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SOUTHERN REGION GEOHAZARD ASSESSMENT
ANNUAL ASSESSMENT REPORT
2007

Submitted to:

Alberta Infrastructure and Transportation
Calgary, Alberta

Submitted by:

AMEC Earth & Environmental,

a division of AMEC Americas Limited

Calgary, Alberta

November 2007

CG25263

November 6, 2007
CG25263

Mr. Roger Skirrow, M.Sc., P.Eng.
Alberta Infrastructure and Transportation
2nd Floor, Twin Atria Building
4999 – 98 Avenue
Edmonton, AB T6B 2X3

Dear Roger:

Re: Southern Region Geohazard Assessment
Annual Assessment Report, 2007

Please find enclosed one copy of the 2007 Annual Assessment Report. Also included is an unbound copy of the appendices for inclusion in the appropriate site binders and a CD containing electronic copies of the report files. Copies of these items have also been sent to Ross Dickson of Alberta Infrastructure and Transportation in Calgary.

If you have any questions or require any further information, please do not hesitate to contact the undersigned at (403) 569-6529.

Yours truly,
AMEC Earth & Environmental,
a division of AMEC Americas Limited

Andrew Bidwell, M.Eng., P.Eng.
Associate Geological Engineer

AB

c: Ross Dickson – AIT

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www.amec.com R:\Projects\Calgary Geo\CG25263 - AIT Southern Region 2007\600 Reports\2007 Annual Inspections\AIT S Region 2007 Annual Assessments .doc

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LIST OF APPENDICES

1.0 INTRODUCTION

AMEC Earth & Environmental (AMEC), a division of AMEC Americas Limited (AMEC), has been retained by Alberta Infrastructure and Transportation (AIT) to conduct annual assessments of identified geohazard sites in the Southern Region. This work is being done in conjunction with semi-annual instrumentation monitoring at several of the identified geohazard sites.

This report presents the results of the 2007 annual assessments along with recommendations for continued assessment, monitoring and additional work where required. The enclosed CD contains electronic copies of the report files.

This work has been authorized by AIT under Consulting Services Agreement CE044/2004.

2.0 BACKGROUND

AIT has implemented a Geotechnical Risk Management Plan (GRMP) in order to estimate the risk levels of geohazard events at specific sites and to assist AIT in the prioritization of mitigative works. This work has been conducted in the past by AIT personnel and since 2000 by outside geotechnical consultants with the work being awarded on a regional basis. AMEC has been awarded the assignment of conducting this work for the Southern Region since the spring of 2000.

The GRMP includes the estimation of a Risk Level for each site that is assessed. The estimated Risk Level is expressed as a number ranging from 1 to 200 that is calculated as the product of a Probability Factor and a Consequence Factor assigned to each site on the basis of annual site assessments, geotechnical instrumentation readings, and other information for each specific site. The descriptions for these factors are listed on Tables A1 to A3 in Appendix A. Table A1 lists general descriptions for these factors, as provided by AIT. Tables A2 and A3 list the sets of probability and consequence factors specific to rockfall hazards and debris flows, respectively, as developed by AMEC for AIT during a recent geohazards review of the Highway 40/Highway 541 corridor.

3.0 FIELD PROGRAM

The annual assessments were performed on June 18 to 21, 2007 for the following sites.

<u>June 18, 2007</u>
S2 – Priddis
S7 – Millarville
S10 – Highway 762 S10(C)
S8 – Fisher Creek
S22 – Highway 762 “S” Curve
S10 – Highway 762 S10(A)
S1 – Jumpingpound Creek
S3 – Cochrane

June 19, 2007
S12 – Spray Lakes Road
S17 – Highway 40 – Mount Baldy Rock Cut
S18 – Highway 40 – Galatea Creek Through-Cut
S19 – Highway 40 – King Creek
S20 – Highway 541 – Highwood House Rock Cut
S21 – Highway 541 – Highwood Base Road Creek
S16 – Chain Lakes Site

June 20, 2007
S15 – Crowsnest Lake Rockfall Barrier
S14 – Bellevue Sites
S27 – Highway 3 – Windmill
S28 – Highway 3A At Range Road 2-2A
S23 – Highway 507:02 – East Of Mill Creek
S24 – Highway 507 – Eastbound Lane Site and Westbound Lane Site
S4 – Willow Creek
S25 – Highway 3 – Monarch

June 21, 2007
S5 – Chin Coulee
S26 – Highway 41 – Elkwater
S29 – Highway 1 – Seven Persons Creek

Each site was visited by Andrew Bidwell of AMEC along with Roger Skirrow and Rocky Wang of AIT. Ross Dickson of AIT participated in the site visits on June 19 to 21, 2007.

Each site was assessed visually and measurements and notes of site features were recorded using field reconnaissance level techniques. Digital photographs of site features were also taken.

4.0 ANNUAL ASSESSMENT RESULTS

4.1 S1 – JUMPINGPOUND CREEK

Background

The Jumpingpound Creek site is located on Highway 1:04, 6 km west of the interchange with Highway 22. The highway is twinned in this area with separate, two lane bridges for the eastbound and westbound lanes across Jumpingpound Creek. The geotechnical monitoring of this site was initiated when slope instability in the east abutment of the westbound lane bridge was first noted by AIT in December 1986. Site assessments, installation and monitoring of slope inclinometers has been conducted at this site since early 1987. Please refer to Section A of the site binder for a more detailed discussion of the site background.

Site Assessment

The site assessment was performed on June 18, 2007. The weather at the time of the site assessment was sunny and clear.

Please refer to Appendix S1 for a site plan illustrating the layout of the site. The east and west abutments of both bridges were inspected along with a segment of the east creek bank upstream of the bridges.

