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GEOTECHNICAL

Tauranga District Council
Private bag 12022
Tauranga

15 April 2021
Avalon Project #21212

For the attention of [REDACTED] s 6 - Maintenance of law

Dear [REDACTED] s 6 - Mai

Mauao Slopes; Final Report for March 2021

The rock bluff survey benchmark monitoring was carried out on the 23rd March.

The site geotechnical walkover inspection was delayed due to bad weather, was carried out on the 8th and 9th April

1. Reported rockfall since previous monitoring

We understand that there has been no rockfall reported to the ranger's office or campground since our previous monitoring.

2. Note on monitoring along new fencelines

In recent years many of Mauao's old fencelines have been renewed, also new fencelines have been installed.

New fences are useful to the rockfall monitoring program in that they give us a starting point to look for evidence of rockfall impacting fences – bent wires and rocks lying alongside and likely caught by the fences.

It would be usefull if we could create an ongoing record of the dates that fencelines were installed.

3. Naturally triggered rockfall evidence found on tracks and fencelines

As part of each monitoring visit we walk one or two fencelines looking for evidence of rock impacts.

The following photographs show rocks caught on a high fenceline between the bush and paddocks above the Southern side of the Campground, around the 70m height contour.



Photo 1; Rock against fence at 70m contour above the Campground.



Photo 2; Second rock against fence at 70m contour above the Campground.

4. Evidence of persons throwing rocks from the Oruahine Bluffs

The following photographs were taken near monitoring photo location C, in Zone 4. This is on the upper bluff crest directly above the Oriahine track.

Rocks going over the edge in this location could pose an **extreme hazard** to anyone on the Oruahine track below. Rock here can impact the track from freefall.



Photo 3; View down from bluff crest to top of a rock column.



Photo 4; Fresh rock on top of column – detail in centre of photo 3, above.



Photo 5; Fresh digging at crest. Column top in 3. is visible centre right.

It appears very likely that rocks have been dug from the crest and deliberately thrown to target landing on top of the column!

A number fresh looking empty alcoholic drink cans were littered in the vicinity.

We have previously seen collected piles of rocks and scars where rocks may have been dug but this is the first time since 2003 that we have come across such clear evidence of persons having been stupid enough to deliberately thrown rocks over the high bluffs!



Photo 6; Scar from dug rock and a small collected group of rocks as found.

5. Ongoing erosion exposing minor rockfall risks at the Base Track

Around the Base Track there are a number of locations where small cut slopes have relatively small rocks exposed in marginally stable positions a few metres above the track.

This occurs as part of the natural erosion process and although they do not present a great hazard they are relatively very easy to scale. Very targeted light hand scaling is recommended occasionally to eliminate the worst of these.



Photo 7; Small rocks immediately above the Base Track.



Photo 8; Small rocks immediately above the Base Track.

6. Reopening of the Goat Track

Just to note that the steep "Goat Track" which connects the Western Base Track to the 4WD Track is now reopened to the public and will be monitored.

7. Driven pins to indicate and restrict movement of a boulder on the lower slopes above the campground

In December 2020 s 6 - Maintenance of I reported a boulder in a marginal looking location above the Northern Campground area, around the 25m height contour.

As part of this monitoring visit we installed three RB25mm driven bars, each 3m in length. These will indicate if there is any movement and help to stop movement. They will be checked at future monitoring visits.



Photo 9; 3m long 25mm diameter pins driven in front of boulder.

9. Unusual void discovered on the lower slopes above the campground

Around 7m south of the boulder reported in 8, above, there is a collapsed sinkhole / void, around 2m in depth, 1m in diameter.

Inspecting the base of this void there appears to be a continuation into the colluvial slope, around 0.4m high by 0.4wide.

The continuation appears to turn right approximately 2m in, possibly also continuing to the left



Photo 10; 2m deep 'sinkhole' / void collapse



Photo 11; 'Tunnel' into slope from base of collapse hole.

What has created this feature is unknown. There were no signs of flowing water or animal tracks.

The springs that issue from the lower colluvial slopes around Mauao indicate widespread underground water movement. Underground drainage routes will tend to form at levels where sandy, relatively permeable colluvium, overlies impermeable clay (weathered volcanic ash) layers.

It is possible that the 'piping' effect, scouring out sand, has created open 'pipes', 'passages'.

We have observed this soil scarp feature on past visits but it appears recently enlarged. It was previously assumed to be a surface feature, possibly above a spring though we never moved vegetation to inspect its base in detail.

