248318 Redacted

AVALON
// ROPE ACCESS SERVICES

PH. 07 846 1686 / FX. 07 846 1016
PO. BOX 5187 / FRANKTON / HAMILTON / NEW ZEALAND
WWW.AVALONLTD.CO.NZ

GEOTECHNICAL

Tauranga District Council
Private bag 12022
Tauranga

11 January 2008

For the attention of s 7(2)(f)(ii)

Mauao Slopes; Monitoring Report; 29 November 2007

Last November we carried out the site work for the ongoing slope inspection/rockfall monitoring program.

Items completed included:

1. Discuss developments with s 7(2)(f)(ii).
2. Full walkover reviewing slopes from all tracks. Spring flows, slip movements, rockfall evidence, vegetation development etc recorded and photographed.
3. Laser EDM survey carried out at 6 benchmark group locations on; West, North, East Bluffs and Zone 6.
4. Sets of photos from locations A to M around summit for scour monitoring.
5. Visit all 2005 slip sites and check for re-vegetation, stability and tension crack development.
6. Established a set of seven photo monitoring sites around the Oruahine and Waikorere tracks and took initial reference photos.

A summary of findings regarding these items would be:

1. A major rockfall of 30 July has been investigated and reported separately.
2. No other significant events reported to or observed by s 7(2)(f)(ii).
3. Occasional evidence found of minor rockfall on various track locations.
4. No significant movement on rock bluff benchmarks (within accuracy of measurement). Ongoing settlement of the Zone 6 scaled boulder is slowing and presents no hazard.
5. Scour continuing to develop on steep ground with no vegetation cover.
6. Minor continuing movement and surface ravelling on some of the May 2005 flood event slips.
7. Major dropouts below the 4WD track and wharf access road have been repaired.

The major event since the last monitoring was the failure of a few cubic metres of rock from a location above the Oruahine track on 30 July. Rockfall generated reached the base track and is reported to have narrowly missed a member of the public. See Avalon's report letter dated 17 August 2007. Remaining very marginally stable rock is planned to be removed by blasting in March 2008.

Vegetation continues to re-establish. As previously recognised any weed spraying must be extremely targeted to not leave loose sandy areas prone to scour.

Scour of sand from non-vegetated patches has continued and has been the source of minor rockfall. As reported previously the majority of this will have occurred during inclement weather, at which times there are few persons on the tracks. The majority of the rock likely to fall from these loose surfaces is in the smaller size range (say <150mm).

There has been no wide area loose rock scaling carried out since the initial, 2003 operation and that some slope areas now have significant quantities of loose surface rock.

The general rockfall hazard probably continues to be highest in the northern areas where rock climbers exiting from the top of routes will walk over unstable slopes from which any disturbed rock freefalls onto the Oruahine with no warning. This hazard is exacerbated by the fact that peak climbing activity will coincide with track walking (ie; at weekends during fair weather).

Photographs:

Each monitoring report will present a very small selection of photographs to illustrate the ongoing processes and any new developments (a full photographic record is stored in our files).

Photograph 1; Repair completed to dropout on lower 4WD track.

Photograph 2; Repair completed to dropout wharf access road.

Photograph 3; Ongoing scour.

Photograph 4; Example of new monitoring point on Waikorere track.

Recommendations:

As per previous reports:

Although the ongoing rockfall risk to individuals on single visits may be acceptable, a calculated fatality return periods in the order of ten years may be unacceptable.

For a person regularly walking the Western Oruahine track (under the rock climbing areas) the rockfall risk may be unacceptably high.

The rockfall risk to individual campers appears likely to be acceptable (unless camping on the boundary row for a month or more per year).

Some contributing factors to the current level of rockfall risk can possibly be mitigated relatively easily:

- *It is recommended that rockfall mitigation options be considered for the North West Oruahine Track, the highest risk area. Measures could include access restriction, rock scaling and possibly the consideration of small catch fences.*

- *The hazard to the Campground is likely to be most cost effectively mitigated by monitoring and controlled scaling at the rockfall source areas (if and when necessary) although catch fences continue to be an option. The landslip hazard may present a greater overall threat here (than rockfall).*
- *TDC's planting and weed control programme should give priority to establishing grass to help stabilise the loose colluvium.*
- *Public off track access to the steep upper slopes should be prohibited.*
- *Effective track closures must be in place before any TDC staff or contractors access the steep upper slopes off track. Any persons entering these areas must be suitably experienced, competent, trained, equipped, insured etc.*
- *Monitoring and inspection should continue six monthly.*
- *Annual rock scaling is recommended.*

Our next programmed monitoring will be due in the autumn.

