Natural Hazards Risks for Lake Poerua Area

THE WEST COAST
REGIONAL COUNCIL

Regarding proposed subdivision at Lake Poerua

There are a number of risks associated with building and/or development on the shores of the lake, particularly at the western end of the lake. The following list of potential hazards is not ranked or prioritised.

Alpine Fault Rupture

The South Island is overdue for a Richter Scale Force 8+ earthquake with associated 300 kilometre plus rupture of the Alpine Fault. This is not a "might be" – it is extremely likely to happen within the next 100 years. See *"Probability and Consequences of the next Alpine Fault Earthquake",* Yetton & Wells, 1998 *(hereafter referred to as Yetton)* and GDC Alpine Fault Lifelines Study Report (draft 2005).

Projected fault rupture would tear apart any building built astride the fault when the earthquake event occurs: there will be up to 1m uplift on the Pacific Plate (up) side of the noticeable fault scarp in the Poerua area and up to 8m sideways movement on Australasian Plate (down) side.

Therefore very careful location of the fault trace in the vicinity of the proposed subdivision will be required. Some maps show more than one trace in the area (see section of the Kumara - Moana Geological Map 1999, GNS 1:50,000).

Anecdotal evidence (local farmers, geologists) suggests there has been some fault movement in this area recently. (Refer Kelvin Berryman, GNS re measurements for a trench across the fault on Harris property (see A4 map marked #).

The level of activity along the subsidiary Granite Hill Fault which joins the AF right by the lake should also be investigated (see map taken from handbook to Kumara-Moana Geology Map 1999).

Severe Earthquake Shaking

In the event of the projected Richter Scale 8+ earthquake dwellings built in this area will be subjected to Mercalli Level 9+ shaking in the event of an Alpine Fault earthquake. Any dwellings built would have to meet required the highest earthquake specifications (probably no two-storey dwellings).

Other Possible Effects

Landslide & Seiche

Landslide off Mt Te Kinga with seiche across Lake Poerua: waves created by a large slump into the lake could inundate/impact on any development on the lake shores. See Yetton p 129, 8.3.5 re effects Buller EQ 1929 for Lake Rotoroa. This needs investigation and the level of risk determined.

Landslide/Gravitational Collapse

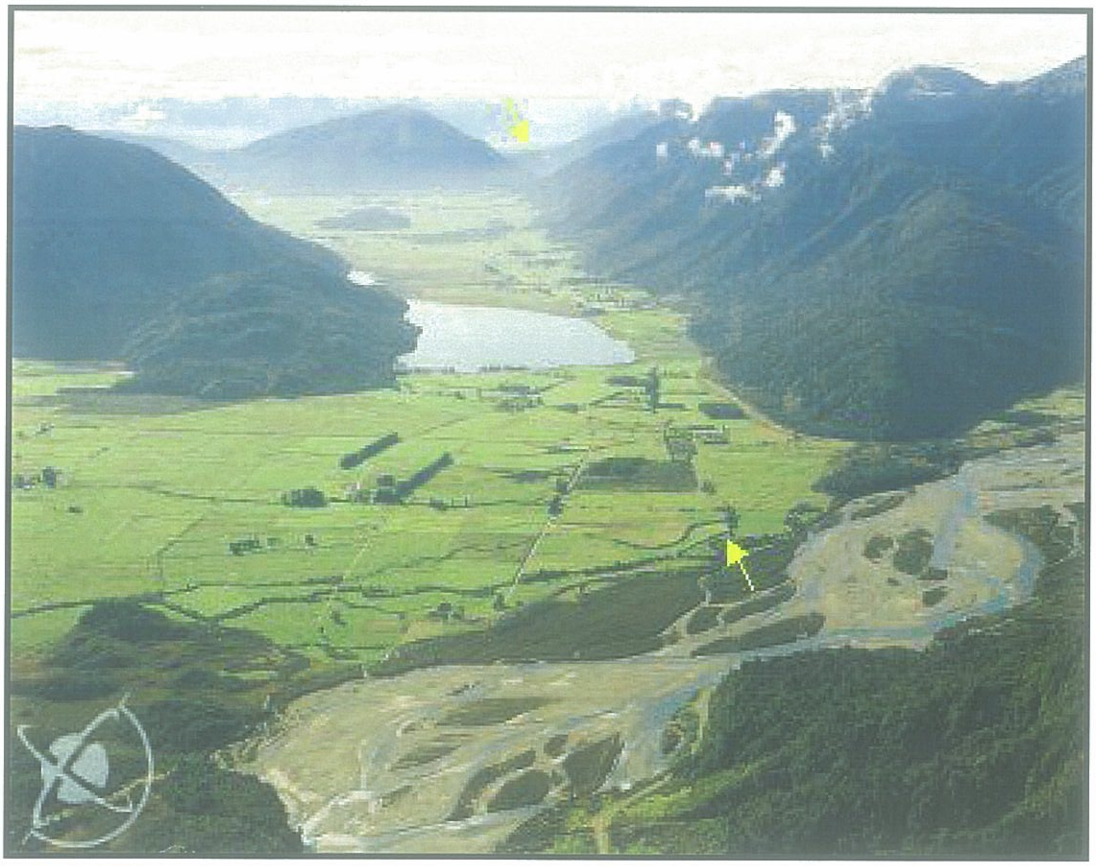
Landslide off the Mt Alexander Range: the bottleneck where the road/rail crosses the fault to pass along the side of the lake between the two mountain areas is a concern. There are landslide debris fans from the creeks coming off the range and there are also two other faults, which branch off the Hope Fault. These run along the Mt Alexander Range parallel to the AF (see A4 Map marked OTHER MAPS). Investigation of or potential for gravitational collapse along the line of the parallel faults and/or landslide from the Mt Alexander side needs to be carried out and the level of risk determined for development at Lake Poerua.

