KLOHN CRIPPEN

November 14, 2003

Alberta Transportation
Central Region
#401, 4902 – 51 Street
Red Deer, Alberta
T4N 6K8

Mr. Melvin Mayfield, P.Eng.
Project Engineer

Dear Mr. Mayfield:

Central Region Landslide Assessment Site C15
SH575 Carbon Creek Embankment
October 2003 Instrumentation Monitoring Report

This Instrumentation Monitoring report was prepared by Klohn Crippen Consultants Ltd. for Alberta Transportation Central Region under Contract No. CE053/2000. The instruments were read by Mr. Joel Hilderman, EIT, of Klohn Crippen Consultants Ltd. on October 31, 2003.

1. PROJECT BACKGROUND

An embankment located on SH575 about 16 km east of Carbon, Alberta across a steep narrow gully is experiencing slope instability and erosion problems which has affected the pavement on top of the embankment. The slope instability on the north side of the embankment appears to have been caused by seepage saturating the fill. Another area of concern is the deep vertical erosion channel present along the southwest side in the area of cut to fill interface.

The slide location, site plan and cross-sections are illustrated on Figures 1 to 3.

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2. SITE OBSERVATIONS

A summary of the instrumentation at the site is provided in Table 1.

Table 1 Instrumentation Summary

ID	Ground Elevation (m)	Tip Elev (m)	Stick-up (m)	Zone Interval	Oct 03 Piezometric Elevation (m)	May 03 Piezometric Elevation (m)	Change in Piezometric Elevation (Observed Range)
Slope Indicators							
2000-3	86.37	68.5	1.25				
Standpipe Piezometers							
2000-1	94.36	84.8		84.80-92.50			Destroyed
2000-2A	90.08	79.36	1.00	79.36-80.96	82.23	82.64	-0.41 m (82.0-82.6)
2000-2B	90.08	87.96	0.96	87.96-90.06	Dry	Dry	- (87.8-88.8)
2000-5A	74.14	66.52	0.90	66.52-71.12	70.06	70.45	-0.39 m (69.3-70.5)
2000-5B	74.14	72.12	0.90	72.02-74.12	72.78	72.74	+0.04 m (72.7-72.9)
2000-7	84.82	75.72	0.75	75.72-84.62	Dry	Dry	
2000-8	82.15	72.63	0.92	72.63-81.63	74.02	74.21	-0.19 m (73.9-74.2)

One inclinometer and six piezometers are still operational and are in good condition as noted on the attached "Field Summary of Instrumentation Monitoring Form". The casing protector for instrument 2000-2 had slipped down into the hole leaving the PVC standpipes exposed. No damage had occurred to the standpipe and the casing protector will be pulled back into position on a subsequent visit when the ground has thawed.

The following data plots are provided for SI #2000-3:

- Cumulative and incremental displacement in A direction on same page.
- Cumulative and incremental displacement in B direction on same page.
- Resolved single movement vector plots.

There has been essentially no movement of the slide area in 2002-2003 as indicated by the installed slope inclinometer. Since installation, the instrument was indicating movement at the following depths:

- Surface to 2 m (elev. 84 m) – total movement of about 80 mm over this depth interval. The total cumulative movement at the surface since installation is 115 mm.

- 8 m to 12 m (elev. 74 m) – total movement of about 20 mm at the fill/bedrock interface.

3. INTERPRETATION

Groundwater levels have typically fallen since the last instrument monitoring report. The data from the installed slope inclinometer indicates that the slide has not moved significantly since the last inspection.

4. RECOMMENDATIONS

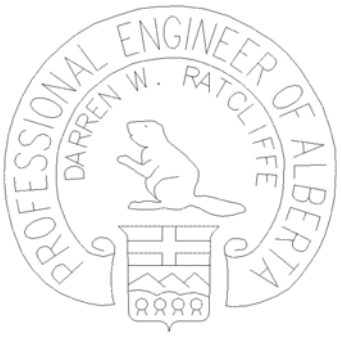
It is recommended that maintenance crews should monitor the culvert on a regular basis to ensure that it remains clear and free flowing.

