



# Geological investigation of a proposed 4.5 ML reservoir at Cambridge

by R. C. Donaldson

## INTRODUCTION

A reconnaissance geological investigation was undertaken for a proposed 4.5 ML reservoir at Cambridge. The investigation sought to provide the Clarence Council with basic information on the suitability of the site from a geological viewpoint, and to ascertain the likely excavation conditions that will be encountered.

The reservoir is to be built on the eastern slopes of Breakneck Hill above *Coomalie* (535870 mE, 5257500 mN). The site has a moderate slope and the construction of the reservoir at the 90 m contour level will entail a substantial cut of the order of 8 to 9 metres (maximum) below the natural surface.

## GEOLOGY

The Hobart 1:50 000 scale geological map sheet (Leaman, 1972) indicates that the reservoir will be sited close to a dolerite-sandstone boundary that runs roughly north-south along Breakneck Hill at about the 80 to 90 m contour level. The Jurassic-age intrusive dolerite body was observed in outcrop on the higher slopes of the hill to the west of the reservoir site whilst Triassic sandstone is exposed in the disused quarry on Colebrook (Richmond) Road south of *Coomalie*.

The surface geology of the site consists of a high plasticity dolerite-derived clay soil. There are several large partially-covered dolerite boulders nearby which are considered to have been derived from further upslope rather than being in situ. Some sandstone float was noted scattered on the lower slopes below the reservoir site.

Because of the lack of outcrop at the site and the probable migration of dolerite-derived materials from upslope, it is not clear as to where the boundary occurs. As no sandstone float was observed upslope of the site, it is probable that the reservoir will be sited on dolerite.

## SEISMIC REFRACTION SURVEY

A two-spread seismic refraction survey was carried out to ascertain the nature of the subsurface materials with respect to the likely excavation conditions. A twelve-channel seismograph with 3.0 m geophone spacings was used. The spreads were fired from both ends, with middle and extension shots used in the case of spread 1. The spread locations are shown on Figure 1 and the results are summarised in Table 1.

The similarity in results between spreads 1 and 2 suggests that reasonable uniformity can be expected across the site.

The surface soil layer ( $V_1$ ) is relatively shallow and the metre or so of material present can be removed with little effort by light machinery.

The velocity plots indicate the existence of a fairly distinct soil/rock interface and there appears to be little development of a gradational weathering profile with depth.

The  $V_2$  velocity layer in both spreads is basically symmetrical and similar in character, consisting of a series of alternating velocity segments varying between 1600 and 2000 m/s across the site. This stepping effect is considered to represent either variations in the weathering characteristics of the rock mass (i.e. from moderately to slightly weathered) and/or variations in the intensity of jointing. In general terms, the more fractured or closely jointed the rock mass, the lower the velocity, given the same degree of weathering.

## EXCAVATION CONDITIONS

The rippability guide chart (fig. 2) relates the excavation capability of heavy machinery (D9 or similar) to seismic velocities over a range of rock types. The chart indicates that dolerite is rippable for velocities up to 1800 m/s. Between 1800 and 2500 m/s, ripping is considered marginal and depends largely on the orientation and intensity of fracturing of the rock mass.

High joint frequency is not an uncommon feature near the margins of an intrusive body. A brief inspection of the dolerite outcropping upslope of the reservoir site showed the rock to be well jointed.

Based on this information, it is anticipated that the majority of the material to be excavated should be rippable using heavy machinery. The intermittent use of an hydraulic impact rock breaker (or similar) in the higher velocity zones would be anticipated. It is possible that minor isolated blasting may be necessary.

## SUMMARY

The site is covered with 1.0 to 1.5 m of soil and is most probably underlain by dolerite. A trial test pit should confirm this.

The velocities obtained from the seismic refraction survey indicate that the materials are rippable beyond the required depth of excavation, although some zones may be marginal and workability will depend on the joint geometry of the

rock mass. It is envisaged that there will be little need for explosives.

Major stability problems associated with the cut are not anticipated although minor isolated rock falls and/or the dislodgement of individual blocks can be expected from time to time as a result of natural degradation processes.