Inundation

Possible inundation from a breakout of the Taramakau River into the Inchbonnie – Mitchells – Lake Poerua area as per Yetton p 133, Figure 8.10. Changes to the level of the Taramakau river bed following an earthquake/ riverbed aggradation/flooding could see the Taramakau re-occupy former flow channels as per this aerial photograph. This needs investigation and the level of risk determined.

Strong Winds

Very strong easterly winds funnel through the gap between Mt Te Kinga and the Alexander Range by the lake at times, mostly in autumn (personal experience of writer was blown over on road by rail crossing).



This photo downloaded from Alpine Fault entry on GNS Active Faults Database.
The yellow arrows show line of fault trace at Inchbonnie – Lake Poerua

Yetton, p. 129-
130. Seiche

It would appear that there is now broad agreement between the most recent analyses and 250 km is a reasonable general guide. Unfortunately no information exists on the percentage of susceptible sediments which are likely to liquefy at given distances but some reasonable inferences can still be made based on the historical record. If we consider the locations in the South Island of main interest in this report we can divide these into three groups based on their likely distance from the epicentral region (Table 8.7)

Defining susceptible soil

Liquefaction is a significant hazard at locations in the first two groups. Table 8.7 makes no assumptions that susceptible soils are present at the sites listed but these locations are in areas where this is definitely possible, and in most cases is likely. The list is not complete but includes typical examples from coastal areas; lake, swamp and river margins; and/or areas that have experienced liquefaction in previous earthquakes.

The only way to determine susceptibility is to carry out site specific subsurface investigation to determine soil size grading; density, and depth to watertable. To our knowledge Christchurch is the only large location where significant information has been gathered. The conclusions from analysis of some of this data confirms that liquefaction is likely in the most susceptible areas tested to date and details of this are included in reports prepared for the relevant Christchurch local authorities.

If liquefaction potential is recognised at a site the options are to pile the foundations, densify or replace soils prior to construction, lower the water table, or avoid the area. For many existing buildings it is frequently not practical to reduce the hazard but for critical structures (hospitals, police stations, and key utilities) remedial work may be justified.

8.3.5 Tsunami & Seiches

Tsunami are seismically generated sea waves produced by submarine faulting, uplift or landsliding. They travel very quickly in the open ocean with little surface expression, but gain in wave height near shore, particularly along gently shelving coastlines and within narrow embayments. The coastline of the west coast is relatively steep and no significant open bays exist, although there are many river mouth settlements. In general the Alpine Fault in central Westland is not expected to produce broad scale submarine uplift or deformation. It is still possible submarine or coastal landslides could be triggered which may produce local tsunami.

In Fiordland the fault continues offshore south of Milford, and rupture in this area, combined with the numerous narrow fiords could combine to create significant tsunami in Fiordland. However the fiords tend to be steep sided and only the head of the embayments would be vulnerable. This could affect the developed area of Milford Sound.

Strong seismic shaking also induces water in lakes to oscillate (or "slop") at a particular frequency controlled by lake size and depth. These oscillations are called seiches and were generated on the west coast during the 1929 Buller earthquake.