It is understood that a design is being prepared by other consultants for the complete replacement of the culvert and the reconstruction of the embankment.

Please contact the undersigned if you have any questions regarding this report.

Yours truly,

KLOHN CRIPPEN CONSULTANTS LTD.



Darren Ratcliffe, P.Eng.
Senior Geotechnical Engineer

Reviewed by Tim Eaton, P.Eng.
Senior Reviewer
APEGGA Permit to Practice No. 433

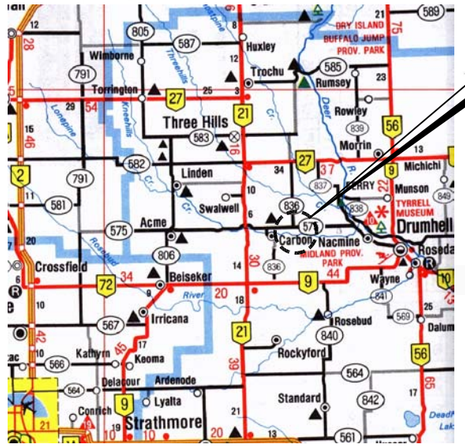
FIELD SUMMARY OF INSTRUMENTATION MONITORING

SITE: **C15**
NAME: **CARBON CREEK**
FILE: **H575**

PROBE # 50302500-26237B
DATAMATE # 50300940-6377

SI NUMBER	2000-3						**FIELD OBSERVATION**
TOP ELEV (m)	87.55						
STICK-UP (m)	1.25						
PIPE INSTALLED (m)	17.8						SI 2000-3, start at 58'
PIPE INSTALLED (ft)	60						end at 4'
READING DEPTH (ft)	58						SI clear with a slight resistance at ~10ft
AZIMUTH OF A+ GROOVE	N						
READING DATE	31-Oct-03						
FILENAME	CARB01						
STANDPIPE PIEZOMETER	2A	2B	5A	5B	7	8	
TOP ELEV (m)	90.06	90.06	74.12	74.12	84.82	82.15	
STICK-UP (m)	1.00	0.96	0.9	0.9	0.75	0.92	
PIPE INSTALLED (m)	11.7	3.2	8.5	2.9	9.85	10.42	
DEPTH TO WATER BTOP (m)	8.83	dry	4.96	2.24	dry	9.05	
DEPTH TO WATER BGL (m)	7.83		4.06	1.34		8.13	
WATER ELEVATION (m)	82.23		70.06	72.78		74.02	

FIGURES



SITE
" C15 "

KEY MAP
N.T.S.

SW 1/4 SEC 29 – TWP – 29 – RGE – 21 – W4M

SEC 2+218.7
2+160
2+180
2+200
A
B
INVERT D/S CULVERT (1500mm C.S.P.) EL. 7109
BH 2000-5 (74.14 m)
SAMPLE #3
INFERRED CULVERT LOCATION
INFERRED SLIDE AREA
BH 2000-3 (86.37 m)
(90.08 m)
BH 2000-2
BH 2000-1 (94.36 m)
GUARDRAIL
CP#1 EL. 100.0 (ASSUMED DATUM)
PREVIOUS ASPHALT PATCHING
DRAINAGE DITCH
℄ OF EXISTING ROAD
L 1+200
L 1+250
BH 2000-6 (m)
EMBANKMENT
EXISTING SHLD OF ROAD
DRAINAGE DITCH
BH 2000-7 (84.82 m)
BH 2000-8 (82.13 m)
GUARDRAIL
A'
DRAINAGE DITCH
ASPHALT PATCHING
TOP OF COULEE BANK
SAMPLE #2
INVERT U/S CULVERT (1500mm C.S.P.) EL. 74.47
SEC 2+372.7
2+400
2+420
TOP OF BANK
1+400
1+450
NW 1/4 SEC 20 – TWP – 29 – RGE – 21 – W4M

LEGEND
- BOREHOLE
- SURFACE SAMPLES

PLAN

PROJECT FILE No. 2908.C15.F1.H.dwg
DRAWING No.
CENTER CODE No.
PWSS PLAN No.
MICROFILM DATE

MARK	DESCRIPTION OF REVISIONS	DATE	DWN.	ENG.
L				
K				
J				
I				
H	NOVEMBER 2003 SITE INSPECTION	NOV. 03	M.D.	D.R.
G	MAY 2003 SITE INSPECTION	MAY 03	M.D.	D.R.

