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THURBER

October 15, 2004 File: 15-16-192

Alberta Transportation
Room 223, Provincial Building
4709 – 44 Avenue
Stony Plain, Alberta
T7Z 1N4

Attention: Mr. Rob Lonson, P.Eng.

NORTH CENTRAL REGION GEOHAZARD ASSESSMENT
HWY 40:28 GREGG RIVER BRIDGE (NC34)
2004 ANNUAL INSPECTION REPORT

Dear Sir;

This letter documents the 2004 annual site inspection of a portion of Secondary Highway 40:28 (km 9, approx.) located approximately 13 km north of the Hamlet of Cadomin, Alberta. The legal location of the site is SE5-48-24-W5M. The work was undertaken by Thurber Engineering Ltd. (Thurber) in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE046/2004, Section B) with Alberta Transportation (AT).

The inspection was undertaken on June 3, 2004 by Mr. Don Law, P.Eng. and Mr. Don Proudfoot, P.Eng. of Thurber. The reconnaissance was carried out in the presence of Mr. Roger Skirrow, P.Eng., Mr. Mike Baik, and Mr. Ron Coley (MCI) of AT.

1. BACKGROUND

The area of previous roadway distress is located in an embankment fill through a gully, adjacent to the east bank of the Gregg River. The height of the fill slope is approximately 14 m and was constructed with a 3H:1V side slope angle. A 1 m diameter centerline culvert located north of the slide area takes surface flow from the east ditch to the west side slope and away from the slide area. The site history is summarized in Section A of the Binder, with a brief summary provided following.

A subdrain system was installed in the east ditch with its outlet on the west side slope in 1990 during construction to repair a slope failure at this site. A 1 m deep fill was placed at the site during vertical realignment in 1997. A failure occurred in

1998 which impacted a 28 m long section of the highway, extending about 2 m toward the centerline from the west pavement edge. Shortly after the failure in 1998, a subdrain and four French drains were installed, and a berm was constructed at the toe of the embankment side slope. The site features including the layout of the toe berm and drainage system are shown in plan and cross-section on Figures NC34-1 and NC34-2, attached in Section F of the binder. Contours showing the outline and topography of the previous failure are also shown on the site plan.

In the fall of 2003, a tension crack was noted in the pavement surface coincident with the previous slide scarp. Instrumentation (including two slope inclinometers and three piezometers) was installed in February 2004 to allow monitoring of slope movements and water levels. The monitoring undertaken to June 2004 in these instruments indicated no significant slope movement and a marginal increase in water levels. Options identified prior to placing asphalt overlay in the summer of 2004 included;

a) placement of a wedge berm in the knee of the slope above the existing berm to provide further support for the upper slope, or

b) continue monitoring without intervention prior to the overlay.

Option b) no intervention was chosen due to the lack of movement observed in the slope over the monitoring period.

It is understood that a clay liner was placed in the east ditch during the 2004 overlay project to reduce the potential for infiltration of surface water into the slide area. Based on correspondence with Mr. Des Kernahan, P.Eng. of Morrison Hershfield (project managers for the overlay), the clay liner extends a width of 7 m (5 m bottom and 1 m up each side slope). The ditch is lined from the inlet end of the 1 m diameter centerline culvert and extends south over a length of 200 m. The liner is understood to be at least 300 mm thick.

2. SITE OBSERVATIONS

The highway roadway surface, side slope and toe area were inspected in the vicinity of the slide repair. In addition, the east ditch and back slopes were inspected. The following points summarize the observations made during the reconnaissance. Site features are shown on the site plan (Figure NC34-1) in Section F. Selected photographs taken during the site reconnaissance are also included in Section F.

Slide Repair Area

Tension cracking was noted in the pavement surface over a distance of 19 m, located approximately as shown on Figure NC34-1. The crack does not extend

into the side slope. The crack was open to 10 mm in some locations, and was less defined in the central portion of its length. No differential height difference was noted across the crack. The cracking location appears coincident with the scarp of the previous failure, and is similar to that observed in the fall of 2003.

There was no indication of slope failure in the side slope or toe berm area.

East Ditch and Back Slopes

The surface flow in the east ditch is steady and originates from a small creek located in the back slope approximately 150 m to 200 m south of the slide area. The flow from the creek enters the ditch at its crest, and approximately 20% of the flow travels south with the remainder flowing north toward the slide area.

Flow from the east ditch is transmitted to the west side of the highway through the 1000 mm diameter centerline culvert located north of the slide area as shown on the site plan. The outlet spills into an open half round culvert to a point partway down the side slope, and travels overland from there.