Benn (1992) quotes from the Greymouth Evening Star (20.6.1929) an account of damage to Lake Rotoroa and the Gowan River, which drains the west end of the lake:

"Lake Rotoroa rocked from side to side like a huge basin of water being tipped out. Half an hour after the main shake, the water receded from the hotel shore and exposed the lake bed for 50 yards. It then came back in a series of large waves. The bridge over the Gowan River at the lake was torn from its piles and the banks of the river and was hurled upstream. The wrecked structure was carried still further upstream by the Gowan waters, which were temporarily flowing back into the lake."

Lake Moana (Brunner) was also reported to have *"sank down in the middle then come up like a typhoon"* during this earthquake.

In general lake seiches are more likely to cause damage during an Alpine Fault earthquake than are tsunami. These lakes are closer to the area of strongest shaking and there are a large number on both sides of the main divide. On the west coast these include several small northern lakes (Haupiri, Lady Lake etc) but also include the much larger Lake Moana and Lake Kaniere, both with lake-shore settlements and dwellings. There are also numerous less populated lakes further south along SH 6 with generally less potential for material damage (Lake Mahinapua, Lake Ianthe, Lake Wahapo, Lake Mapourika, Lake Matheson; Lake Paringa, Lake Moeraki and Okarito Lagoon).

Of more concern than a shaking induced seiche for Lake Brunner and Lake Kaniere is the more remote possibility of a significant landslide falling into one of these lakes and creating a damaging wave. Both these lakes are very close to the fault trace (7 km and 500 m respectively) and both have steep peaks along their shorelines elevated more than 1000 metres above lake level (Mt Te Kinga, elevation 1204m and Mt Tuhua, elevation 1125m). Hawley (1984) and Benn (1992) also note this possibility.

East of the main divide are the large moraine dammed lakes of the Mackenzie Basin (Tekapo, Pukaki, Ohau) and Lake Benmore. All four are close to the likely epicentral region and seiches are likely to also be created in these. The larger southern lakes (Wanaka, Hawea and Wakatipu) are within 100 km of the fault trace and may also experience seiches although probably to a lesser extent.

8.4 Longer term effects

This section considers the likely longer term impacts which may follow an Alpine Fault earthquake. The time frame for these impacts extends from a matter of days following the main shock up to years or possibly tens of years.

8.4.1 Effects on forests and vegetation

Chapter 4 outlines the evidence preserved in the age structure and growth rings of the current forest which we interpret as indicating the impact of past Alpine Fault earthquakes. Vegetation in general will be killed or damaged immediately by strong shaking, landsliding, and liquefaction; and more slowly in the post seismic period by later rainfall triggered landsliding, aggradation, river channel avulsion and flooding.

Yetton, 8.10.
p. 153

Figure 8.10 - An aerial photo showing the Inchbonnie area and Lake Poerua with the current Taramakua River just visible turning left to Kumara. Note the old channels visible in the air photo heading to the right to the Mitchells end of Lake Brunner (Moana), and also back around into Lake Poerua. The white pointer shows the location of a buried grass sample 1.2 m below the current surface which returned a post 1700 AD date suggesting these channels may be very young. Reoccupation of the these channels following earthquake induced aggradation could result in floodwater from the Taramakua entering the flood prone Grey River catchment.