Observations

The following points summarize the observations made during the site assessment. Please also refer to Appendix S1 for a site plan and annotated photographs illustrating key observations.

Creek bank erosion:

- Creek bank erosion was visible in the west creek bank, downstream of the bridges, as shown in Photo S1-1. It is hypothesized that this erosion started when the previous rip-rap armouring along the creek bank was removed during high creek flows following the heavy rains in June 2005, as shown in Photo S1-2.

- East bank, upstream of eastbound bridge – as shown in Photos S1-7, 8, 9, 10 and 11 the east bank upstream of the bridges is along the outside of a bend in the creek channel and appeared to be undergoing significant erosion at the time of the inspection.

Instability on slopes adjacent to the bridges:

- The slump that was first noted in 2005 on the east abutment slope, just downstream of and adjacent to the pier of the westbound bridge, was still visible and appeared to have increased slightly in size since the 2005 and 2006 inspections however overall it did not appear to be developing into a risk to the bridge abutment stability to date. Photos S1-3 and S1-4 show comparative views of this area from the 2005 and 2007 inspections. This slump appears to be shallow instability that occurred as a result of a concentration of surface runoff from the north side of the westbound bridge area and possibly also due to toe erosion following the loss of rip-rap armouring along the creek bank during the peak flows in 2005.

- The slope instability at the crest of the east creek valley slope, downstream of the westbound lane bridge, that has been noted in each annual inspection since 2000 did not appear to have worsened significantly since the previous assessments. Photos S1-5 and S1-6 show comparative views of this area from the June 2007 and June 2005 assessments.

Surface runoff and erosion issues:

- Extensive oversteepening and erosion of the exposed shale bedrock was noted on the east abutment of the eastbound lane bridge. The cause of the erosion appears to be uncontrolled runoff from the bridge deck and surrounding areas and is fundamentally the same as noted in previous inspections dating back to 2004. However, it appears to have worsened since the 2006 inspection.

- The previously-noted erosion in the west abutment slope of the eastbound lane bridge, as shown in Photo S1-12, has not changed significantly since the previous inspections.

<u>Assessment and Risk Level</u>

There does not appear to be any significant, active geotechnical instability affecting the bridges at this time. Monitoring of the SI #1A and SI #3A up to the spring of 2004 (when SI #1A became unreadable) did not show any significant movement in the east abutment slope for both bridges up to a depth of 15 m (comparable to the estimated height of the slope). Similarly, monitoring of SI #3A up to the spring of 2007 has not shown any significant movement in the east abutment for the eastbound lane bridge. There have not been any visual indications of retrogressive landsliding seated in the bedrock during the annual inspections and no reports of problems with settlement/misalignment of the bridge decks.

However, as noted in the previous annual reports, there are geotechnical risks at this site due to the following hazards:

1. Slope erosion due to uncontrolled surface runoff from the bridge decks and surrounding areas:

- Erosion and shallow instability in the abutment and creek valley slopes due to concentrations of surface runoff onto areas without sufficient erosion protection.

- Potential loss of support for the bridge decks due to instability in the abutment slopes. Such instability could be caused by weathering of the exposed bedrock in the abutment slopes and oversteepening of the abutment slope. This was the apparent cause of the shallow instability noted in 1986 and prompted the installation of the SI's.

2. Creek bank erosion and scouring around the bridge piers during high creek flows:

- Instability of the abutment slopes or adjacent creek valley slopes due to creek erosion at the toe of the slopes.

- Scouring around the bridge piers due to creek erosion.

Therefore, AMEC recommends the following Risk Level factors for this site:

- Probability Factor of 3 on the basis of the continued lack of definite movement in the SI readings from 2004 to 2007. This is a reduction from the value of 4 that was recommended after the 2006 inspection.

- Consequence Factor of 10 on the basis of a potential for reactivation of the previous slide at this site or significant movement in the SI #3A area that could ultimately result in loss of a bridge abutment and possibly the bridge deck for either the eastbound or westbound lanes, which would be a significant loss.

Therefore, the current recommended Risk Level for this site is equal to 30, which is a reduction from the value of 40 after the 2006 inspection. This reduction in Risk Level is considered reasonable despite the creek bank erosion issues noted above because at present they do not present a significant risk to the bridges. However, if left unchecked, the Risk Level associated with the creek bank erosion could increase in future years.

Recommendations

The recommendations from the previous annual inspections were typically related to inspection and cleaning of the bridge deck gutters and control of the surface drainage on the bridge abutment slopes. It is not clear if these recommendations have been relayed to the appropriate AIT personnel and the maintenance contractor, however it does appear that the bridge deck gutters are being cleaned at least annually (likely as part of the regular bridge maintenance). Nonetheless, the slope conditions at the bridge abutments do not appear to have changed significantly in recent years, therefore, the following recommendations from the 2005 and 2006 assessments are still valid and are re-presented below for completeness:

1. Inspection and cleaning of the bridge deck drainage collection gutters should be continued. AMEC understands that this is done annually when the bridges are washed by the maintenance contractor.

2. Control of surface drainage on abutment slopes of the eastbound lane bridge should be upgraded in order to mitigate surface erosion noted in these areas. It is recommended that repairs/upgrading of the surface drainage be prioritized as follows:

a. Upgrade the surface runoff control measures for the east abutment slope of the eastbound lane bridge. The exposed bedrock in this abutment slope showed significant erosion and oversteepening during the 2007 inspection. Consider the installation of a flexible plastic drain pipe to extend the outlet of the bridge deck drainage gutter on the north side of the bridge to discharge near the toe of the abutment slope and reduce further surface erosion around and just downslope of the current outlet position.

b. The west abutment of the eastbound lane bridge – the gutter outlet above the erosion shown in Photo S1-12 should be connected to either of the concrete-lined runoff channels already in place on adjacent areas of the slope face to both the north and south of the eastbound lane bridge.

c. Install a flume or pipe to intercept the surface runoff from the area that currently drains into the slump on the east abutment slope, below the north side of the westbound bridge (Photo S1-3), and carry it to a discharge point at the toe of the slope. Also, repair/replace the rip-rap armouring along the toe of the slope below this slump.