The general location is a revegetating slope, separated from the public by a new fence line, however, being relatively close to the campground it is possible that children could find it. Attempting to enter it obviously would present a very serious hazard.

We would recommend we revisit and use an inspection camera (on extendable fibreglass poles) to determine if the tunnel continues beyond that currently visible and then temporarily block it to prevent entry.

Avalon routinely carries out confined space works, including rock and soil tunnel access.

10. Scaling works undertaken since previous monitoring

In November 2020 at s 6 - Maintenance of request Avalon successfully scaled an area above the Oruahine Track known to be particularly hazardous since 2017.



Photo 12; Marginally stable rock above the Oruahine track has now been removed.



Photo 13; Some of the rock in Photo #12 stopped on the Oruahine track.



Photo 14; A few of the larger blocks crossed the Base Track

Some of the larger rocks continued rolling and bouncing down the slope.

A few of the larger rocks crossed the Base track, coming to rest on the shoreline.

Immediately after scaling above the Oruahine track the team moved on to scale the scoured slope face above the mid western Base Track.



Photo 15; Scoured slope face above the Western Base Track.
Fresh rocks are regularly exposed on this slope as the natural weathering process proceeds.

Avalon's team cleared the least stable, 'loose' surface rock.



Photo 16; Rock removed from scoured slope face above the Western Base Track.



Photo 17. Rock removed from scoured slope face above the Western Base Track.

5. Photographic Survey

At each monitoring visit we take many photographs at 13 locations/viewpoints to document changes in erosion and vegetation on Mauao. To follow are a sample comparing November 2018 with this visit, March 2021.

The detail in the following dhow examples of small scale natural changes as vegetation grows and erosion removes soil, exposing rock fragments, some of which then disappear as they are washed over/fall down the slopes.



Photo 18; 2018



Photo 19; 2021



Photo 20; 2018



Photo 21; 2021



Photo 22; 2018



(±1617m)

Photo 23; 2021



Photo 24; 2018



Photo 25; 2021



Photo 26; 2018



Photo 27; 2021

6. Climbing anchors removal

Since 2003 we have been aware of the hazards posed by rock climbers on the very loose slopes on and above the crest of the bluffs above the Oruahine Track.

The marginally stable surfaces above this track section contain much surface rock and are subject to ongoing weathering and scour.

The rockfall triggered by climbers disturbing the loose rock in this vicinity has long been identified as likely to be one of the higher rockfall risks on Mauao.

In July 2020 Mauao's Joint Administration Board, Nga Poutiriao o Maua decided not to approve the use of sport rock climbing routes on Mauao.

We understand that TCC very recently used an arborist company to remove the "hangars" and disable the protection anchors on these rock faces to discourage future climbing.



Photo 28; Climbing routes with hangars still in place on 8 April.

During this inspection we noted that hangars still remained on some climbing routes, particularly on the Southern Oruahine Bluffs