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X Approximate Trench Area

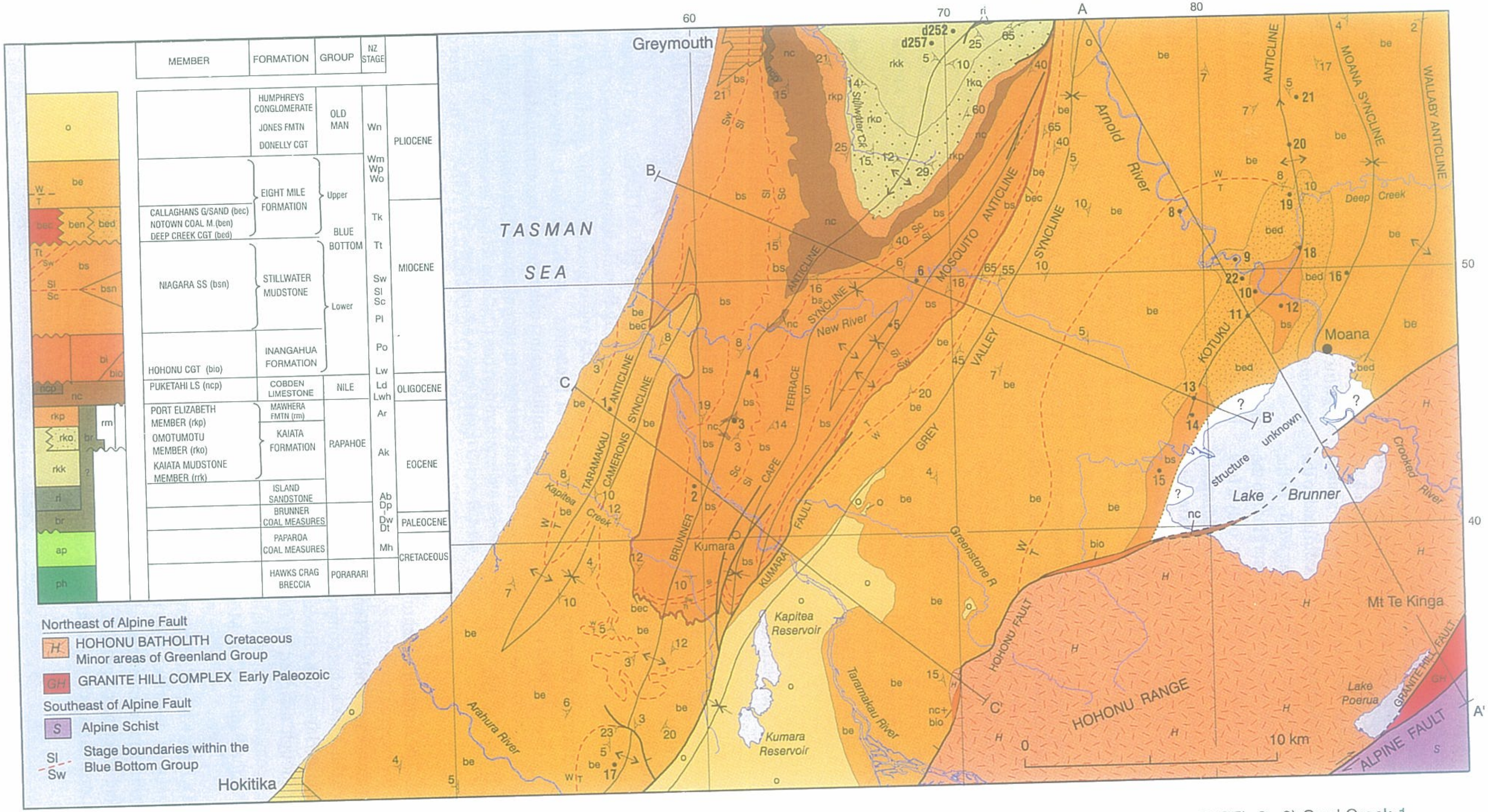

Figure 4.1 Pre-Quaternary geology of the Kumara-Moana district. Oil-prospecting wells: 1) Taramakau-1, 2) Corehole 6, 3) SFL-1, 4) Kumara-2, 5) SFL-2, 6) Card Creek-1, 7) Kokiri-1, 8) Kaimata-1, 9) Aratika-2, 10) Arnold River-1, 11) Glen Creek-1, 12) Taipo Creek-1, 13) Niagara-1, 14) Niagara-2, 15) Hohonu-1, 16) Aratika-3, 17) Kawhaka-1, 18) Corehole 9, 19) Molloys Lookout-1, 20) Mawhera-1, 21) Paddy Gully-1, 22) Corehole 10, 23) Kawhaka-1. These oil-prospecting wells do not include numerous shallow wells close to the Kotuku oil seep.

AF

← other ll fault

← Hope Fault.

