5 Geology

The geology of the area generally comprises volcanic rocks and sedimentary soils of the Pliestocene era (1.8 million years to recent). The distribution of these materials is shown in Figure 25 (taken from the DSIR Geological Map of New Zealand 1:250,000 series, Sheet 5 - Rotorua and Sheet 8 – Taupo (Healy et. al 1964)) and described below in order of increasing age.

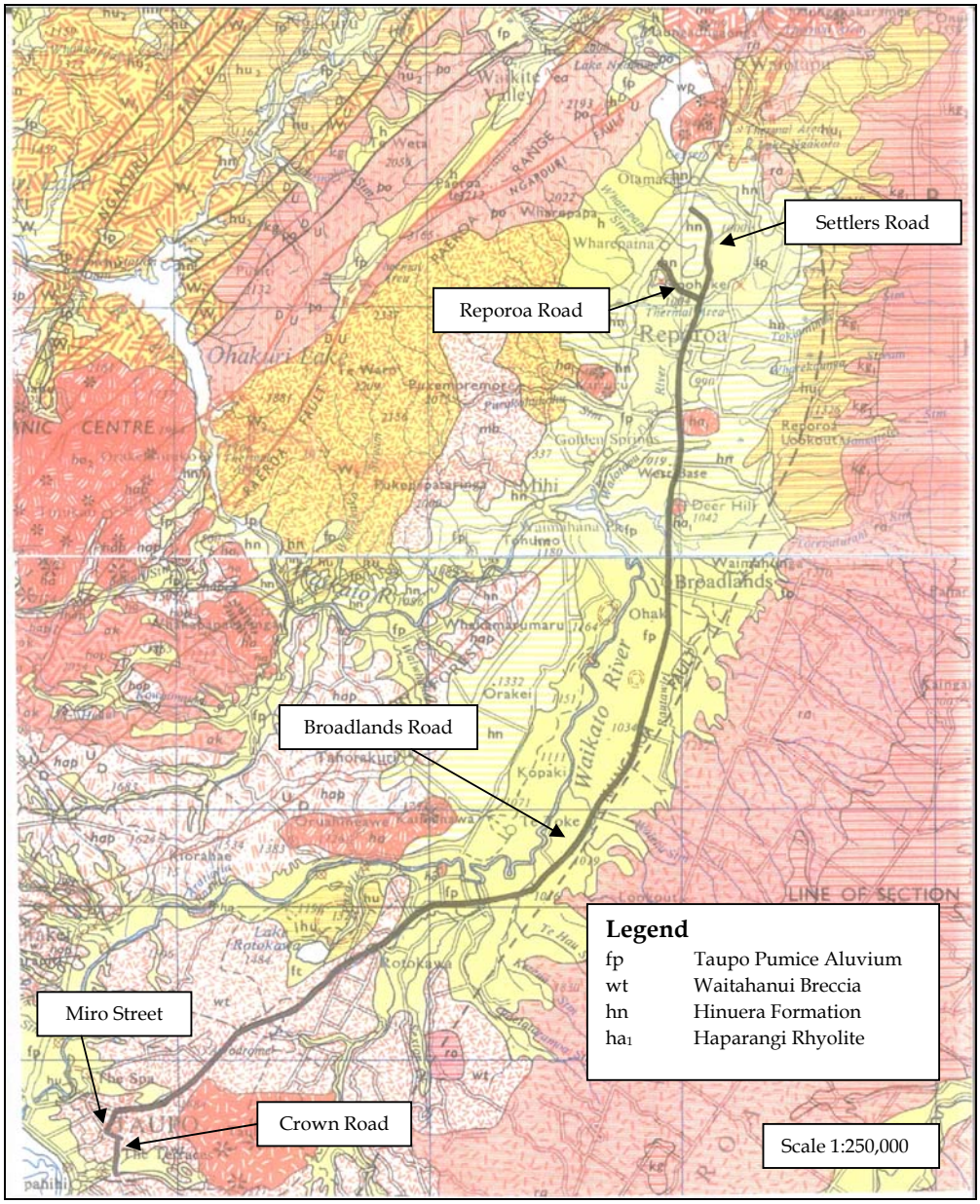

Figure 25. Geology of the study route

The descriptions of the materials the route traverses (largely taken from the Geological Maps (Healy et. al 1964)) are as follows.

(a) Taupo Pumice Alluvium: Pumice alluvium lahar and glowing avalanche deposits. Typically forming flat terrain, infilling the valleys (valley confined) in the Hinuera Formation at this locality

(b) Waitahanui Breccia: Pumice breccia, lapilli tuff and glowing avalanche deposits. Low hummocky and gently sloping terrain

(c) Hinuera Formation: Fluvatile pumice – rhyolite and ignimbrite sands and gravels. Typically low rolling terrain with shallow slope angles

(d) Haparangi Rhyolite: Lithoidal rhyolite, dissected domes and flow. Proximally bounded by younger Hinuera Formation deposits.