7. Bluff survey

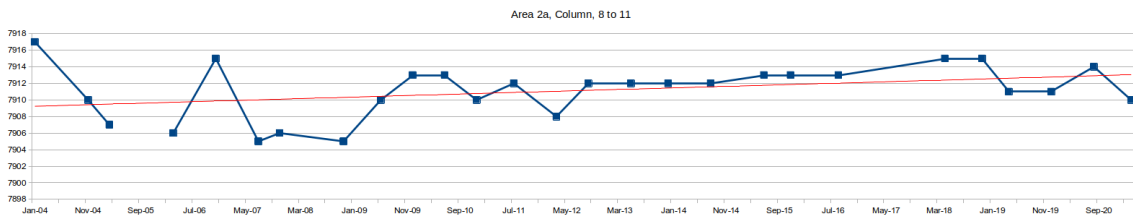
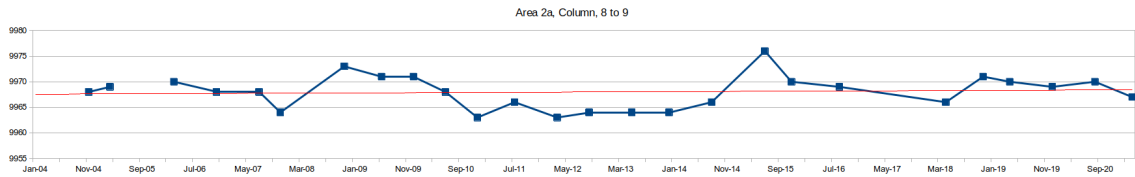
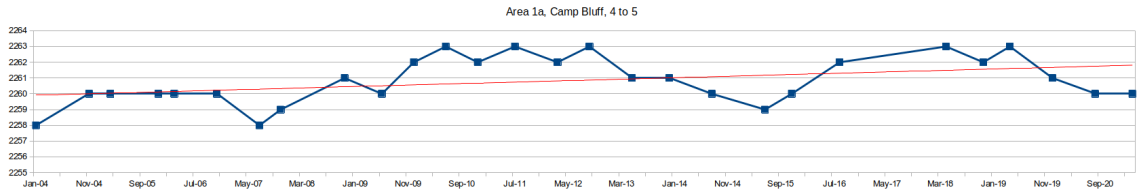
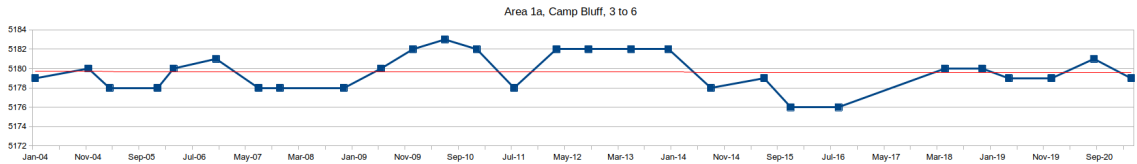
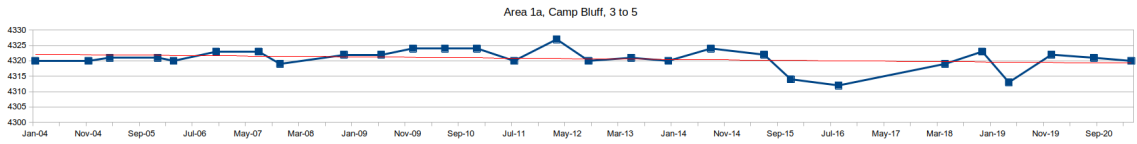
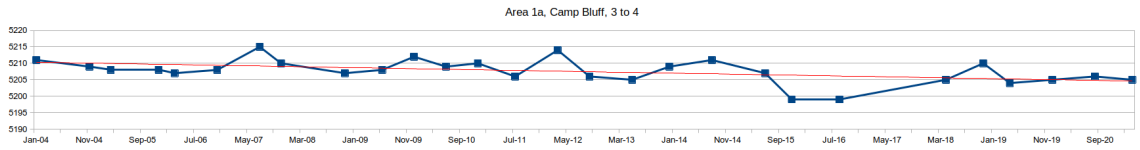
The benchmark survey found no significant recent movement on the high bluffs which are monitored. The ongoing very slow movement of some bluffs continues. Plotted data is appended to this report.