OTHER FAULTS

MAPS

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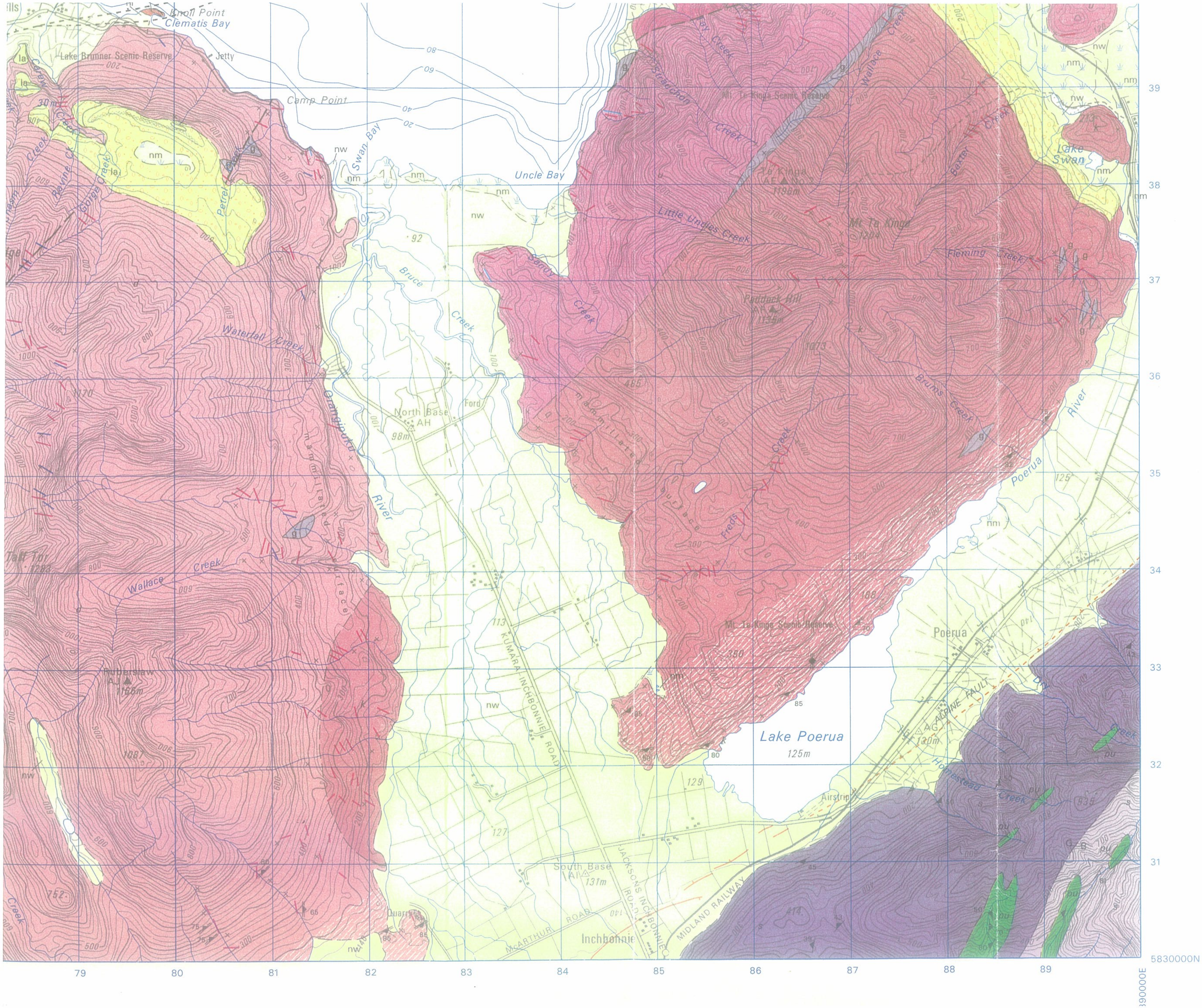
Knoll Point
Clemātis Bay
Lake Brunner Scenic Reserve
Jetty
Camp Point
Swan Bay
Uncle Bay
Petrel Creek
Waterfall Creek
Orangipuku River
North Base
AH
98m
Ford
Bruce Creek
Sandy Creek
Te Kinga
AE
1196m
Mt Te Kinga
1204
Mt Te Kinga Scenic Reserve
Little Uncles Creek
Fleming Creek
Baxter Creek
Wallace Creek
Lake Swan
Paddock Hill
1134m
Bruns Creek
Poerua River
Freds Creek
mammillated surface
Wallace Creek
Tait Tor
1283
Rubertslaw
AJ
1166m
1087
752
KUMARA-INCHBONNIE ROAD
JACKSONS-INCHBONNIE ROAD
McARTHUR ROAD
South Base
AI
131m
Inchbonnie
Quarry
MIDLAND RAILWAY
Lake Poerua
125m
Poerua
ALPINE FAULT
AG
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Homestead Creek
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1:10,000 Based on Topo Maps K32, K33

(Emily Smith Paper 2004
Map 7 Mass Movements & Basic
Geomorphology, Jacksons to
Rotoma

Mass Movement Features

🟥 Landslide Source area, active in the last 5 years.

🟧 Landslide Source area, active in the last 50 years

🟦 Landslide Source area, not active in the last 50 years

🟥 Landslide Deposition area, active in the last 5 years.