## REFERENCE

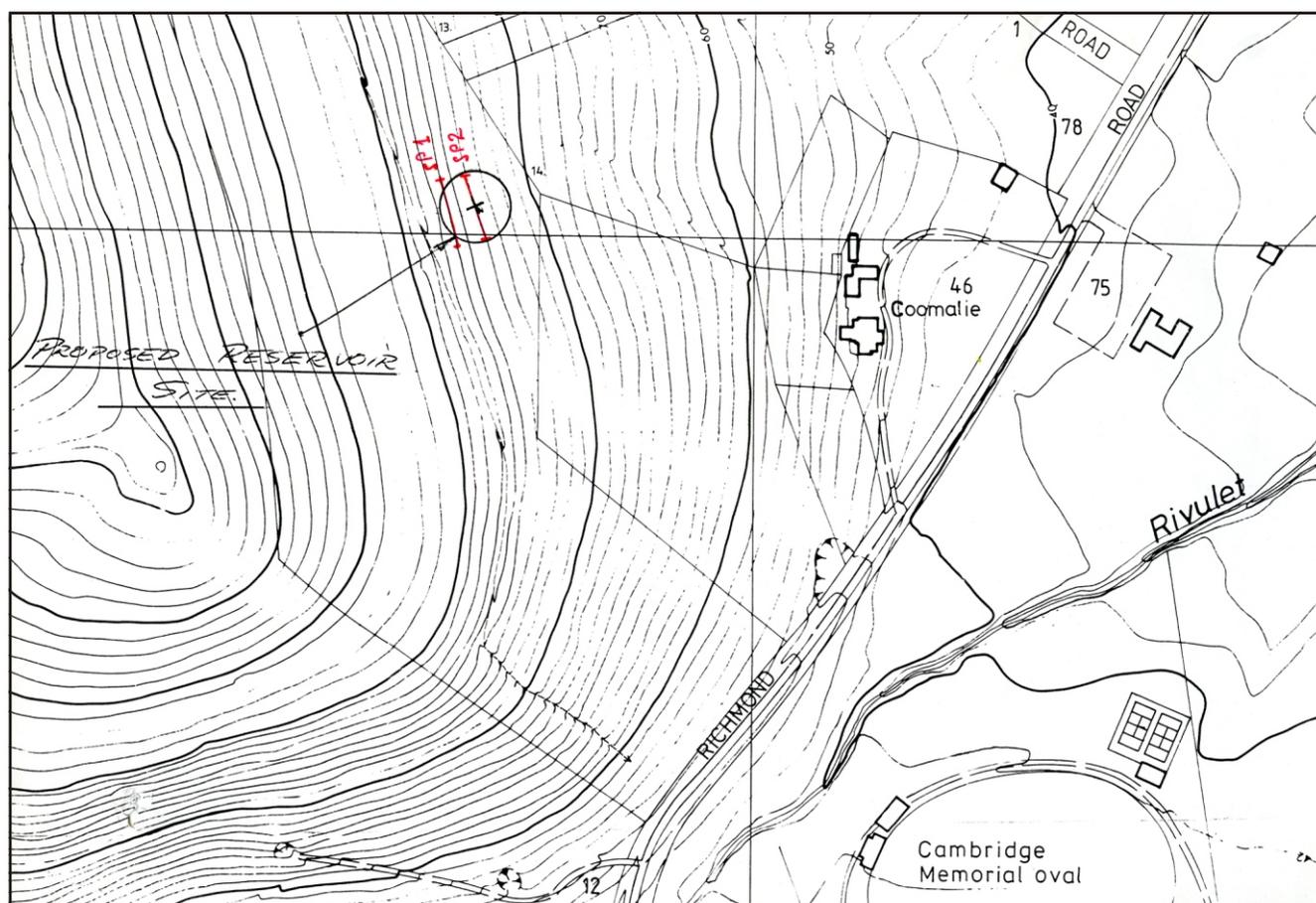
LEAMAN, D. E. 1972. *Geological Atlas 1:50 000 scale series. Sheet 82 (8312S). Hobart.* Department of Mines, Tasmania.

