

Mauao Landslips – 29 January 2011

Concept Remedial Options for Large Slips
affecting the Base Track

Presentation to:
Mauao Steering Group - 03 March 2011



Background

- Landslips occurred on 29 January 2011
- Initial Inspection by TCC staff - 30 January 2011
- Inspection by Tonkin & Taylor Ltd - 01 February 2011
- Presentation to Mauao Steering Group - 03 February 2011
- Landslips Classified by size:
 - 22 Minor (<1m³ debris)
 - 20 Small (1 to 5m³ debris)
 - 14 Medium (5 to 20m³ debris)
 - 7 Large (20 to 100m³ debris)
 - 2 Major (>100m³ debris)





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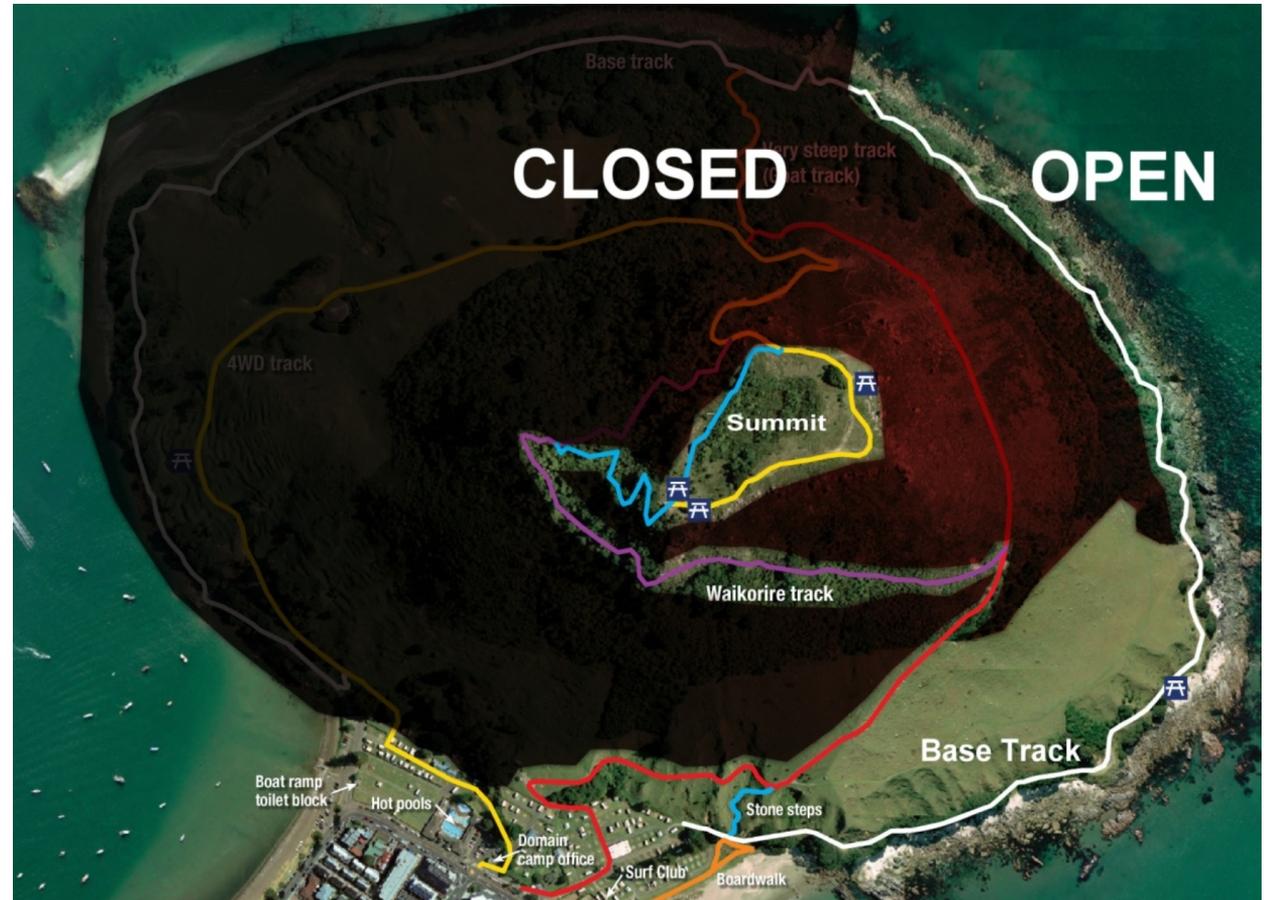
Mauao Base Track Large Landslips



Progress to Date

Re-opened 11 February 2011

- Base Track (ocean side)
- Stone Steps
- Lighthouse Track
- Wakorire Track
- Summit Track



Progress to Date...continued

- Four Wheel Drive Track – re-opened 28 February 2011
- Engineering designs for two Oruahine Track slips completed
 - construction likely to commence 14 March 2011
 - Oruahine Track re-opened by end of March / early April 2011
- Goat Track badly damaged by very large slip - not feasible to repair / re-open in near future (long-term?)