PERMIT

SEAL

DESIGNED BY S.A.T. | APPROVED BY D.W.R.
DRAWN BY E.N.L. | CHECKED BY D.W.R.
SCALE 1:1000 0 10 20 m

CONSULTANT
KLOHN CRIPPEN

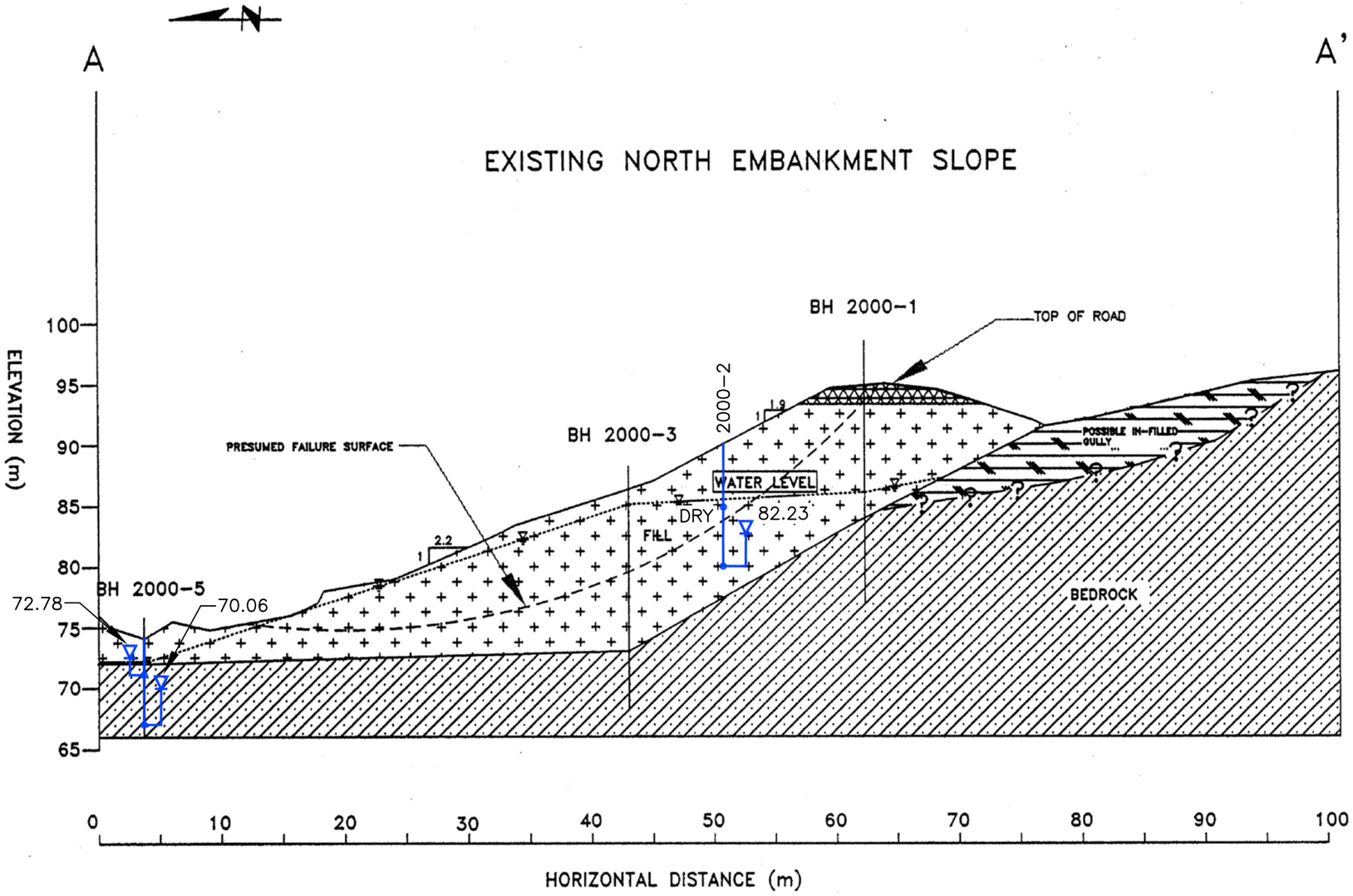
Alberta TRANSPORTATION

PROJECT CENTRAL REGION
LANDSLIDE RISK ASSESSMENT
TITLE SITE C15 : CARBON CREEK (SH 575) SITE PLAN
DATE NOV. 2003 | SHEET 1 of 3 | DRAWING No. FIGURE 1 | REV. H

NOTES

1. BEDROCK BOUNDARIES SHOWN ARE BASED ON BOREHOLE INFORMATION.
2. WATER LEVEL IN EMBANKMENT IS BASED ON PIEZOMETER READINGS.

