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**GEOTECHNICAL**

Tauranga District Council  
Private bag 12022  
Tauranga

26 July 2007

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

**Mauao Slopes; Monitoring Report; July 2007**

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

Items completed included:

1. Discuss developments with Ranger 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. Report on dropout below 4WD track and new pipeline trench.

A summary of findings regarding these items would be:

1. No significant events reported by Ranger.
2. Occasional evidence of minor rockfall on tracks.
3. No significant movement on rock bluff benchmarks (within accuracy of measurement). Ongoing 50mm of settlement of the Zone 6 scaled boulder, which presents no hazard and continues as anticipated.
4. Scour continuing to develop on steep ground with no vegetation cover.
5. Minor continuing movement and surface ravelling on some of the May 2005 flood event slips.
6. \*Dropout below 4WD track reported separately (letter dated 24/7/07).

Attached is a summary of the benchmark and slip monitoring data.

In the period since the herbicide spraying programme has been 'on hold', vegetation continues to re-establish. Although the fastest growth has been in some weed species, they are beneficial from a geotechnical point of view in reducing scour and increasing stability.

Scour of sand from non-vegetated patches has continued as previously and certainly has been the source of much minor rockfall, however, as reported previously the majority of this will have occurred during inclement weather, at which times there are

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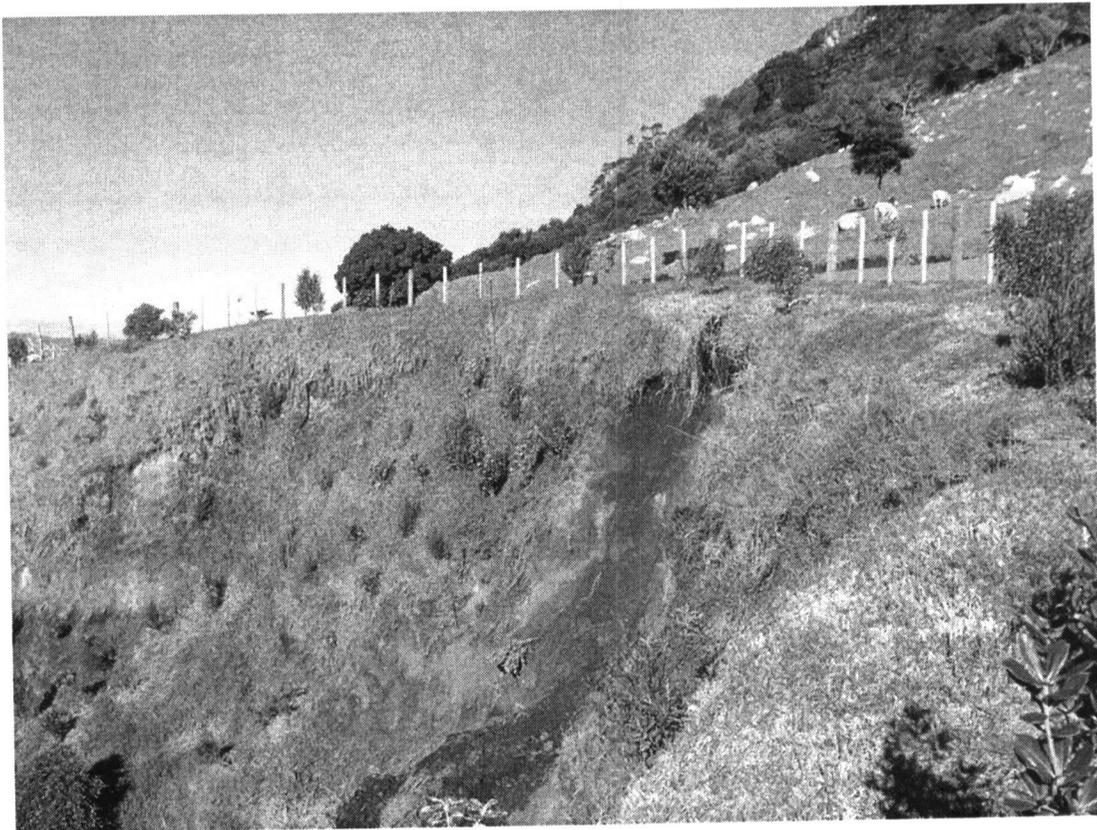
few persons on the tracks. The majority of the rock likely to fall from these loose surfaces is in the smaller size range (say <150mm).