Some seepage was noted in the back slope above the slide area, which is fed by a small gully further up the slope. The flow in the gully appears to collect on a local bench in the back slope and infiltrates into the ground, causing additional seepage from the slope between the bench and the ditch. This seepage adds a small volume of surface water to the east ditch.

Surface Water Discharge

Significant flow (10 to 15 litres per minute) was noted from the outlet of the CSP subdrain installed during the 1998 construction, located northwest of the toe berm. In addition, approximately 4 litres per minute of flow was observed from each of the two subdrain outlets installed in August 1990 (sign post on site). Flow from these sources travels overland and pools near the toe of the slope to the north of the toe berm (wet area shown on the site plan), where it infiltrates into the ground surface. The flow from the half round culvert discussed previously also flows into this area.

The discharge area is well vegetated with grasses and widely spaced trees. No erosion was noted in the side slope from the flow discharged in this area.

The valley wall is located about 120 m (horizontal distance) from the highway centerline, and is a near vertical, bedrock controlled feature with very hard sandstone ledges. The flow in the area of the surface water discharge does not reach the valley wall at ground surface.

3. ASSESSMENT AND RECOMMENDATIONS

The cracking in the pavement surface does not appear to have developed significantly since the fall of 2003, and no other signs of slope instability were noted at the site. In addition, the drainage systems previously installed at the site appear to be functioning in a satisfactory manner, and outflow from these systems is not causing erosion.

Based on the above noted observations and the results of recent instrumentation monitoring, the cracks in the roadway surface are expected to be a result of a minor reactivation of the old slide, likely due to high water levels within the slope. These movements have not registered on the slope inclinometers since the time of their installation; hence it is possible that water levels were higher in the slope last fall than those recently measured.

Crack filling should be undertaken to reduce the potential for surface water flow into the embankment through the tension cracks.

Continued monitoring of the instrumentation and visual inspection of the site is recommended on a semi-annual basis. If slope movements are observed in the future, further intervention may be required such as the wedge berm in the knee of the slope as previously recommended to increase the factor of safety against slope failure.

Consideration was given to diverting the water entering the east ditch at a location about 150 m to 200 m uphill from the site to the south (i.e. away from the failure area), however it is understood that survey of the ditch profile undertaken prior to the overlay program indicated that significant ditch re-grading to the south would be required and hence the work was not undertaken. The clay liner provided in the east ditch during the overlay program should reduce the likelihood of infiltration of ditch water into the slide area.

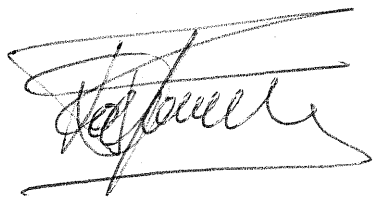
4. RISK LEVEL

A risk level of 15 is considered applicable to this site, based on a Probability Factor of 5 (inactive, or active but very slow rate of movement) and a Consequence Factor of 3.

5. CLOSURE

We trust this assessment meets your needs at this time. Please contact the undersigned should questions or concerns arise.