82.23 RESPONSE ZONE & WATER LEVEL ON OCT. 31, 2003 SHOWN THUS



SECTION A (Fig 1)
N.T.S.

MARK	DESCRIPTION OF REVISIONS	DATE	DWN.	ENG.
L				
K				
J				
I				
H	NOVEMBER 2003 SITE INSPECTION	NOV. 03	M.D.	D.R.
G	MAY 2003 SITE INSPECTION	MAY 03	M.D.	D.R.

PERMIT

SEAL

DESIGNED BY S.A.T. | APPROVED BY D.W.R.

DRAWN BY E.N.L. | CHECKED BY D.W.R

SCALE AS SHOWN

CONSULTANT KLOHN CRIPPEN

Alberta TRANSPORTATION

PROJECT CENTRAL REGION

LANDSLIDE RISK ASSESSMENT

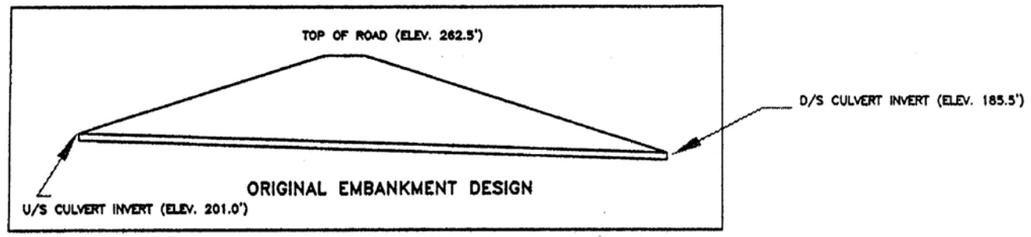
TITLE SITE C15 : CARBON CREEK (SH 575) SECTION A–A