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 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).

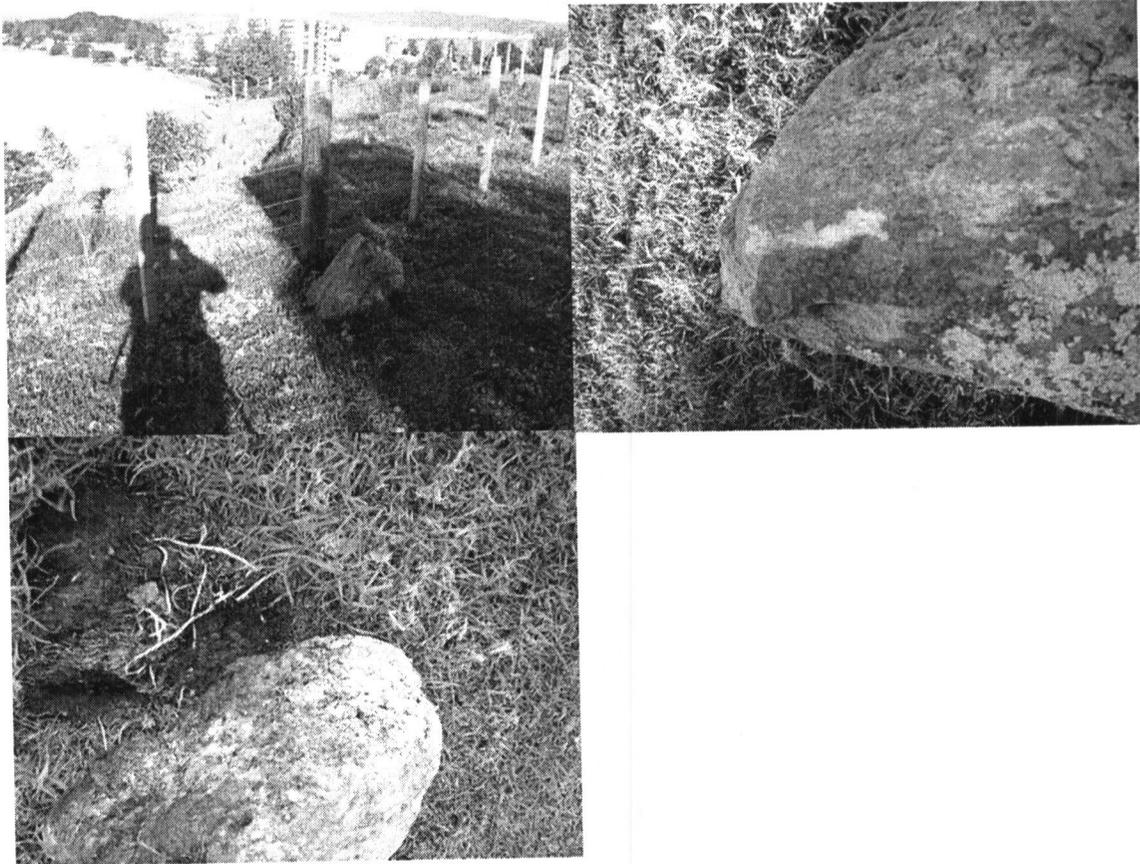
### **Photographs:**

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; Minor shallow slipping continues (slip 34)*

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*Photograph 2 (a,b,c); Surface boulder above slip 34 shows signs of impact and has decaying grass underneath.*