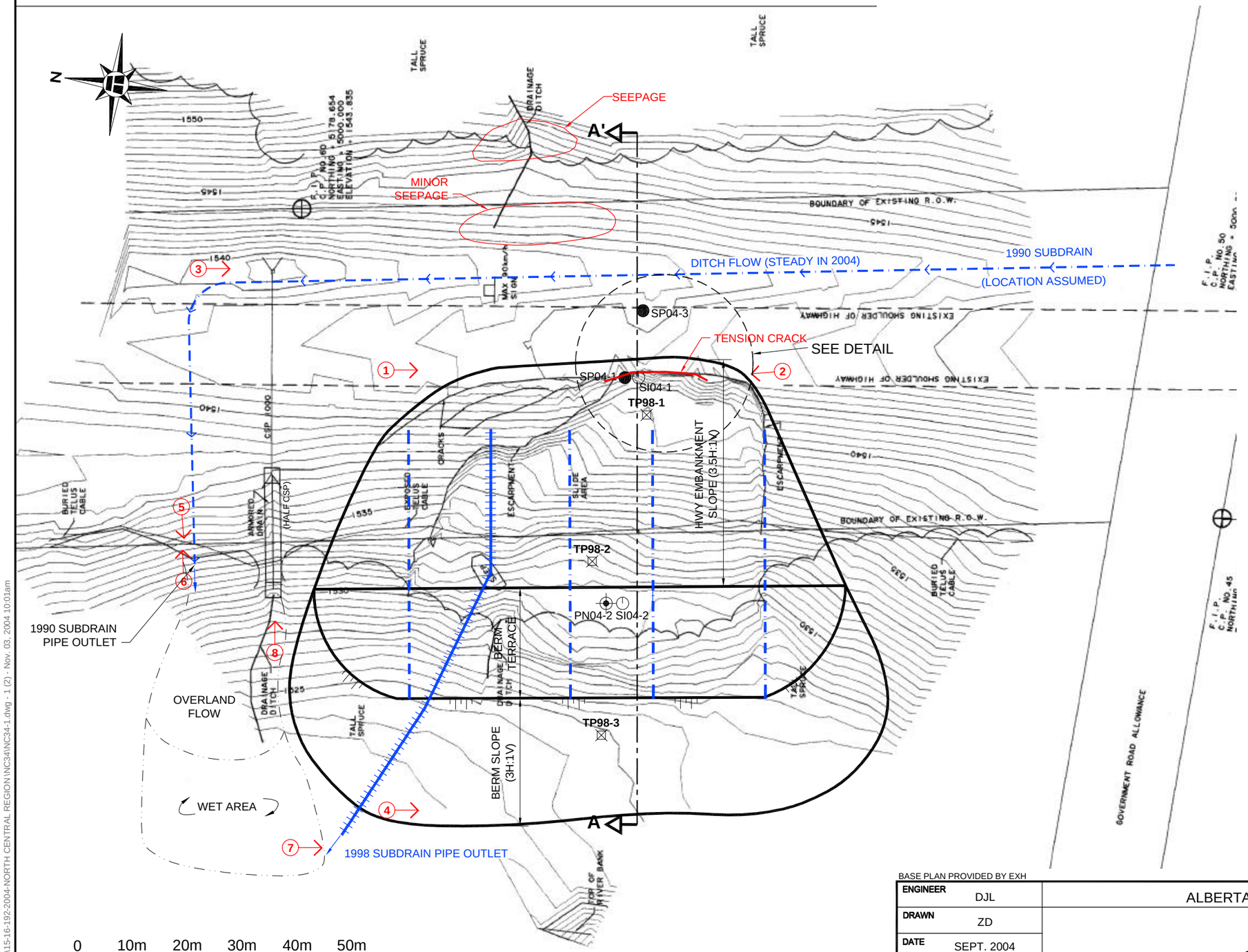
Yours very truly,
Thurber Engineering Ltd.
D. Papanicolas, P.Eng.
Review Principal



D.J. Law, P.Eng.
Project Engineer
/slp

Attachments

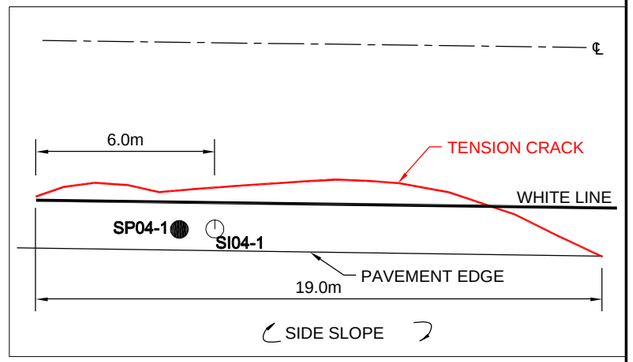
cc: Mr. Roger Skirrow, P.Eng., Director of Geotechnical Services, AT



LEGEND

- SLOPE INCLINOMETER
- STANDPIPE PIEZOMETER
- PNEUMATIC PIEZOMETER
- PREVIOUS TEST PIT COMPLETED IN 1998
- PERFORATED SUBDRAIN PIPE (1998)
- FRENCH DRAIN (1998)
- 1990 SUBDRAIN
- PHOTO NUMBER AND DIRECTION

2004 FEATURES SHOWN IN RED



DETAIL OF SCARP AREA (PLAN)

SCALE 1:200 (APPROX.)

