THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

August 23, 2006 File: 15-85-32

Alberta Infrastructure and Transportation
Unit 2, Jewell Building
3603 – 53 Street
Athabasca, Alberta
T9S 1A9

Attention: Mr. Arthur Kavulok

NORTH CENTRAL REGION GEOHAZARD ASSESSMENT HWY 661:02 NEAR THE NORTHEAST BOUNDARY OF THE TOWN OF FORT ASSINIBOINE (NC14) 2006 ANNUAL INSPECTION REPORT

Dear Sir:

This letter documents the 2006 annual site inspection of an area of slope instability located along Hwy 661:02 on the northeast boundary of the Town of Fort Assiniboine, Alberta (refer to Figure NC14-1 attached for inclusion in Section F of the binder).

Thurber Engineering Ltd. (Thurber) undertook this inspection in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract CE143/2006 with Alberta Infrastructure and Transportation (AIT).

Dr. Renato Clementino, P.Eng of Thurber undertook the inspection on May 19, 2006 in the presence of Mr. Roger Skirrow, P. Eng. and Mr. Rick Ellwein of AIT.

1. BACKGROUND

Thurber last visited the site in May 2005 and the site condition at that time is described in our Part B assessment letter in the site binder. Additional site information is provided in the Geotechnical File Review in Section A and Section G of the binder.

Thurber installed five slope inclinometers (SI) and 12 standpipe piezometers (SP) at this site In March 2006 under a different assignment for AIT (Thurber File 15-85-28). Attached is a copy of the instrumentation installation report dated

May 31, 2006 for inclusion in Section G of the binder. The instrumentation installed and one existing standpipe piezometer (A1) have been added to the Geohazards Instrumentation Monitoring program.

2. SITE OBSERVATIONS

The changes in condition since last year are shown on the attached site sketch plans; Figure NC14-1 (overview) and NC14-2 (detail of the mid-hill slide area). A cross-section prepared by AGRA Earth & Environmental passing through the main portion of the slide was presented in Thurber's (2000) report as Figure NC14-3 and is included in Section F of the binder for reference. Selected photographs taken during the 2006 visit are also attached.

The previous cracks that were partially re-appearing through the pavement patch performed last year have now fully formed in a similar pattern as observed before the patch. No differential drop was observed across the cracks. A slight depression on pavement at the east end of the mid-hill slide area was also noted.

A 38 mm diameter subhorizontal drain pipe outlet was found in the side slope, located approximately as shown in Figure NC14-1. The drain was not flowing.

Other slide features, i.e., scarps and graben, existing on the sideslope were inspected and no noticeable changes were observed from that observed last year.

The collection well (CSP) located at the toe of the mid-hill slope was inspected and the existing pipes were trickling with a steady drip of water at the time of the inspection.

The CSP manhole with lid located in the back slope near the bottom of the hill was also inspected, but the lid could not be removed. The CSP is perforated just above the ground level to collect surface water, however these holes were mainly clogged and water was ponding at surface to the east of the manhole. The source of the water appears to be from a natural surface drainage course that comes from the north side of the manhole. The holes were cleaned with a stick and water started to flow into the manhole.

3. ASSESSMENT

The readings taken in the recently installed slope inclinometers (SI) were taken approximately one and half months after installation and as of yet do not show a defined depth of slope movement. The readings from the standpipe piezometer (SP) show that the water levels are currently relatively deep, with measured depths below ground surface in the range of 6 m to 8 m. The highest ground water level was measured in SP06-1 at the top of the hill which was at 2.4 m below ground surface. The relatively low groundwater elevation is consistent with the relatively small development of slope instability features noted at the site this year. Further assessment will be undertaken when a longer record of reading is available.

SP06-4 and 06-5 were installed adjacent to each other at 15 m and 25 m depths, respectively. The water levels measured in SP06-4 and SP06-5 were 8.8 m and 15.3 m below ground surface, respectively. This may be an indication of perched water, which could be a contributing factor to the slope instability.

As discussed in previous reports, the slope instability for this site appears to be related to high water level; consequently, the rate of slope movement is linked to groundwater condition. Based on the observations from the last few years, it appears that the slope movement rates have reduced to an ongoing creep movement probably due to the low groundwater as measured in the SPs. Slope movement rates may increase again if groundwater levels rise.