We will be in touch regarding the planned blasting works.

Regards

s 7(2)(f)(ii)

For Avalon Industrial Services Ltd.

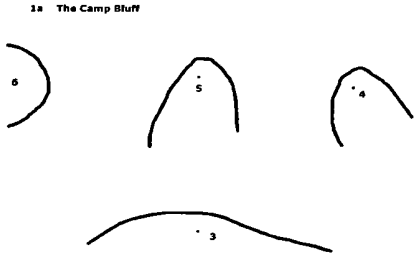
s 7(2)(f)(ii)

Attached: Site records for Nov 2007 Slope Monitoring.

Avalon Industrial Services Ltd

Mauao Survey Benchmark Monitoring **1-Nov-07**

Area 1a; "Camp Bluff" Installed post blasting, November 2003



Distance measurement mm

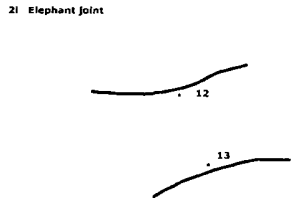
			Nov-03	Jan-04	Nov-04	Mar-05	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07
3	→	4		5211	5209	5208	*not possible*	5207	5208	5215	5210
3	→	5		4320	4320	4321	*due to*	4320	4323	4323	4319
3	→	6		5179	5180	5178	*public*	5180	5181	5178	5178
4	→	5		2258	2260	2260	*below*	2260	2260	2258	2259

Area 2a; "Blasted Column" Installed post blasting, November 2003

Distance measurement mm

			Nov-03	Jan-04	Nov-04	Mar-05	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07
8	→	11		7917	7910	7907	*not possible*	7906	7915	7905	7906
8	→	9			9968	9969	*due to*	9970	9968	9968	9964
10	→	8			3111	3111	*public*	3112	3126	3126	3126
10	→	9			11636	11636	*below*	11633	11635	11634	11634
10	→	11			8325	8325		8325	8325	8325	8320

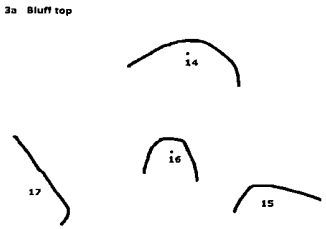
Area 2i; "Elephants Joint" Installed March 2003



Distance measurement mm

			Mar-03	Nov-03	Jan-04	Nov-04	Mar-05	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07
12	→	13	2885		2884	2882	2887	2887	2887	2887	2885	2285

Area 3a; "North East Bluff" Installed March 2003

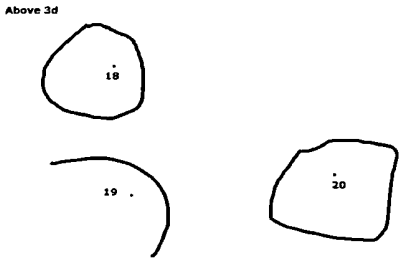


Distance measurement mm

			Mar-03	Nov-03	Jan-04	Nov-04	1/03/2005 *	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07
14	→	17	8110			8122	8124	8129	8129	8135	8130	8132
15	→	17	5050			5050	5049	5050	5050	5056	5056	5054
16	→	17	4868			4874	4877	4879	4879	4868	4869	4880
15	→	16	3575			3581	3571	3577	3577	3575	3575	3573
15	→	14	7560			7478	7488	7485	7485	7484	7486	7486

*EDM

Blocks above Area 3d; "North Promentary" Installed March 2003



Distance measurement mm

			Mar-03	Nov-03	Jan-04	Nov-04	1/03/2005 *	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07
18	→	19	5248			5265	5256	5256	5254	#	5253	5253
20	→	19	3380			3385	3373	3376	3376	3377	3375	3374
20	→	18	8038			8065	8050	8056	8050	8053	8053	8054

* EDM WITH BLOCK (=-10)
\# not recorded

Zone 6 Boulder 6b Installed December 2005

23 (LH outcrop) 22 (RH Outcrop)
21 (boulder)

			Dec-05	Mar-06	Nov-06	Jul-07	Nov-07
21	→	23	7560	7590	7615	7663	7639
21	→	22	5799	5830	5865	5999	5891