CONTOURS FROM 1998, INTERVAL 0.5m
FEATURE LOCATIONS APPROXIMATE

BASE PLAN PROVIDED BY EXH

THURBER PROJECT #15-16-192

ENGINEER	DJL	ALBERTA TRANSPORTATION
DRAWN	ZD	SITE PLAN
DATE	SEPT. 2004	
APPROVED		
SCALE	1:750	NORTH CENTRAL GEOHAZARD ASSESSMENT — HWY 40:28 (NC34) GREGG RIVER

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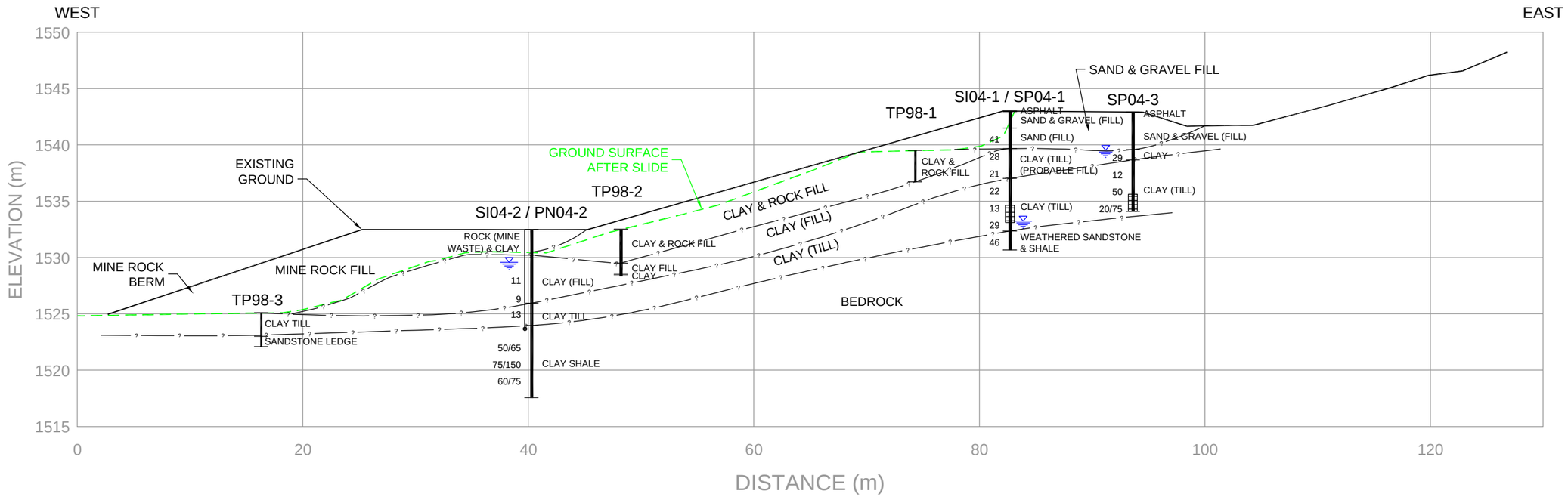
DRAWING No. FIGURE NC34-1

G:\ACADFILE\15\15-16-192-2004-NORTH CENTRAL REGION\NC34\NC34-1.dwg - 1 (2) - Nov. 03, 2004 10:01am



LEGEND

- WATER LEVEL
- 29 SPT "N" VALUE
- STANDPIPE PIEZOMETER SLOTTED SECTION
- PNEUMATIC PIEZOMETER TIP

BASE CROSS-SECTION PROVIDED BY EXH

THURBER PROJECT #15-16-192

ENGINEER	DJL
DRAWN	ZD
DATE	SEPT. 2004
APPROVED	
SCALE	1:400

ALBERTA TRANSPORTATION

STRAITIGRAPHIC CROSS-SECTION A-A'

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HWY 40:28 (NC34) GREGG RIVER

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DRAWING No. FIGURE NC34-2

PHOTO 1 - PAVEMENT DISTRESS AREA (LOOKING SOUTH)

HWY 40:28 GREGG RIVER (NC34)
SELECTED PHOTOGRAPHS

JUNE 3, 2004
THURBER PROJECT #15-16-192

PHOTO 2 - PAVEMENT CRACKS (LOOKING NORTH)

PHOTO 3 - EAST DITCH LOOKING SOUTH
(CENTERLINE CULVERT INLET IN FOREGROUND)

PHOTO 4 - TOE BERM AND TOE AREA (LOOKING SOUTH)

PHOTO 5 - 1990 SUBDRAIN OUTLET (LOOKING WEST)

PHOTO 6 - 1990 SUBDRAIN OUTLET (LOOKING EAST)

PHOTO 7 - 1998 SUBDRAIN OUTLET (LOOKING SOUTH))

PHOTO 8 - HALF ROUND CULVERT FLOW FROM EAST DITCH (LOOKING EAST)