DATE	SHEET	DRAWING No.	REV.
NOV. 2003	2 of 3	FIGURE 2	H

PROJECT FILE No. 2908.C15.F2.H.dwg
DRAWING No.
CENTER CODE No.
PWSS PLAN No.
MICROFILM DATE

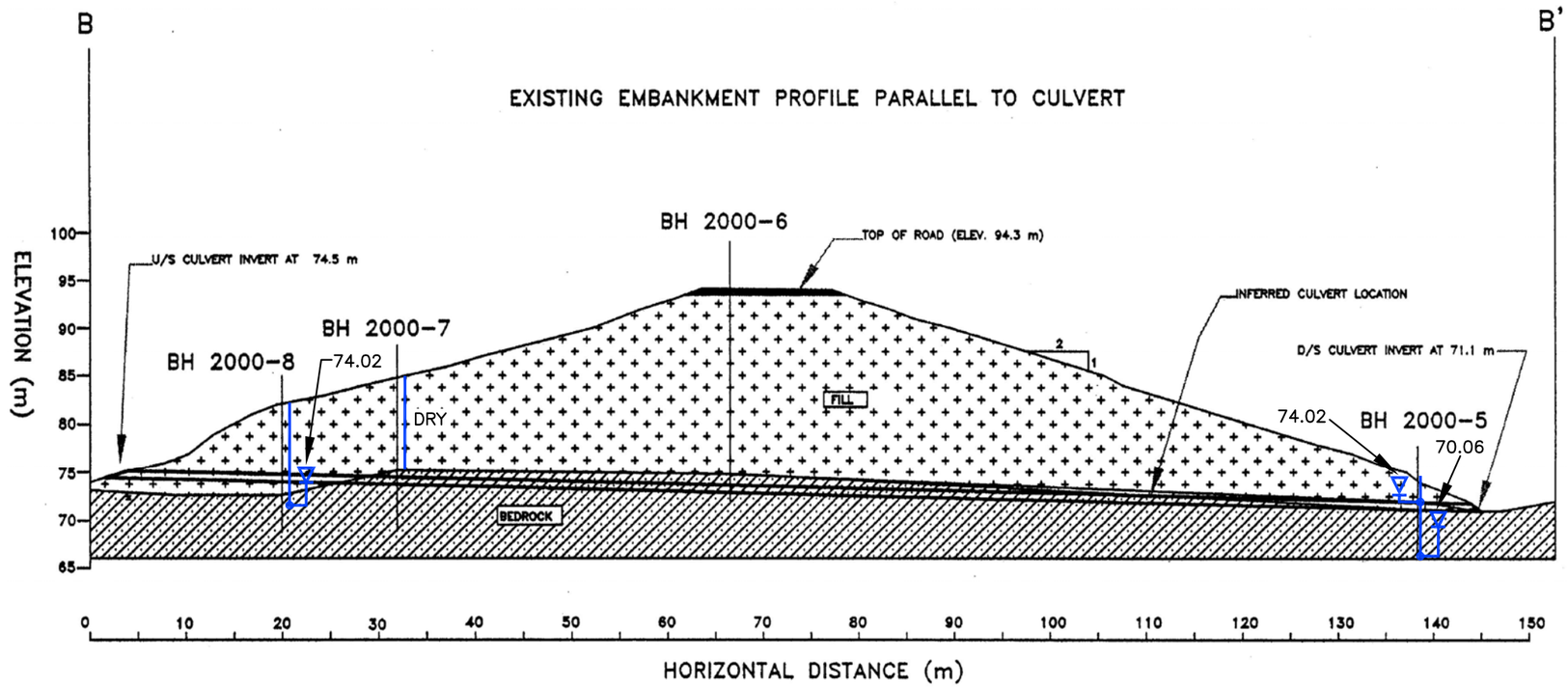
NOTE

1. BEDROCK BOUNDARIES SHOWN WERE BASED ON BOREHOLE INFORMATION.



RESPONSE ZONE & WATER LEVEL ON OCT. 31, 2003 SHOWN THUS

EXISTING EMBANKMENT PROFILE PARALLEL TO CULVERT



SECTION B N.T.S. Fig 1

MARK	DESCRIPTION OF REVISIONS	DATE	DWN.	ENG.
F				
E				
D				
C				
B	NOVEMBER 2003 SITE INSPECTION	NOV. 03	M.D.	D.R.
A	MAY 2003 SITE INSPECTION	MAY 03	M.D.	D.R.

PERMIT | SEAL

DESIGNED BY: S.A.T. | APPROVED BY: D.W.R.
DRAWN BY: E.N.L. | CHECKED BY: D.W.R.
SCALE: AS SHOWN

CONSULTANT: KLOHN CRIPPEN

Alberta TRANSPORTATION

PROJECT: CENTRAL REGION
LANDSLIDE RISK ASSESSMENT
TITLE: SITE C15 : CARBON CREEK (SH 575) SECTION B–B

DATE	SHEET	DRAWING No.	REV.
NOV. 2003	3 of 3	FIGURE 3	H