3. Furthermore, the creek bank erosion appeared to be relatively worse in 2007 than during previous inspections with a developing potential for erosion of the east creek bank upstream of the bridges. Therefore, creek bank protection measures should be applied at the following locations:

   a. The bank protection along the west creek bank north of the westbound lane bridge (see Photos S1-1 and S1-2) should be replaced.

   b. The segment of the east creek bank shown in Photos S1-7, 10 and 11 should be protected from further erosion in order to prevent the development of a risk to the stability of the east abutment of the eastbound lane bridge.

   It may be possible to utilize environmentally sensitive bank protection treatments (including bioengineering treatments) similar to those used during the 2005 and 2006 repairs at AIT's Highway 734 Pembina River sites in the North Central Region and the planned repairs at the S4 – Willow Creek site in the Southern Region.

As discussed on site during the inspection, it is judged that the semi-annual instrumentation readings can be discontinued and that an annual inspection shall be performed in 2008. If no significant changes to the site conditions are noted during the 2008 inspection, then the annual geotechnical site inspections can likely also be discontinued with the understanding that the AIT bridge maintenance personnel and the maintenance contractor will be responsible for subsequent annual inspections and maintenance at this site. However, the risk to the bridges from the creek bank erosion conditions as seen during the 2008 inspection will need to be considered before a final decision to discontinue the annual inspections after 2008.

APPENDIX A

Tables

Table A1 – Geohazard Risk Level Factors

Risk Level = (Probability Factor, PF) x (Consequence Factor, CF)	
Probability Factor (ranked on a scale of 1 to 20)	
1	Inactive, very low probability of slide occurrence.
3	Inactive, low probability of remobilization.
5	Inactive, moderate probability of remobilization, uncertainty level moderate, or active but very slow rate of movement or indeterminate movement pattern.
7	Inactive, high probability of remobilization or additional hazards, uncertainty level high, or active with perceptible movement rate and defined zone(s) of movement.
9	Active with moderate steady, or decreasing, rate of ongoing movement.
11	Active with moderate but increasing rate of movement.
13	Active with high rate of movement, steady or increasing.
15	Active with high rate of movement with additional hazards.
20	Catastrophic slide is occurring.
Consequence Factor (ranked on a scale of 1 to 10)	
1	Shallow cut slope where slide may spill into ditches or fills where slide does not impact pavement, minor consequence of failure, no immediate impact to driver safety, maintenance issue.
2	Moderate fills and cuts, not including bridge approach fill or headslopes, loss of portion of the roadway or slide onto road possible, small volume. Shallow fills where private land, waterbodies or structures may be impacted. Slides affecting use of roadways and safety of motorists, but not requiring closure of the roadway. Potential rock fall hazard sites.
4	Fills and cuts associated with bridges, intersectional treatments, culverts and other structures, high fills, deep cuts, historic rock fall hazards areas. Sites where partial closure of the road or significant detours would be a direct and unavoidable result of a slide occurrence.
6	Sites where closure of the road would be a direct and unavoidable result of a slide occurrence.
10	Sites where the safety of public and significant loss of infrastructure facilities or privately owned structures will occur if a slide occurs. Sites where rapid mobilization of large scale slide is possible.

Table A2 – Rock Fall Risk Level Factors

Probability Factor – Rock Falls
(For Each Rock Cut or Rock Slope)

Weight	Description
1	Inactive, very low probability of fall occurrence.
3	Inactive, low probability of fall occurrence.
5	Inactive, moderate probability of fall occurrence.
7	Inactive, high probability of fall occurrence (e.g. seasonal, following freeze/thaw cycles) and/or a fall has occurred in the historic past.
9	Active, falls occur after exceptional weather (e.g. the melting of greater than average snow accumulations or exceptionally intense precipitation), fall frequency is in the order of once a decade.
11	Active, one or two falls occur each year triggered by annually recurring weather conditions.
13	Active, several falls occur each year and/or the frequency of falls is increasing in comparison to equivalent time periods in previous years.
15	Active, many falls occur each year and/or the area producing rock falls is expanding. Ongoing or persistent rock falls during specific times of the year.
20	Active, a large volume of rock is surrounded by open cracks. Toppling or sliding of the displacing mass is accelerating. Sites where rapid movement of a large fall is possible.

Consequence Factor – Rock Falls
(For Each Rock Cut or Rock Slope)

Weight	Description
1	Rock fall contained by ditch if cleaned as required to maintain capacity.
2	Rock fall onto roadway removable by maintenance crews by hand or with shovels. Road closure not required. Minor damage to the road surface that can be repaired during annual patching and sealing of the road. Minor to no damage to vehicles being struck by falling rocks or striking rocks deposited onto road.
3	Rock fall onto road that could damage a vehicle (e.g. flat tire, dent body of vehicle). Rocks bounce or roll onto the road surface but likely not with a trajectory that would pass through the windows or windshield of a passing vehicle.
4	Individual rocks or the total volume of rocks deposited on the road large enough to: Damage vehicles or cause accidents if struck by traffic or damage vehicles and injure occupants if they strike a moving vehicle. o Cause partial closure of the road or require a detour lane prior to cleanup. Damage to the road surface may require temporary repair in order to re-open road.
6	Individual rocks or the total volume of rocks deposited on the road large enough to: o Damage/destroy vehicles and severely injure occupants if struck by traffic or damage/destroy vehicles and severely injure/kill occupants if they strike a moving vehicle. o Cause complete closure of the road, with a rough detour/diversion possible within hours to days. o Require days to weeks required to restore the road to normal service. Possibly significant damage to the road surface that requires immediate repair.
8	Same as weighting of 6, but with several days required to develop a rough detour/diversion around the rockfall site.
10	Individual rocks or the total volume of rocks deposited on the road large enough to: o Damage/destroy vehicles and severely injure occupants if struck by traffic. o Bury vehicles if they strike a moving vehicle. o Cause complete closure of the road, with a temporary, rough detour or diversion possible in days to weeks. o Require complete reconstruction or rerouting of the road after the rockfall.