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Base Track – Harbour Side

- Slips to be repaired include:
 - 7 Minor
 - 7 Small
 - 3 Medium
 - 3 Large
 - 1 Major
- Two small slips affect down slope side and require engineering structures to support track
- Minor, small and medium slips all need to be repaired / debris cleared to provide plant access to undertake remedial works on large and major slips





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Base Track Large and Major Slips





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Failure Mechanisms

Slips 3, 4 and 5

Notes:

- Head scarps are up to 12m high, 16m wide with debris run out distances >100m, debris volumes >200m³.
- There are similar size historic slips all around the base of the Mauao – these are nothing unusual





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Remedial Options – Slips 3, 4 and 5

- General Philosophy
 - Ongoing regression of recent (and historic) slips during prolonged and/or intense rainfall events is inevitable
 - Major engineering works required to prevent this – very expensive and major impact on Mauao environment
 - Historic equivalent slips which did not reactivate during recent storm are equally likely to fail in the future
 - Main focus is to keep Mauao accessible and safe to visitors
 - Major slips only likely to occur during / following large rainfall events – temporary track / Mauao closure may be considered during such events?





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Remedial Options – Slips 3 and 4

- Track largely undamaged
- Clear debris from slips, track and foreshore (vegetation, incl. unstable trees?)
- Line scour channels with boulders from slip debris
- Hydroseed and planting on slip scars to reduce visual impact
- Reinstate track and stormwater control
- Include erosion protection measures to reduce risk of future damage to track
- Fence off head scarps or include warning signs where readily accessible to visitors
- Accept risk of future regression of slips and associated damage to Mauao and tracks





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Remedial Options – Slips 3 and 4...continued

- Reduce potential impact of future land slips
 - Include a debris barrier (rock/soil bund or timber posts) with stormwater control
 - Cross section of Slip 3 showing debris bund / timber poles with vegetation
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- Reduce likelihood of further significant slope failures
 - Cross section of Slip 3 showing head scarp regraded to 1V:2H and removal of trees?





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Remedial Options – Slip 5

- Track badly damaged
- Reinstatement of track requires significant engineering works:
 - Retaining structure to support track – down slope side high (7-8m), steep and unstable
 - Concrete crib wall
 - Gabion wall
 - Anchored timber wall
 - MassBloc wall, rock protection
- Cross section through Base Track showing crib wall option





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Remedial Options – Slip 5

- Trimming back slope difficult (access), destructive (large number of mature trees)
- Allow future failures to occur but reduce risk to track / visitors

Footbridge

Plan view of footbridge
possible locations

Concrete culvert

Cross section of track
showing outfall





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Remedial Options – Slip 5...continued

Option	Advantages	Constraints
Footbridge	<ul style="list-style-type: none"> • High level of safety • Built off site – short timeframe • Minimal works to slip required • Less disturbance to natural system • Feature / Aesthetic • Education • Re-use boulders to line channel 	<ul style="list-style-type: none"> • High Cost • Foundation construction • Future maintenance / inspection costs • Aesthetic
Culvert	<ul style="list-style-type: none"> • Reduced risk to users • Minimal works to slip required • Less disturbance to natural system • Minimal maintenance • Availability of existing culvert(s)? 	<ul style="list-style-type: none"> • High Cost • Construction of gabion walls or similar to support track either side of culvert • Rock protection below to dissipate stormwater runoff • Future maintenance – debris clearance • Aesthetic • Requires hand rail
Retaining Structure	<ul style="list-style-type: none"> • Minimal maintenance 	<ul style="list-style-type: none"> • High Cost • Safety – doesn't reduce potential risk from future slips • Import of materials to site • Requires hand rail





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Slip 6

- Loss of surface material from existing slip – 24m high, very steep (50-60°), 12m wide
- Immediately adjacent to track, but track not badly damaged
- Remedial options
- To achieve an equivalent level of safety as prior to 29 January 2011
 - Minor works including scaling of slip face, debris clearance, track reinstatement, hydroseed to reduce visual impact
 - Can be completed quickly to re-open further section of Base Track to Slip 5