🟧 Landslide Deposition area, active in the last 50 years

🟦 Landslide Deposition area, not active in the last 50 years

Note: Dashed lines indicate location and activity as assessed from aerial photographs, where as full lines indicate these were assessed in the field.

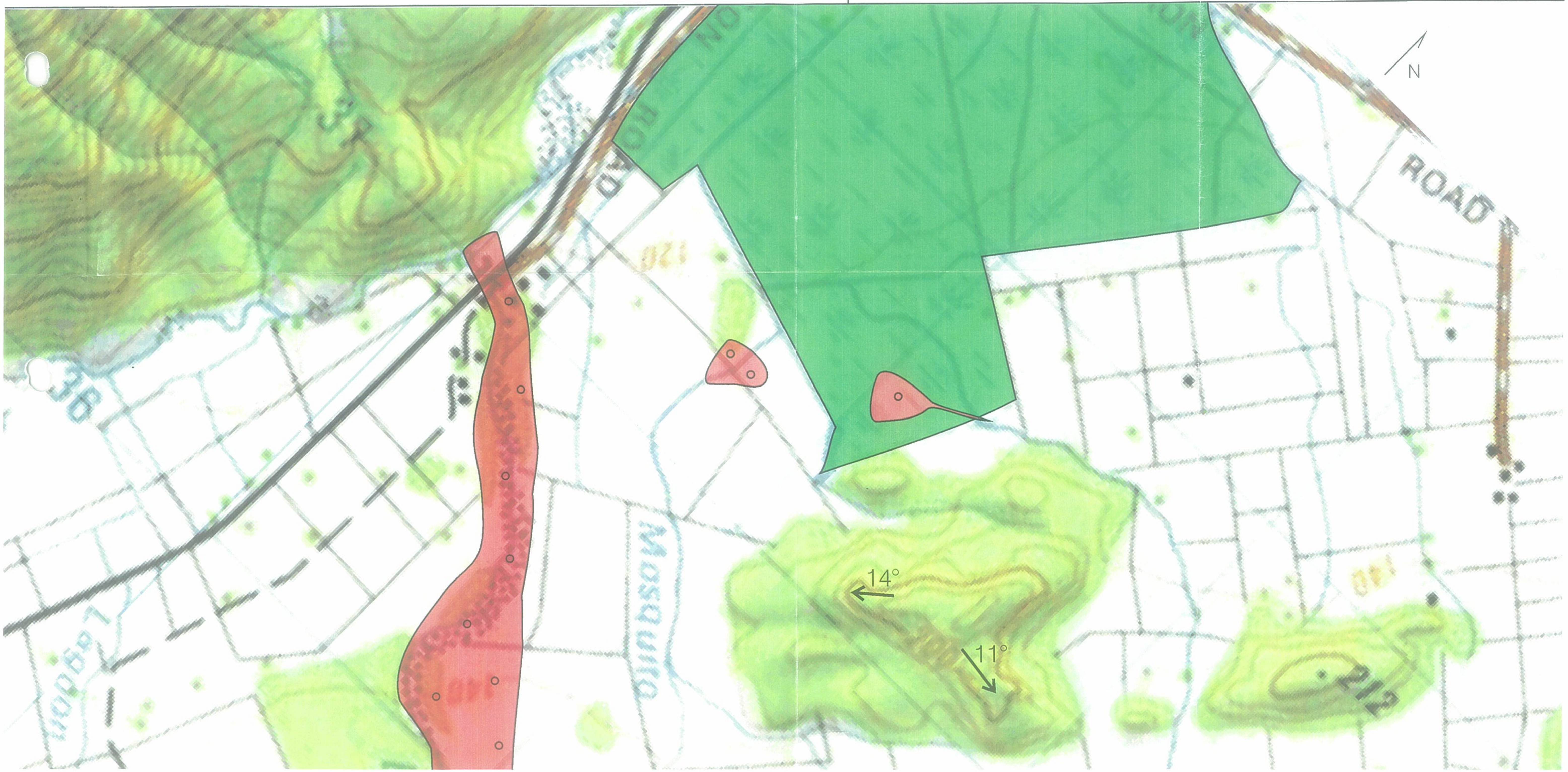
Other Geomorphic Features

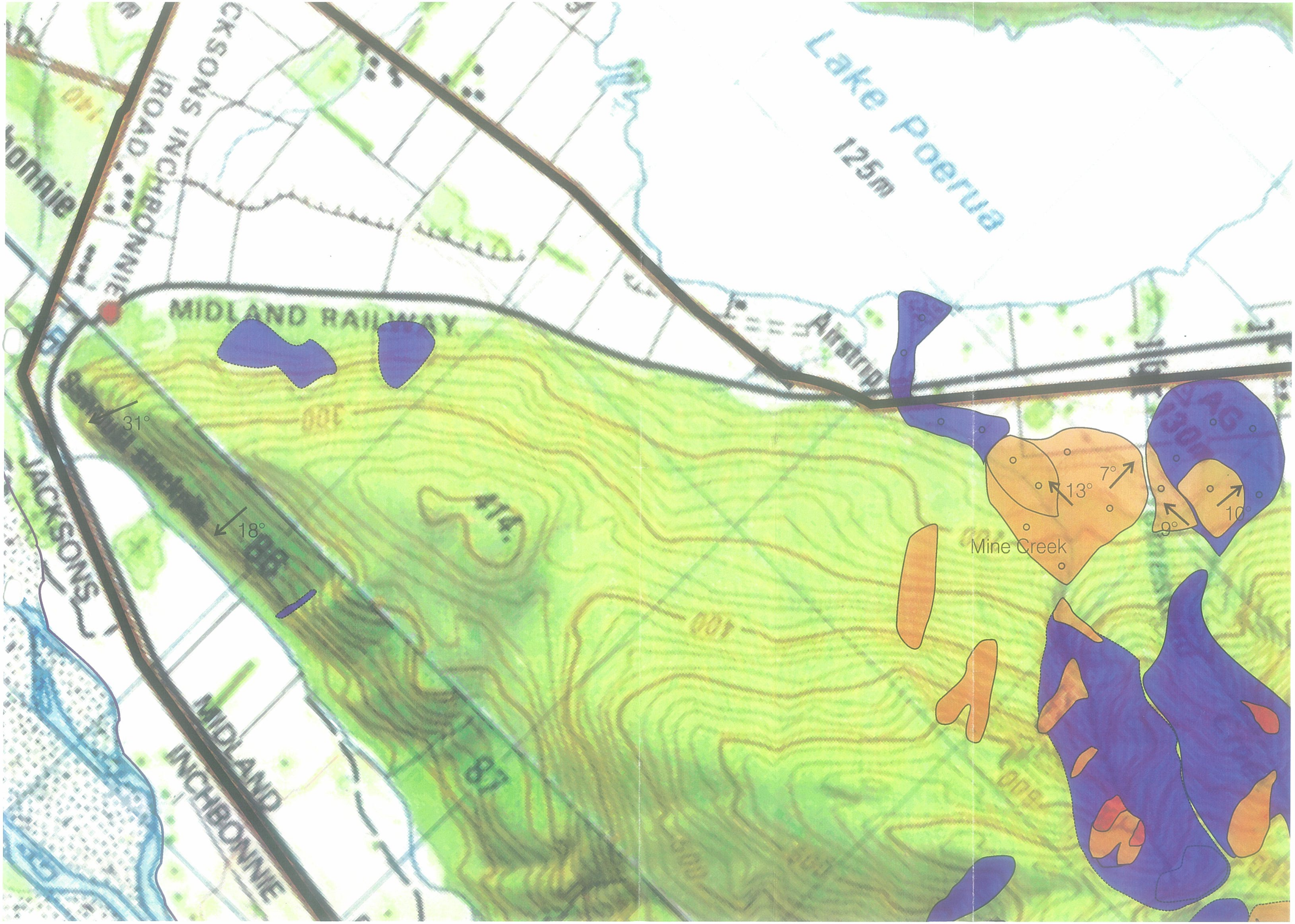
↗ 8° Maximum slope angle, arrow indictes direction reading was taken, number is angle in degrees.