Table A3 – Debris Flow Risk Level Factors

Probability Factor – Debris Flows
(For Each Fan)

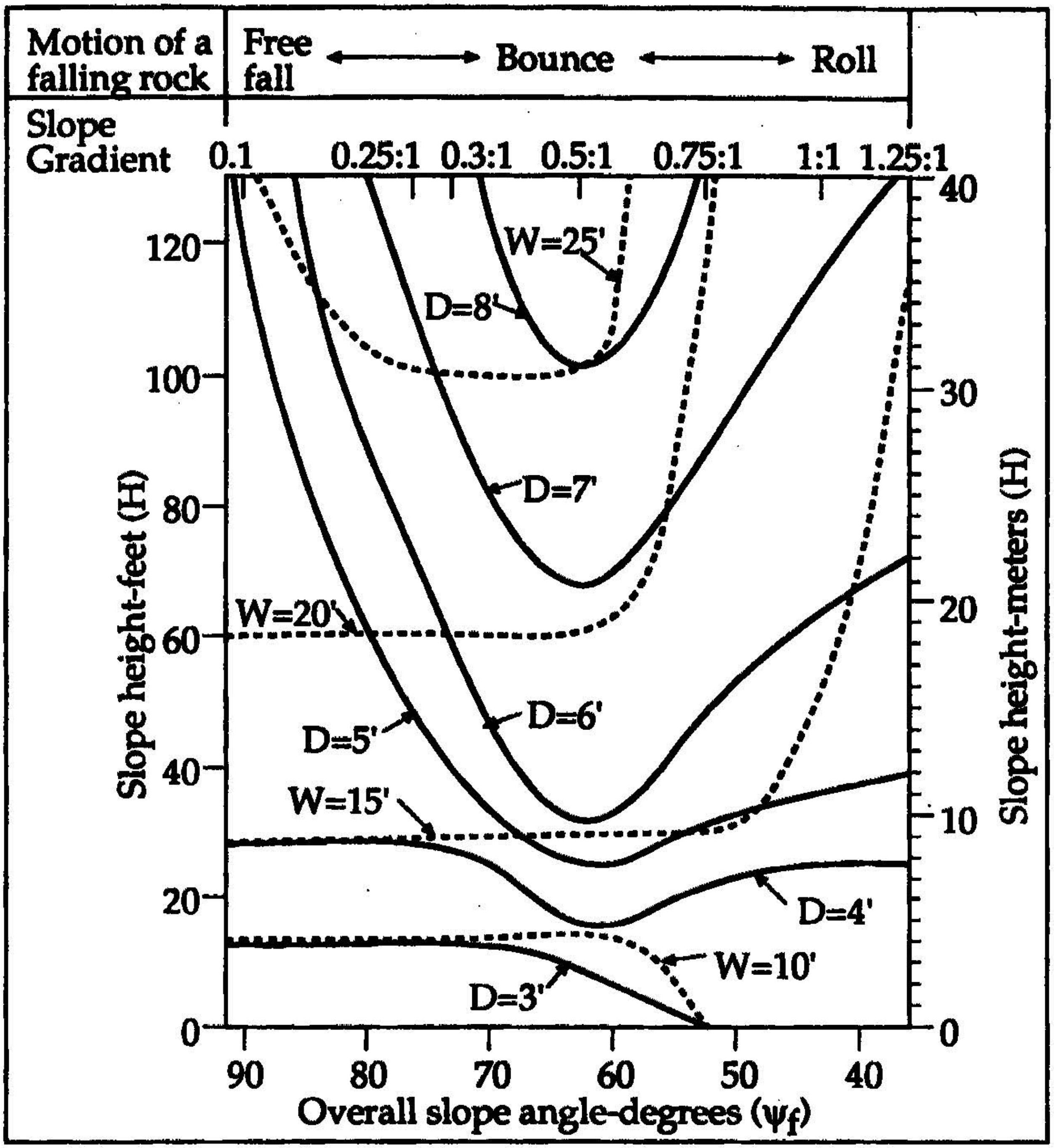
Weight	Description
1	Inactive, very low probability of a flow. No historical or current visual evidence of debris flow activity.
3	Inactive, low probability of a flow.
5	Inactive, moderate probability of a flow based on channel morphology and presence of debris in the potential source zone.
7	Inactive, high probability of a flow; a flow has occurred in the historic past and/or debris buildup in the channel/source area is considered to be ongoing.
9	Debris accumulation normally present in the source area. Fan is considered to be active, with flows occurring after the melting of an exceptional snow accumulation or an exceptionally intense rainfall.
11	Active, one or two flows per year triggered by annually recurring weather conditions.
13	Active, several flows each year.
15	Active, many flows each year, the area producing flows is expanding.
20	Active, a large volume of debris is impounding a large and rising reservoir of water upstream. Overtopping and dam-break is expected.

