

23 May 2023

Tauranga City Council  
Private Bag 12022  
Tauranga 3143

Attn: [REDACTED]

Dear [REDACTED]

**WSP Memo TCC Slip Inspections - Category 1 Geo Professional Review**  
(Our Reference: 22463.000.001\_01)

## 1 Introduction

ENGE Ltd was requested by Tauranga City Council (TCC) to undertake a Category 1 Geo Professional review of the WSP Memorandum *TCC Slip Inspections for Council Reserves*, dated 1 March 2023 (Ref 2-9B559.00). This work has been carried out in accordance with our Short Form Proposal dated 4 March 2023 (ref. P22463.000.001\_01).

## 2 WSP Memorandum

The WSP memorandum appears to have been prepared to advise TCC of immediate risk to people or property as a result of recent landslips within local reserves following a period of intense and / or prolonged rainfall, and to advise possible remediation options.

WSP inspected the following sites at the request of TCC during the preparing the memorandum:

- Mauao Campground
- McLaren Falls Park
- Te Auhi Pa
- Wharepai Domain

During our review, we visited the above referenced sites to observe the specific landslip features referred to by WSP, as well as the surrounding landform.

This letter has been separated into sections related to each site in keeping with the format of the WSP memorandum.

### 3 Mauao Campground

The WSP memo indicates a long tension crack had developed near the edge of the walking track above a group of campground cabins. The walking track extends along the crest of a steep slope, around 5 m in height, with evidence of overland flow and ponding of surface water near the crest and toe of the slope during the WSP site visit on 31 January 2023.

Ponding of water was observed on the walking track and at the toe of the slope below it during our site visit undertaken on 16 February 2023. We also noted evidence of slow creep of the slope and potential instability in the lower parts of the slope.

As outlined by WSP there is a localised depression above the walking track which is able to function as a collection point for water to pond and is likely to focus the discharge onto the affected area. WSP recommended filling the tension crack with bentonite clay, which appears to have been completed prior to our ENGEO site visit. This is a suitable short-term measure to reduce the infiltration of water into the slope.

We agree with the WSP recommendations that additional geotechnical site testing and slope stability modelling will be required. However, there is evidence of slow creep of the slope and potential instability in the lower parts of the slope. Given that there is a desire to place a cabin back at the toe of the slope, life safety must be considered. It is likely that landform modification to promote the flow of water away from the affected area and construction of a retaining wall will be required at the toe of the slope to provide extra protection to the cabins and allow for the site below the tension crack to continue to be used for holiday accommodation or camping. An alternative solution may be to buttress the slope; however this may result in the loss of use of that area of the holiday park.

### 4 McLaren Falls Park

#### 4.1 Road Slump

The WSP memo notes a large arcuate tension crack has occurred on the access road to the Waterfall Loop track within the McLaren Falls park. WSP conclude that the crack has likely formed as result of overland water flow and elevated groundwater level, resulting in slope movement.

ENGEO visited the site on 8 March 2023 and noted that the small fence beside the tension crack had not moved and so it is unlikely that slope instability is responsible for the movement. From our site visit it appears that the road has been built on fill material, with a steep bluff to the east and a small stream to the west. Historical aerial imagery indicates the road is likely to have been built in the 1970s. A culvert is located at the site which appears to move water from the bluff side of the road to the stream. A small swale to the east of the road appears to direct the water away from the road and toward the culvert. We noted there are several depressions across the road and that the tension crack appears to align with the culvert. It is not clear exactly how the road embankment has been built; however, it is likely that the tension crack is a result of settlement in the fill embankment material and / or due to piping around the culvert.

We recommend that intrusive geotechnical investigations are undertaken to determine the embankment material and develop a suitable solution. Solutions may include simplified works such as lining the culvert and reinforcing the entry and exit areas and / or could require excavation around the culvert to improve drainage and stabilise the pavement.