4. RISK LEVEL

The risk level for this site has been assessed as follows:

PF(9) * CF(4) = 36

A Probability Factor of 9 is considered appropriate since the slide is active with a moderate steady rate of ongoing movement. A Consequence Factor of 4 is considered appropriate since the embankment fill is fairly high and a partial closure of the road would be a direct result of an aggressive slide movement.

5. RECOMMENDATIONS

5.1 Short Term

In the short term the site should be regularly inspected by the MCI especially after heavy and long precipitation events. Cracks in the surface of the road that open up should be sealed to reduce the inflow of water into the slide mass.

5.2 Long Term

High groundwater levels appear to be the major cause of the instability at this site. The newly installed instrumentation will provide, with time, valuable information for understanding the failure mechanism and will allow for a better assessment of the potential remediation options for this site, including roadway realignment.

5.3 Maintenance

As a maintenance item for short term improvement of the slope stability it is recommended to inspect and clean the existing collection points to improve groundwater discharge that seems to be decreasing over the years possibly due to siltation in the collection points.

Consideration should be given to installing a surface drainage treatment around the collection point located at the south end of the backslope to reduce the potential of having the existing holes clogged. This treatment may consist of excavating around the perimeter of the manhole to expose the holes, cover the exposed perimeter and holes with non-woven geotextile and backfill with washed rock. This should allow the surface water to enter the manhole while reducing the potential for clogging of the holes.

6. CLOSURE

We trust this assessment and recommendations meet your present requirements. Please contact the undersigned should questions arise or if the slide condition worsens.

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

Renato Clementino, P.Eng.
Project Engineer
/dw
Attachments

cc Mr. Roger Skirrow, P.Eng. (Geotechnical Director, AIT)

Photo 1. Up hill general pavement cracks, May 19, 2006.

Photo 2. Scarp and graben feature on the sideslope unchanged, May 19, 2006.

Photo 3. Collection point at the toe of the slope, May 19, 2006.

Photo 4. Subhorizontal drain outlet found in the side slope, May 19, 2006.