Consequence Factor – Debris Flows
(For Each Fan)

Weight	Description
1	Debris flow contained by the ditch or able to be conveyed past the road alignment via a sufficiently sized culvert or clear span bridge.
2	Debris flow onto roadway easily removable by maintenance crews. No damage to the road surface. Road closure not required and/or road still passable without damage to vehicles provided reduced speed limit established.
4	Partial closure of the road or significant detours would result from a debris flow. Debris flow onto roadway that requires partial closure of the road or significant detours while maintenance crew uses heavy equipment to clear debris and restore road surface. Damage to the road surface possible.
6	Complete closure of the road would result from debris flow while maintenance crew uses heavy equipment to clear the roadway and/or remove debris flow deposits plugging culvert or ditch. Geotechnical inspection required to assess post-event stability of road fills. Damage to the road surface likely.
10	Sites where the safety of the public is threatened by a debris flow, where there will be significant loss of infrastructural facilities or privately-owned structures if a flow occurs.

Table A4 – Summary of Recommended Risk Levels for Southern Region Sites

Site	Recommended Risk Level Value		Recommendations		
	Current	2006	Annual Inspection In 2008	Further Assessment	Design and Repair or Maintenance Work, With Notes On Schedule Where Applicable
S15 – Crowsnest Lake Rockfall Barrier	90	15	Yes	No	Repairs to net required ASAP.
S14 – Bellevue Sites (Potential sinkhole site)	72	72	No	Borehole drilling to follow-up and supplement 2004 GPR survey.	Nothing planned. To be confirmed once borehole information available.
S12 – Spray Lakes Road	54	63	Yes	No	Develop list of repair options for AIT review and decision.
S26 – Highway 41 - Elkwater	52	n/a	Yes	Boreholes to assess applicability of horizontal drains to reduce landslide movement.	Horizontal drain design, pending information from boreholes. Boreholes not scheduled yet. Ongoing road maintenance as required.
S19 – Highway 40 – King Creek (worst case scenario)	50	50	Yes	No	Design/cost estimate for secondary culvert, for AIT review and decision.
S2 – Priddis	45	45	Yes	New piezometers.	Maintenance of road surface as required.
S17 – Highway 40 – Mount Baldy Rock Cut - East Cut Slope	45	45	Yes	No	Scaling – as soon as practical. Ditch cleaning – ongoing.
S18 – Highway 40 – Galatea Creek Through-Cut - East Cut Slope	45	45	Yes	No	Ditch cleaning – ongoing. Increase capacity of East Ditch (if possible while maintaining clear width requirements).
S20 – Highway 541 – Highwood House Rock Cut	45	45	Yes	Track and assess required effort for ditch cleaning to verify if it is cost-effective vs. other measures.	Ditch cleaning – ongoing.
S10 – Highway 762 S10(A)	44	44	Yes	No	Develop list of repair options for AIT review and decision.
S21 – Highway 541 – Highwood Base Road Creek	33	33	Yes	No	Excavate and haul away debris from upslope side of road. Clean out debris from existing culvert or install second culvert.
S1 – Jumpingpound Creek	30	40	Yes	No	Surface drainage improvements and apply creek bank erosion protection measures.
S23 – Highway 507:02 – East Of Mill Creek	30	30	Yes	No	Excavation to maintain south ditch capacity – if required. Maintenance work if/when required.
S7 – Millarville	30	24	Yes	Install SI's and piezometer in new cracking area. Locate and mark shear key drain outlet for future visual monitoring.	Nothing planned. To be confirmed once new instrument data available.
S3 – Cochrane	27	27	Yes	No	Repairs to ditch berm. Develop list of repair options for AIT review and decision.
S24 – Highway 507 – Westbound Lane Site	27	27	No (unless recommended further assessment work performed)	Boreholes to check subsurface conditions and investigate causes of damage to road surface.	Depends on findings from boreholes, otherwise continue with road surface maintenance as required.
S10 – Highway 762 S10(C)	27	n/a	Yes	Overexcavate existing sinkhole in west embankment slope to further assess its cause.	Nothing planned. To be confirmed once further assessment completed.
S8 – Fisher Creek	24	32	Yes	No	Shear key design previously completed. Defer repair work until if/when more significant damage occurs.
S28 – Highway 3A At Range Road 2-2A	24	n/a	Yes	Airphoto review, site survey, and borehole drilling/instrumentation to characterize slope instability.	Design work based on further assessment data. In the meantime, road surface maintenance as required.
S5 – Chin Coulee	20	25	Yes	No	Install soil nails to stabilize downslope shoulder of road.
S22 – Highway 762 "S" Curve	20	10	Yes	No	Maintain road surface as necessary. Develop list of repair options for AIT review and decision.
S19 – Highway 40 – King Creek ('typical' year)	10	n/a	Yes	No	Design/cost estimate for secondary culvert, for AIT review and decision.
S4 – Willow Creek	18	18	Yes	No	Repair work to be tendered, late 2007. Planned to be completed in spring 2008.
S24 – Highway 507 – Eastbound Lane Site	18	18	No	No	Road surface maintenance as required.
S14 – Bellevue Sites (Rock cut site)	15	15	No	No	n/a
S18 – Highway 40 – Galatea Creek Through-Cut - West Cut Slope	12	12	Yes	No	Ditch cleaning in conjunction with east ditch at this site.
S27 – Highway 3 – Windmill	7.5	n/a	Yes	No	Nothing planned.
S16 – Chain Lakes Site	5	n/a	Yes	Instrument readings in 2008.	n/a
S25 – Highway 3 – Monarch	5	n/a	Yes	Not recommended.	Road surface maintenance as required.
S29 – Highway 1 – Seven Persons Creek	5	n/a	Yes	No	n/a

