Whitecourt, Alberta, NTS 83J". Alberta Research Council, Map 114, Report 76-3.

3. Alberta Research Council, 1976. Map No. 57. "Bedrock Topography of the Whitecourt Area, NTS 83J, Alberta".

4. St-Onge, D.A. 1975. "Surficial Geology, Whitecourt, West of Fifth Meridian, Alberta". Geological Survey of Canada, Map 1367A.

5. Survey and Mapping Branch, Department of Energy, Mines, and Resources, 1981. NTS 1:50,000 Topographic Map, 83 J/4: Whitecourt, Alberta.

6. Alberta Transportation, Geotechnical Files.