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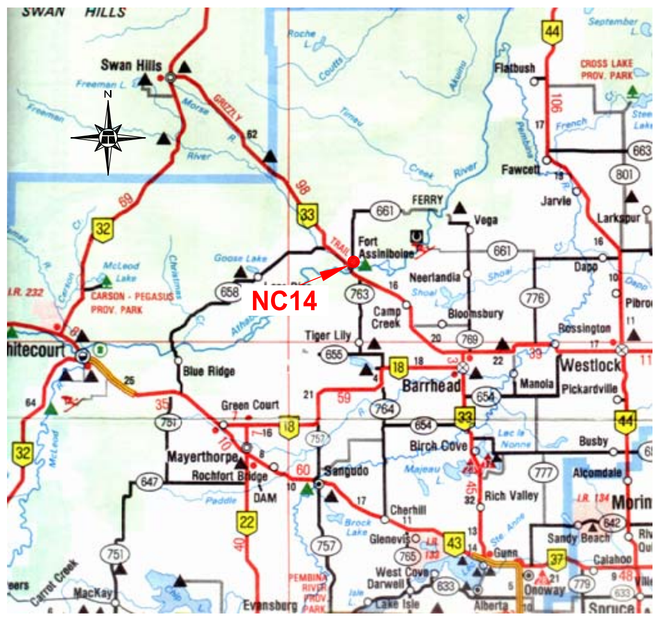
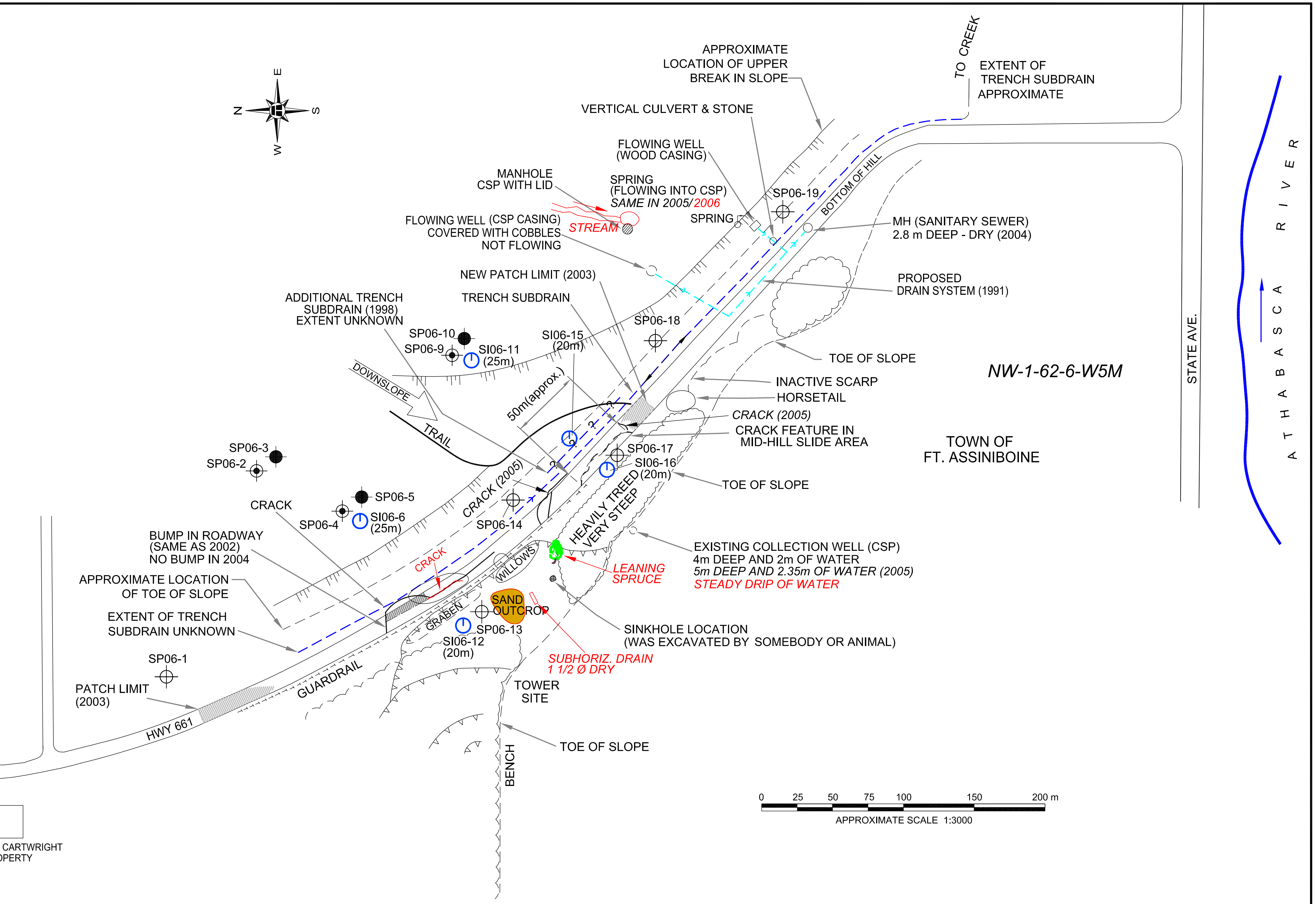


KEY MAP
N.T.S



BASE PLAN FROM THURBER ENGINEERING REPORT 15-16-192

THURBER PROJECT #15-85-32

LEGEND

▨	ASPHALT PATCH
▨	ASPHALT PATCH (2004)
SI (_m)	SLOPE INCLINOMETER AND DEPTH
● SP	STANDPIPE PIEZOMETER (25m DEPTH)
⊕ SP	STANDPIPE PIEZOMETER (15m DEPTH)
⊕ SP	STANDPIPE PIEZOMETER (10m DEPTH)

NOTES

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
3. *MAY 2006 OBSERVATIONS SHOWN IN RED*