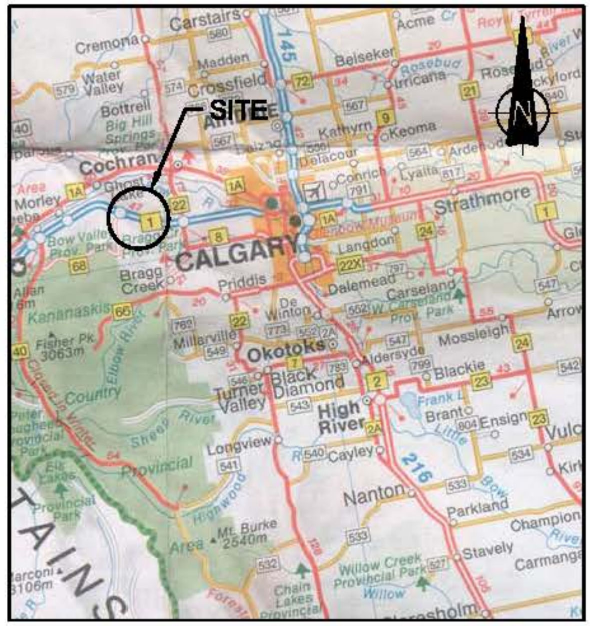


NOTES:

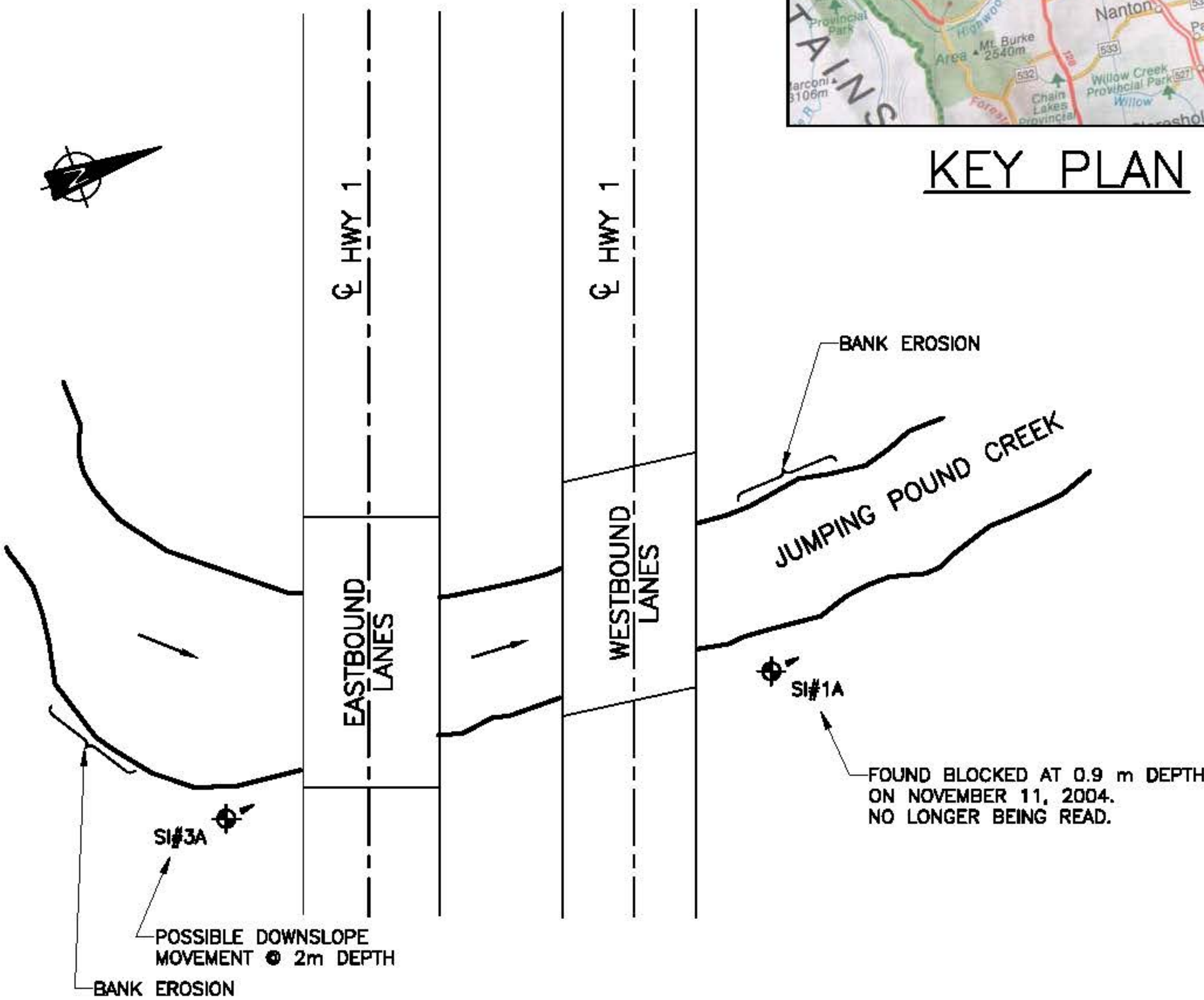
1. AFTER RITCHIE (1963), AS SHOWN IN TRANSPORTATION RESEARCH BOARD SPECIAL REPORT 247 (1996).

amec Earth & Environmental	PROJECT: SOUTHERN REGION GEOHAZARD ASSESSMENT			
CLIENT: Alberta INFRASTRUCTURE AND TRANSPORTATION	TITLE: ROCKFALL CATCHMENT DITCH SIZING CHART			
DATE: AUGUST 2007	JOB No.: CG25263	CAD FILE: 25263X04.dwg	FIGURE No.: FIGURE A1	REV. A

APPENDIX S1
Jumpingpound Creek



KEY PLAN



APPROXIMATE SCALE

1:400 0 2 4 6 8 m

NOTE: SCHEMATIC SITE PLAN – SCALE IS APPROXIMATE

LEGEND

SI#1A SLOPE INCLINOMETER WITH A–GROOVE ORIENTATION RELATIVE TO MAGNETIC NORTH.

amec Earth & Environmental

CLIENT: Alberta INFRASTRUCTURE AND TRANSPORTATION

PROJECT: SOUTHERN REGION GEOHAZARD ASSESSMENT AND INSTRUMENTATION MONITORING

TITLE: INSTRUMENTATION SITE PLAN HWY 1 JUMPING POUND CREEK

DATE:	JOB No.:	CAD FILE:	FIGURE No.:	REV.
AUGUST 2007	CG25263	25263N06.dwg	FIGURE S1–1	A

Photo S1-1 – June 2007 (upper left)
West creek bank, downstream of the westbound bridge. Note the erosion visible along the unarmoured segment of the creek bank in comparison to the 2005 photo of the same area (Photo S1-2).