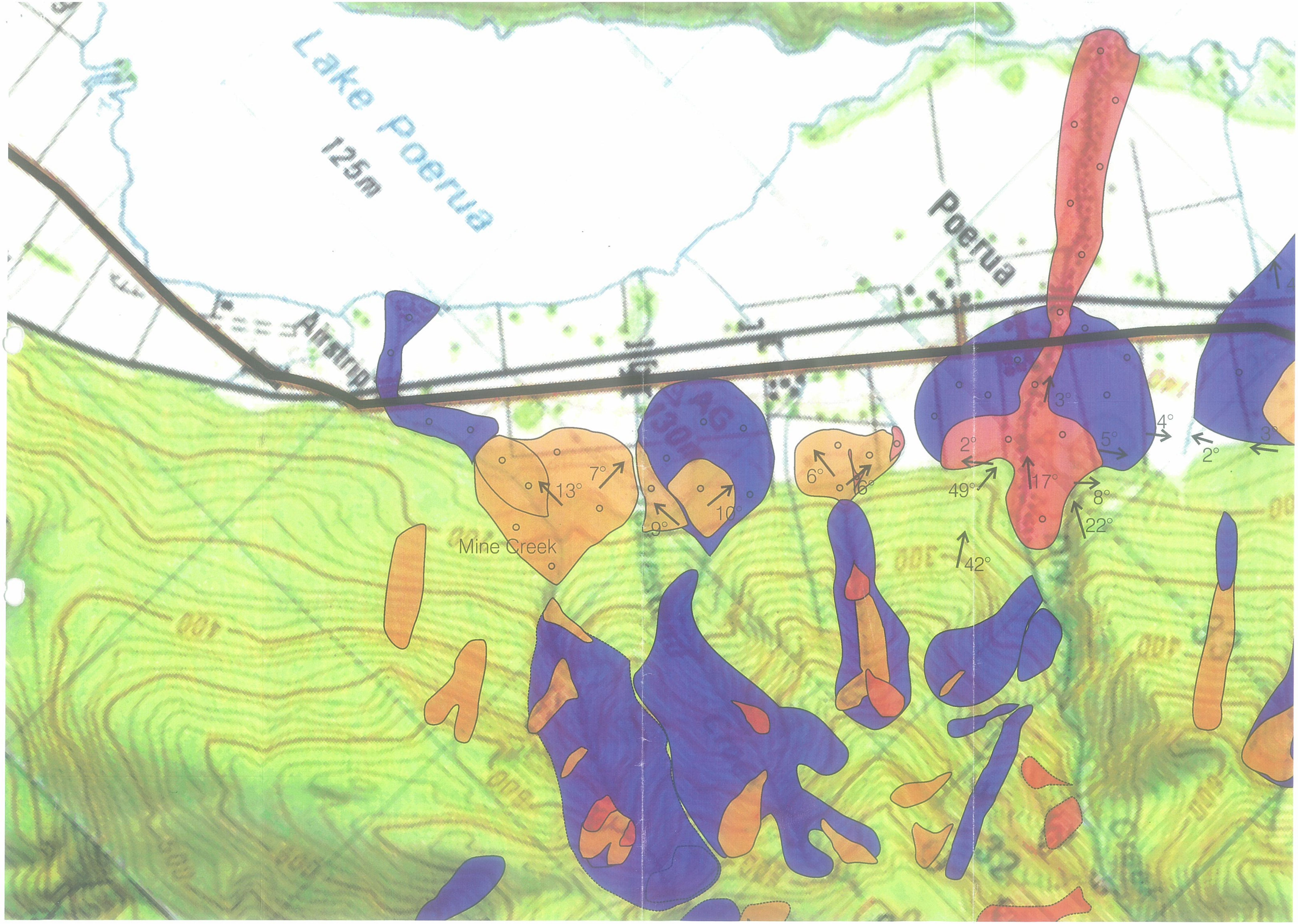
Purple line indicates boundary between active riverbed and flood plain

🟩 Swamp

▢ Alluvial fan




Lake Poerua
125m
MIDLAND RAILWAY
JACKSONS INCHBONNIE ROAD
onnie
140
Airstrip
100
31°
18°
88
87
414
JACKSONS
MIDLAND
INCHBONNIE
100
300
500
400
7°
13°
9°
10°
Mine Creek


Lake Poerua
125m
Poerua
Airstrip
AG
130m
Mine Creek
13°
7°
9°
10°
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16°
2°
49°
3°
17°
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42°
5°
4°
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3°
100
300

Paper References

1. ***Planning for Development of Land on or Close of Active Faults***: A guideline to assist resource management planners in New Zealand: J Kerr and others MFE & GNS, May 2003
2. ***Planning for the development of land on or close to active faults***: A study of the adoption and use of the Active Faults Guidelines: J Becker, W Saunders, R Van Dissen, GNS June 2005
3. ***Probability and Consequences of the next Alpine Fault Earthquake***: M Yetton, A Wells, N Traylen, March 1998. Also see reference section this publication.

People to call on

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* Put out a report earlier this year about active faults and urban planning for Wellington. May be useful for GDC re Lake Poerua proposed sub-division.

Mary Trayes
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7/9/2006

Two other views of Alpine Fault at Lake Poerua – Inchbonnie (courtesy GNS)