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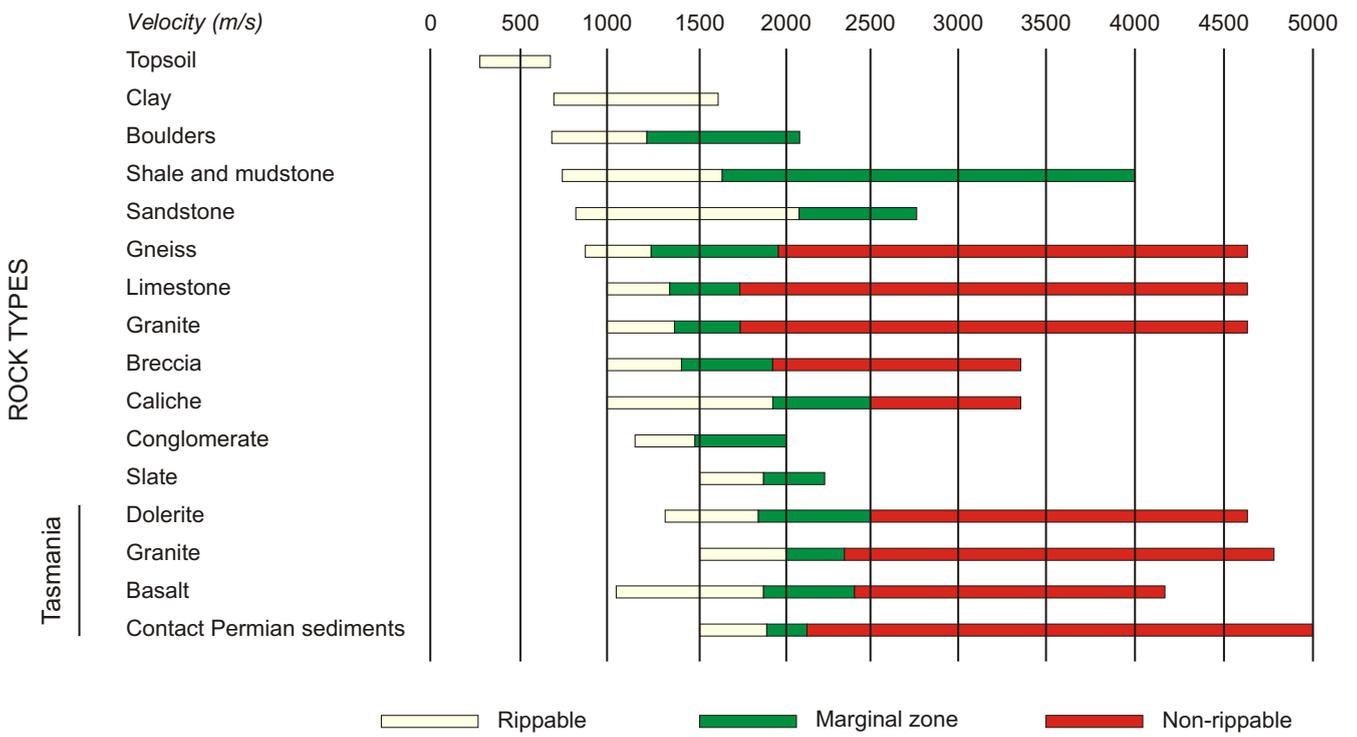
**Table 1**  
*Seismic refraction survey results*

Spread	Velocity (m/s)	Depth (m)	Geological Interpretation
1	V <sub>1</sub> : 300–600 V <sub>2</sub> : 1600–1750 (segments to 2000)	0.8–1.2 12–13 <sup>†</sup>	Unconsolidated surface clay (CH) layer MW–SW rock; joints open-tight
2	V <sub>1</sub> : 375–450 V <sub>2</sub> : 1800–2000	0.8–1.3 13–14 <sup>†</sup>	Unconsolidated surface clay (CH) layer MW–SW rock; joints open-tight

MW = moderately weathered; SW = slightly weathered; † = minimum layer depth assuming V<sub>3</sub> = 2500 m/s



**Figure 1**  
*Location of proposed reservoir and seismic refraction spreads*



**Figure 2**  
*Guide to rippability (adapted from Soil Test Inc.)*