Photo S1-2 – June 2005 (upper right)
West creek bank, as seen during the June 2005 inspection.

Photo S1-3 – June 2007 (lower left)
East creek bank, downstream of the westbound bridge. The slumping just above the upslope limit of the rip-rap armouring appears to have increased slightly in size since the 2006 inspection (see Photo S1-4) however it does not appear to have developed into a significant risk to the bridge abutment stability to date.

Photo S1-4 – June 2006 (lower right)
East creek bank, as seen during the 2006 inspection.

Photo S1-5 – June 2007 (top)
Slope instability along the crest of the east creek valley slope, downstream of the westbound lane bridge. This instability has been noted since the first annual inspection in 2000, however it does not appear to have worsened significantly since that time nor retrogressed towards the highway. Compare with the view of the same area from the 2005 inspection, as shown in Photo S1-6.

Photo S1-6 – June 2005 (bottom)
Slope instability along the crest of the east creek valley slope, downstream of the westbound lane bridge – as seen during the 2005 inspection.

Photo S1-7 – June 2007 (top)
East creek bank, upstream of the eastbound lane bridge. Compare with views of the same area from the 2005 and 2004 inspections in Photos S1-8 and S1-9. See also Photos S1-10 and S1-11 for other views of this area from 2007.

It appeared that this bank has been eroded by high flows in recent years. There is a chance that continued bank erosion could eventually develop into a risk to the stability of the east bridge abutment.

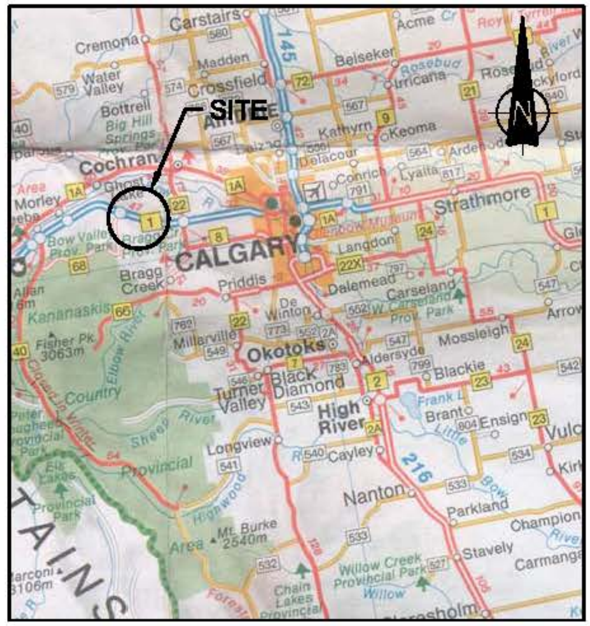
Photo S1-8 – June 2005 (lower left)
East creek bank, upstream of the eastbound lane bridge, as seen during the 2005 inspection.

Photo S1-9 – May 2004 (lower right)
East creek bank, upstream of the eastbound lane bridge, as seen during the 2004 inspection.

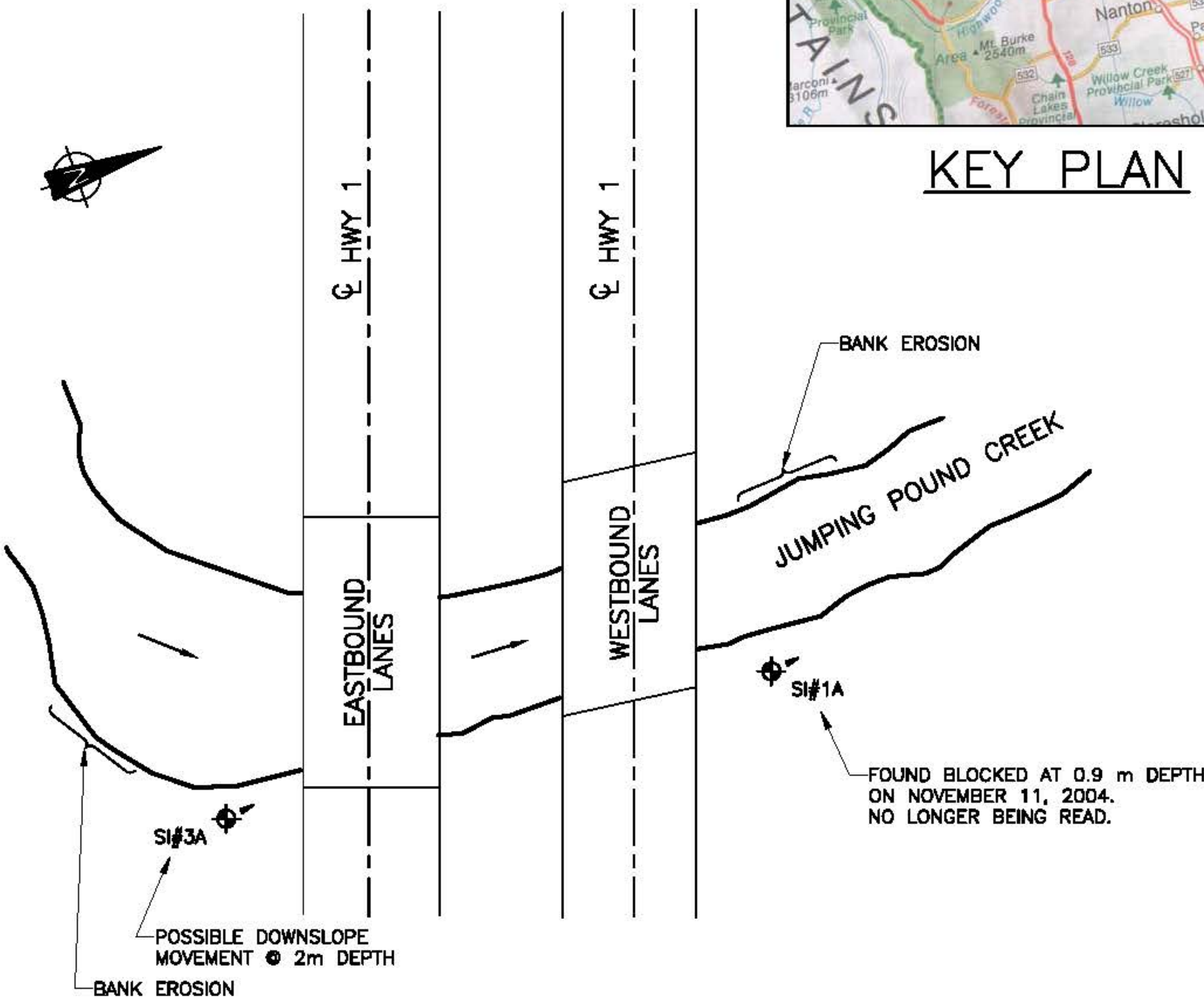
Photo S1-10 – June 2007 (upper left)
Facing upstream along the east creek bank, upstream of the eastbound lane bridge. The high creek flows are eroding into the unprotected east bank.