## 4.2 Hamilton Point

The WSP memo describes two slip failures that have occurred at the Hamilton Point campsite. The description of the failures is consistent with the typical types of debris flow failures that can occur in steeply graded Tauranga ash materials when they become saturated. WSP indicated that there was evidence of seepage at the toe of the slope. The two slips are likely a result of overland flow in combination with the loss of strength resulting in significant slope vacation.

Generally, the Tauranga ash sequence can stand steeply when protected from water. Remediation by way of benching or by retaining as suggested by WSP may be suitable for reinstatement of the walkway below the camping area. We also recommend that a setback from the slope crest should be considered to avoid placing campers at risk of slope failures following heavy rain. The provision of stormwater controls to move water away from the slopes and direct it elsewhere is also recommended.

## 5 Te Auhi Pa

WSP describe in their memo a debris flow failure that has occurred from the Te Auhi Pa site damaging a boundary fence and inundating the garage of a neighbouring property, travelling around 70 m in total. The larger head scarp of the Te Auhi Pa site is noted on TCC GIS database as being a relict slip. WSP note that significant overland flow is likely a contributing factor with seepage occurring at the toe of the slope.

This debris flow was a mid-slope failure, and thus larger failures could occur. ENGEO visited the site on 14 February 2023 and noted that there is evidence of pumiceous material at the toe of the slope which could be controlling the seepage and wider slope stability. Debris flow failures are typical for the area and likely to be a frequent issue. We agree with the recommendations from WSP that recontouring the damaged area and planting this out is a suitable option to stabilise the slope. However, other options may also be considered such as a debris collection fence / barrier, a debris bund, or localised remedial earthworks.

## 6 Wharepai Domain

WSP note that the landslide at the Wharepai Domain is located at the crest of the slope beyond existing fencing with the debris travelling to the traffic barriers on Takitimu Drive below. The slip appears to have occurred within the Post-Rotoehu and Rotoehu ashes above the less permeable Hamilton Ash.

During our site visit we noted that the Hamilton Ash does not appear to have been affected and provides a shelf below the slip. A significant amount of end tipped concrete is present at the site and small tomo are evident throughout the slip face. A stormwater sump is present above the slope, with no piping to this sump evident from TCC Mapi. The sump is listed as low criticality and it is not clear if it is still in service. There is evidence of overland flow on isolated parts of the slope around the slip zone with no evidence of water having pooled above the slope. There is clear water scour damage further south in the Domain along the path leading from the grandstand to the athletics track start area, which does not continue down to the failure area.

This failure is likely to be a combination of overland flow destabilising the surface and internal pore pressures in the Rotoehu ash causing piping. All overland flow should be controlled above the slope and directed to a suitable disposal area. The slope may require regrading with erosion protection added (non-woven geotextile and rocks) and / or retaining depending on the risk of failure of adjacent material and if there is a need to protect upslope structures / infrastructure.

## 7 Discussion

From our Peer Review, we are satisfied that the WSP memo covers the key aspects of their site visits and some high level / preliminary details for consideration in remediation. We understand this was their brief and it appears to have been met.

The desktop study detail is not provided and should have been clearly outlined as part of the document to support the recommendations, or at least to provide some context as to the history of the landform at the landslip locations. It is unlikely that this would have changed the WSP recommendations though, and it is expected that site specific remedial design will incorporate a desktop study as part of those specific packages.

The final conclusions appear to be of high level and similar for all sites, however there are likely distinct variations in the reasons for the failures at each site.

We agree that site specific geotechnical investigations, analysis and reporting will be required to determine suitable remediation options for each site. We would expect some iteration with TCC on these options for the purpose of pricing, access, practicality, and local / iwi consultation. ENGEO would like the opportunity to undertake these works for TCC.

## 8 Limitations

- i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Tauranga City Council, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.
- ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.
- iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.
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We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (07) 777 0209 if you require any further information.

Report prepared by

Report reviewed by

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