Subsection	Route Position (m)	Dominant Geology
Settlers Road	0-1,700	Hinuera Formation
	1,700-5,300	Taupo Pumice Alluvium
	5,300-5,800	Hinuera Formation
	5,800-6,130	Taupo Pumice Alluvium
Reporoa Road	0-2,252	Taupo Pumice Alluvium
Broadlands Road RDC	0-1,800	Taupo Pumice Alluvium
	1,800-2000	Hinuera Formation
	2,000-2200	Haparangi Rhyolite
	2,200-13,800	Taupo Pumice Aluvium with Hinuera Formation forming high points
Broadlands Road TDC	0-11,000	Waitahanui Breccia
	11,000-24,522	Taupo Pumice Alluvium
Miro Street	0-1,053	Waitahanui Breccia
Crown Road	307-2,040	Waitahanui Breccia

Table 38. Geology along the study route

5.1 Faulting, Seismicity and Geothermal activity

The Geological Maps (Healy et. al 1964) show a concealed northeast to southwest trending normal fault, downdropped to the northwest, running adjacent to the alignment at a distance of 1 to 5km. It is thought that this fault is inactive. There are several other active faults within 20km proximity of the alignment.

EW TR96/17 places the study area in Unit A for a Preliminary Ground Shaking Hazard in the Environment Waikato Region. Unit A is the most hazardous with typical amplification of approximately two MMI (Modified Mercalli Index) units. Settlement and liquefaction resulting from seismic activity is common. Areas underlain by Hinuera formation have widespread amplification potential and localised liquefaction and landsliding potential.

The Geological Maps (Healy et. al 1964) show thermally active areas north and west of Reporoa and south of Broadlands. Geothermal activity is evident near Taupo adjacent to Broadlands Road and documented in the TDC Summary of Subsidence Report – February 2003.

Extraction of geothermal groundwater from the Wairakei-Tauhara field has been identified as causing differential settlement in several areas in Taupo. Crown Road and Miro Street are included in the area identified by the Taupo District Council (TDC Summary of Subsidence Report – February 2003). Parts of Crown Road can expect differential settlements of up to 100mm over a 25m horizontal run.

5.2 Landscape and Topography

Generally the route follows the near level plains formed by the Taupo pumice alluvium. There are numerous stream and drain crossings, some in deep gullies. It is expected that soft silty alluvium will be encountered in these watercourses. The route passes over and around several Hinuera formation hills with shallow sideling cuts and fills. Nearer Taupo the route traverses the Waitahanui Breccia with several cuttings as the road moves onto the next terrace level. Geothermal activity is evident near the alignment, which runs through the diverse Taupo Fault Belt.

5.3 Geotechnical Characteristics

For each of the geological formations that we expect to encounter, we have identified the following general geotechnical characteristics that may constrain roading works. Detailed investigations and design will be required.

1. Taupo Pumice Alluvium:
   - Variable silts, sands and pumiceous gravels
   - Silt deposits can be wet and sensitive and difficult to work with. Generally not suitable for fill.
   - Shallow cut slopes in silty soils typically stand at angles of 2H:1V. Erosion Control is required on cut slopes.
   - Cuts through the sands and pumiceous gravels stand steeply in the short to medium term.
   - Moderate settlement is expected under fill, with some softer areas also expected.

2. Waitahanui Breccia:
   - Variable sands and pumiceous gravels
   - Cut slopes typically stand at angles of 1H:1V. Erosion Control is required on cut slopes.
   - Cuts through the welded sands stand vertically in the short to medium term.
   - Cuts through the gravel sized material tend to fritter back to a 40^{o} slope angle

3. Hinuera Formation:
    - Highly variable interbedded silts, sands and pumiceous gravels
    - Silt deposits can be wet and sensitive and difficult to work with. Generally not suitable for fill.
    - Shallow cut slopes in silty soils typically stand at angles of 2H:1V. Erosion Control is required on cut slopes.
    - Cuts through the sands and pumiceous gravels stand near vertical up to 1.5m
    - Moderate settlement is expected under fill, with some softer areas also expected.

4. Haparangi Rhyolite:
    - Silts and sands
    - Cut slopes stand at 1.5H:1V

Cut slopes in pumice sands are highly erodible. Accepted practise in pumice sands is to cut slopes as steep as possible to limit the flow of surface water on the slope face. Shallow cuts may be constructed vertically, with sufficient set back from the alignment to prevent debris falling onto the carriageway. As the topography is relatively flat and we envisage that the cuts and fills will be relatively shallow. The proximity of the faulting and the near surface geothermal activity also make shallow, lightweight embankments necessary. Structures, services and drainage should to be designed to accommodate the differential settlement expected due to ground subsidence from the extraction of geothermal groundwater.