Photo S1-11 – June 2007 (upper right)
Facing downstream along the east creek bank, towards the eastbound lane bridge. The high creek flows are eroding into the unprotected east bank.

Photo S1-12 – June 2007 (lower left)
Erosion of the west abutment slope, below the north side of the eastbound lane bridge, due to surface drainage discharge onto the slope. The erosion does not appear to have worsened significantly in recent years.



KEY PLAN



APPROXIMATE SCALE

1:400 — 0 2 4 6 8 m

NOTE: SCHEMATIC SITE PLAN – SCALE IS APPROXIMATE

LEGEND

SI#1A — SLOPE INCLINOMETER WITH A–GROOVE ORIENTATION RELATIVE TO MAGNETIC NORTH.

amec Earth & Environmental

CLIENT: Alberta INFRASTRUCTURE AND TRANSPORTATION

PROJECT: SOUTHERN REGION GEOHAZARD ASSESSMENT AND INSTRUMENTATION MONITORING

TITLE: INSTRUMENTATION SITE PLAN HWY 1 JUMPING POUND CREEK

DATE:	JOB No.:	CAD FILE:	FIGURE No.:	REV.
AUGUST 2007	CG25263	25263N06.dwg	FIGURE S1–1	A

*PLOT 1:1=4 (P)

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Photo S1-1 – June 2007 (upper left)
West creek bank, downstream of the westbound bridge. Note the erosion visible along the unarmoured segment of the creek bank in comparison to the 2005 photo of the same area (Photo S1-2).

Photo S1-2 – June 2005 (upper right)
West creek bank, as seen during the June 2005 inspection.

Photo S1-3 – June 2007 (lower left)
East creek bank, downstream of the westbound bridge. The slumping just above the upslope limit of the rip-rap armouring appears to have increased slightly in size since the 2006 inspection (see Photo S1-4) however it does not appear to have developed into a significant risk to the bridge abutment stability to date.

Photo S1-4 – June 2006 (lower right)
East creek bank, as seen during the 2006 inspection.

Photo S1-5 – June 2007 (top)
Slope instability along the crest of the east creek valley slope, downstream of the westbound lane bridge. This instability has been noted since the first annual inspection in 2000, however it does not appear to have worsened significantly since that time nor retrogressed towards the highway. Compare with the view of the same area from the 2005 inspection, as shown in Photo S1-6.

Photo S1-6 – June 2005 (bottom)
Slope instability along the crest of the east creek valley slope, downstream of the westbound lane bridge – as seen during the 2005 inspection.

Photo S1-7 – June 2007 (top)
East creek bank, upstream of the eastbound lane bridge. Compare with views of the same area from the 2005 and 2004 inspections in Photos S1-8 and S1-9. See also Photos S1-10 and S1-11 for other views of this area from 2007.

It appeared that this bank has been eroded by high flows in recent years. There is a chance that continued bank erosion could eventually develop into a risk to the stability of the east bridge abutment.

Photo S1-8 – June 2005 (lower left)
East creek bank, upstream of the eastbound lane bridge, as seen during the 2005 inspection.

Photo S1-9 – May 2004 (lower right)
East creek bank, upstream of the eastbound lane bridge, as seen during the 2004 inspection.

Photo S1-10 – June 2007 (upper left)
Facing upstream along the east creek bank, upstream of the eastbound lane bridge. The high creek flows are eroding into the unprotected east bank.

Photo S1-11 – June 2007 (upper right)
Facing downstream along the east creek bank, towards the eastbound lane bridge. The high creek flows are eroding into the unprotected east bank.

Photo S1-12 – June 2007 (lower left)
Erosion of the west abutment slope, below the north side of the eastbound lane bridge, due to surface drainage discharge onto the slope. The erosion does not appear to have worsened significantly in recent years.