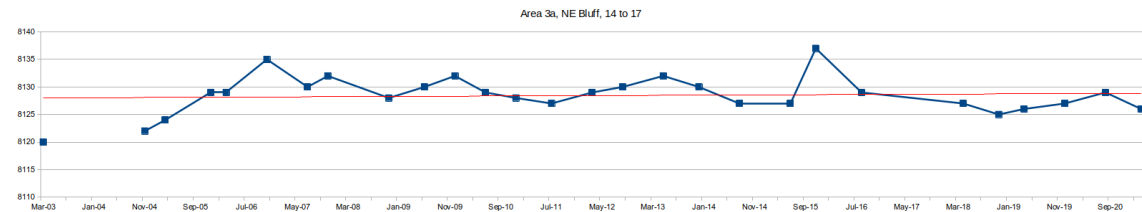
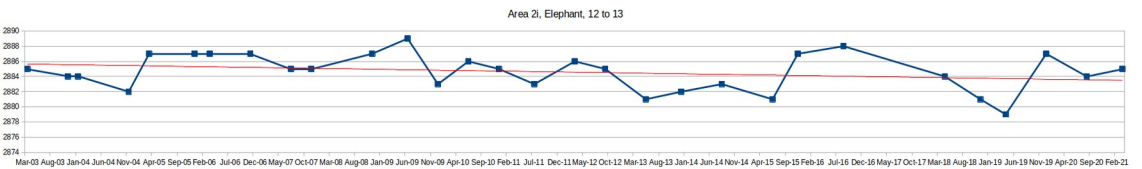
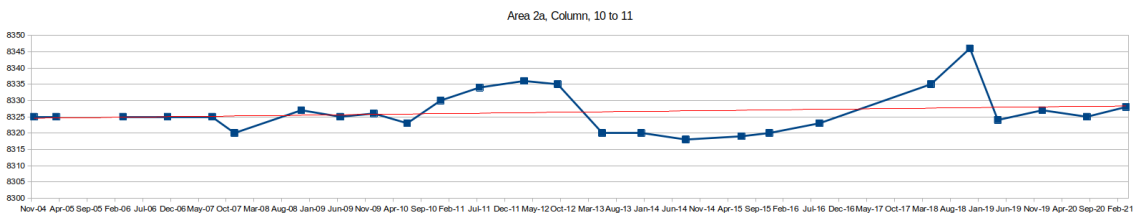
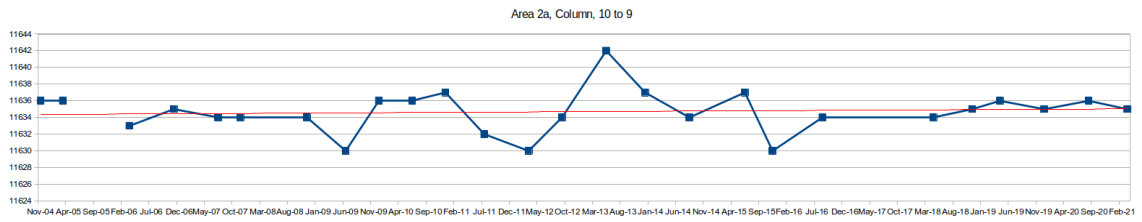
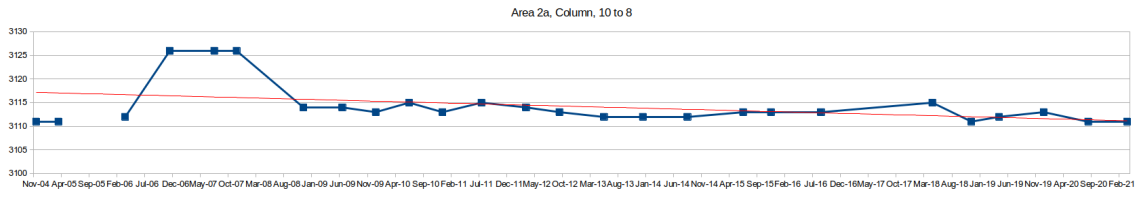
If you have any queries please don't hesitate to contact me.