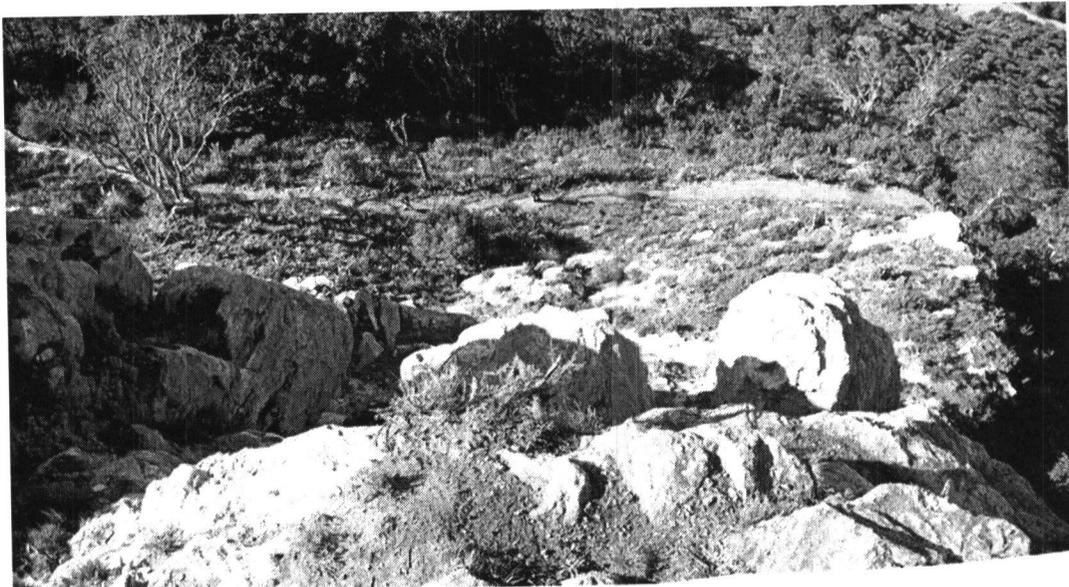


*Photograph 3 (a & b); 18 months after moving 10m this boulder is well embedded again.*

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*Photograph 4 (a & b); Small rocks on the Oruahine track appear likely to have fallen from above.*



*Photograph 5 (a & b); Ongoing scour on the camp bluff.*



*Photograph 6; Vegetation re-establishing on the North Western slopes.*

**Recommendations:**

Very much as per our previous reports:

*Although the rockfall risks 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).*

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- *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 spring (November).

If Avalon can be of any assistance to you with OSH compliant access to steep areas for vegetation management or other purposes then please give me a call.

Regards

§ 7(2)(a) Privacy

For Avalon Industrial Services Ltd.

Attached: Site records for Nov 2006 Slope Monitoring.



**Avalon Industrial Services Ltd**  
**Mauao Survey Benchmark Monitoring**

**9-Nov-06**

**Area 1a; "Camp Bluff"**

Installed post blasting, November 2003

1a The Camp Bluff



Distance measurement mm

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

**Area 2a; "Blasted Column"**

Installed post blasting, November 2003

2a Column



Distance measurement mm

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

Area 2i; "Elephants Joint"

Installed March 2003

2i: Elephant's joint



Distance measurement mm	
Mar-03	2885
Nov-03	2884
Jan-04	2882
Nov-04	2882
Mar-05	2887
Dec-05	2887
Mar-06	2887
Nov-06	2887
Jul-07	2885

12 → 13

Area 3a; "North East Bluff"

Installed March 2003

3a: North top



Distance measurement mm	
Mar-03	8110
Nov-03	5050
Jan-04	4874
Nov-04	3581
Mar-05	7488
Dec-05	8129
Mar-06	8129
Nov-06	8135
Jul-07	8130

14 → 17  
15 → 17  
16 → 17  
15 → 16  
15 → 14

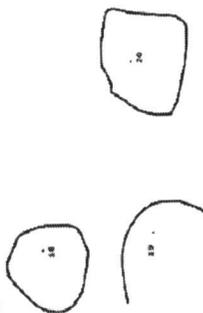
Distance measurement mm	
Mar-03	8110
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Mar-05	7488
Dec-05	8129
Mar-06	8129
Nov-06	8135
Jul-07	8130

\*EDM

Blocks above Area 3d: "North Promontary"

Installed March 2003

Block 3d



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

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

Zone 6 Boulder 6b

Installed December 2005

		Dec-05	Mar-06	Nov-06	Jul-07
23 (LH outcrop)		7560	7590	7615	7663
	21 (boulder)	5799	5830	5865	5999
21	→				
21	→				