ALBERTA INFRASTRUCTURE & TRANSPORTATION

SITE PLAN SHOWING 2006 INSTRUMENTATION LOCATIONS

NORTH CENTRAL (ATHABASCA) 2006
GEOHAZARD ASSESSMENTS

NC14 - HWY 661:02 km1.8
NW-1-62-6-W5M
N. OF FT. ASSINIBOINE, AB

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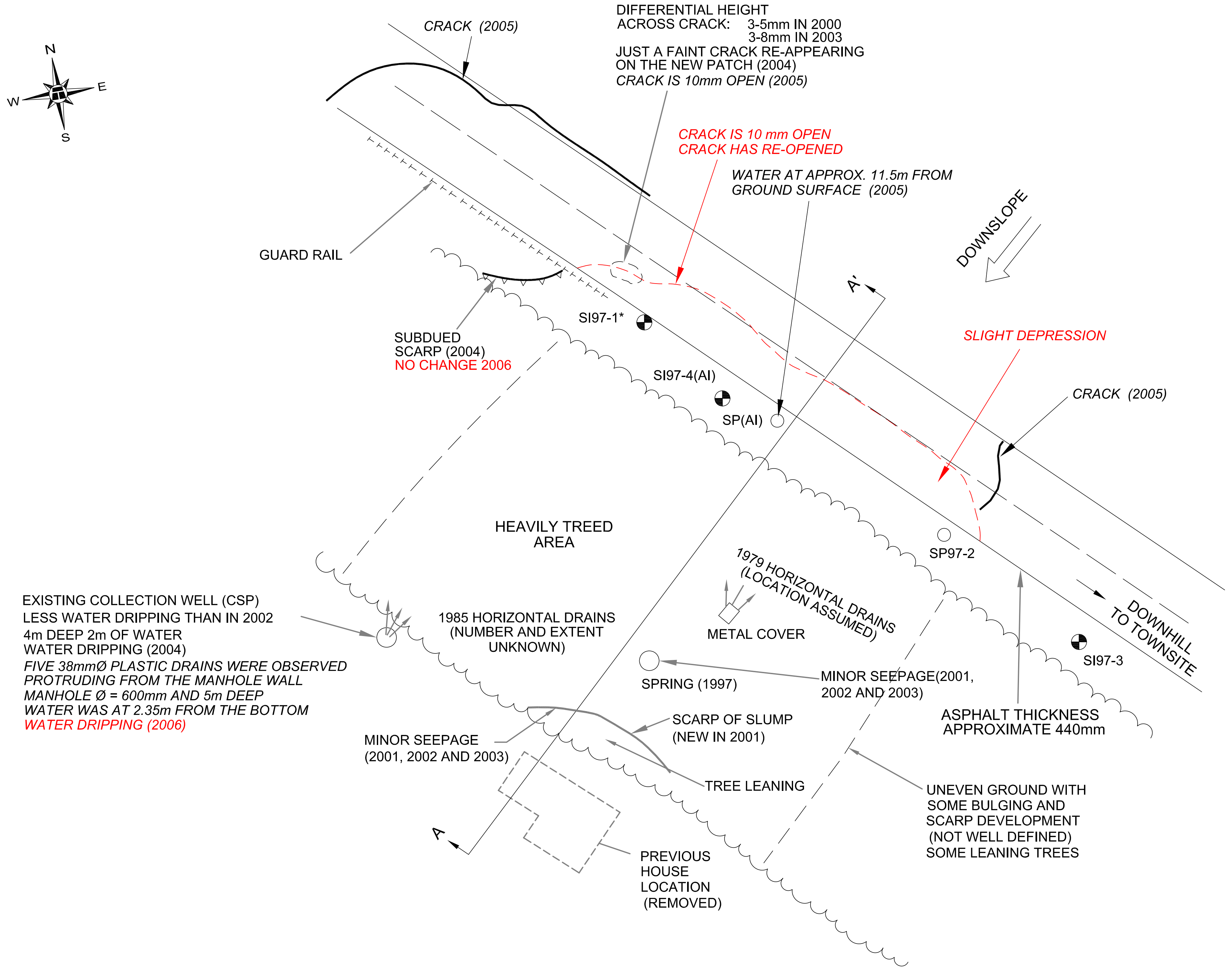
ENGINEER : RVC	DRAWN : JW	APPROVED :
DATE : AUG. 2006	SCALE : APPR. SCALE 1:3,000	DRAWING No. FIGURE NC14-1

Z:\15\15-85-32\15-85-11_NC14-2.dwg



NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
3. PREVIOUS CRACK PATTERN WAS COVERED BY NEW (2004) ASPHALT PATCH
4. *MAY 2006 OBSERVATIONS SHOWN IN RED*

LEGEND

SI - SLOPE INCLINOMETER
SP - STANDPIPE PIEZOMETER

THURBER PROJECT #15-85-32

ALBERTA INFRASTRUCTURE & TRANSPORTATION

SITE PLAN
MID-HILL SLIDE AREA

NORTH CENTRAL (ATHABASCA) 2006
GEOHAZARD ASSESSMENTS

NW-1-62-6-W5M
NC14 - HWY 661:02 km1.8
N. OF FT. ASSINIBOINE, AB

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ENGINEER :	DRAWN :	APPROVED :
RVC	JW	
DATE : AUG. 2006	SCALE : NOT TO SCALE	DRAWING No. FIGURE NC14-2