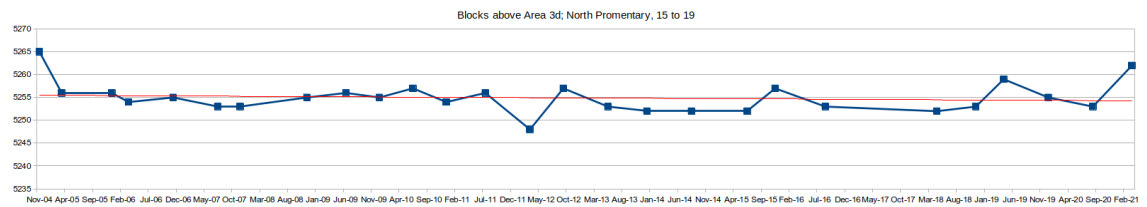
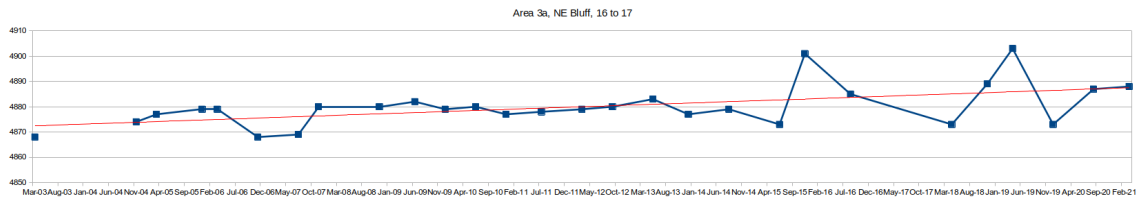
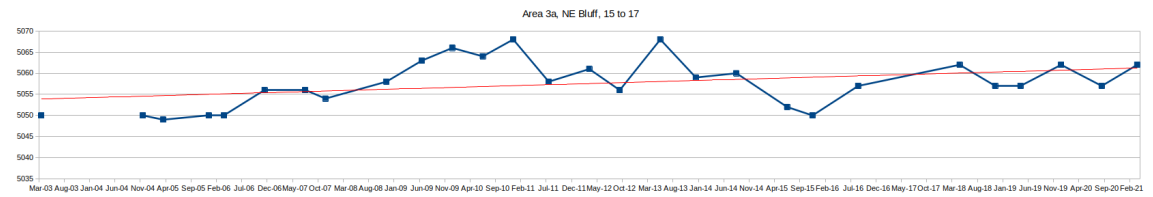
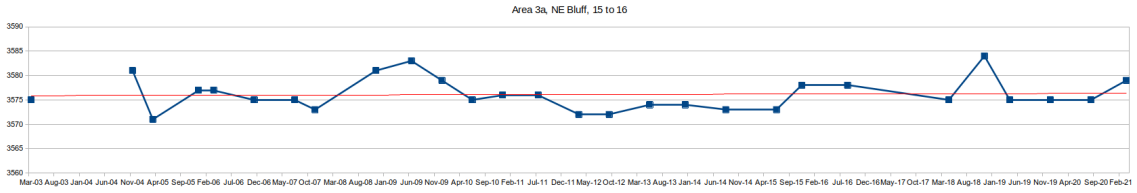
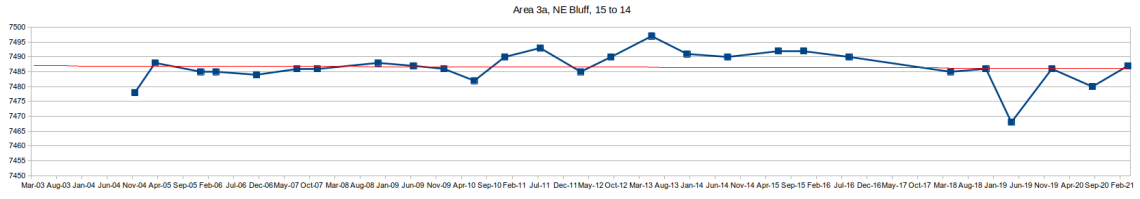
Regards

s 7(2)(a) - Privacy

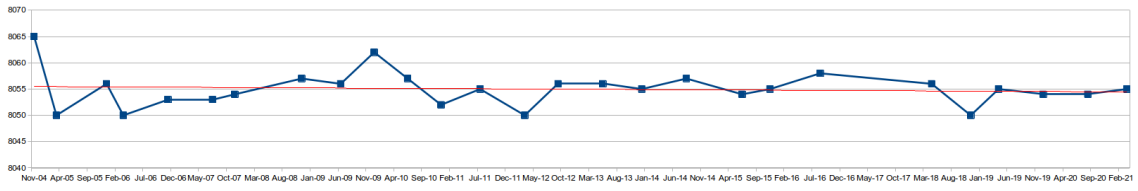
Appendix 1; Rock bluff EDM Survey Data



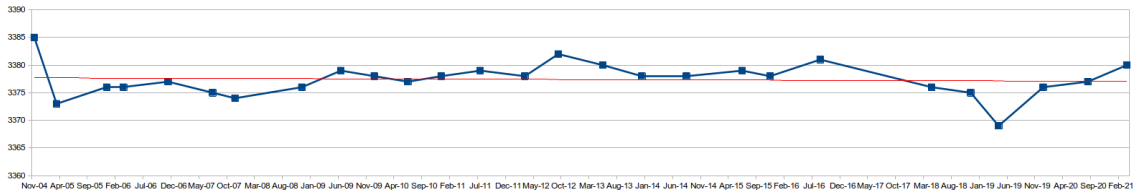




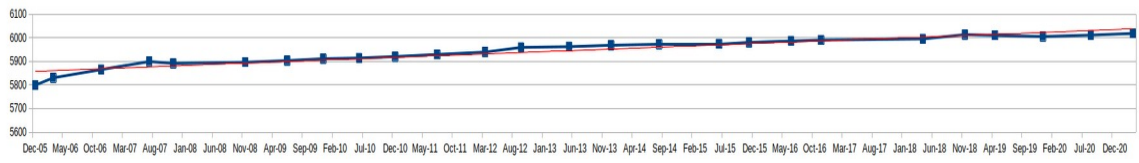
Blocks above Area 3d; North Promentary, 20 to 15



Blocks above Area 3d; North Promentary, 20 to 19



Zone 6 Boulder, 6b, 21 to 22



Zone 6 Boulder, 6b, 21 to 23

