



Geological investigation of a proposed water storage reservoir at Single Hill, Seven Mile Beach

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INTRODUCTION

A reconnaissance geological investigation for a proposed 9.0 ML water storage reservoir at Single Hill sought to provide the City of Clarence with a geological appraisal of the site to ascertain its suitability and the likely excavation conditions that could be encountered.

The reservoir site is located below a saddle on the western flanks of Single Hill (540400 mE, 5253150 mN). A general locality plan is shown as Figure 1. The site has a gentle slope and the construction of the reservoir at about the 84 m contour level will entail a maximum cut of 4.5 m or so below the natural surface. The extent of the excavation will be approximately 25 m radius around the centre peg.

The investigation involved reconnaissance geological mapping in association with a seismic refraction survey.

GEOLOGY

The provisional 1:25 000 Engineering Geology Map of the Greater Hobart Area (Hofto, 1990) indicates that the proposed reservoir site is entirely underlain by Jurassic age dolerite. The site investigation has confirmed this to be the case.

The surface geology at the site consists of dark brown high plasticity clay with scattered dolerite float. Dolerite was noted to sub-outcrop on the hill immediately to the north of the site and also on the higher ground to the east (Single Hill). Permian and Triassic age sediments were noted to outcrop about 100 m to the southwest beyond the gully.

The morphology of the slopes in the vicinity of the reservoir site is such that the surface materials overlying bedrock could either be talus, which has been derived from further upslope, or residual material resulting from the weathering on in situ rock.

GEOPHYSICAL SURVEY

Survey details

A three spread seismic refraction survey was carried out at the site (fig. 2). A Nimbus 12-channel seismograph was used, with 3.0 m geophone spacings in spreads 1 and 3 and 2.0 m geophone spacings in spread 2. Shots were fired from both ends and from the centre in one case (spread 1) using AN Gelignite 60 and electric detonators. Calculations were carried out using the critical distance, intercept time, and where appropriate, the reciprocal time methods.

Data interpretation

In any investigation employing geophysical methods, the results are an interpretation (based largely on experience) of the physical properties measured. Investigative work at this preliminary survey level cannot accurately predict the extremes or rapid variability of materials (both laterally and vertically) that may exist over short distances.

Whilst every effort has been made to predict the likely nature and range of materials to be encountered, contractors should view the results as a guide only to conditions anticipated at the site. Additional investigations, such as a series of trial excavations, should preferably be undertaken to test the validity of the information inferred from the geophysical results. This would also enable contractors to assess the capability and suitability of their machinery for varying rock conditions.

Survey results

The velocity plots vary from asymmetrical to symmetrical in the broad sense with 'stepping' being apparent in some velocity segments. This 'stepping' effect is considered to represent either variations in the weathering characteristics of the rock mass and/or variations in the intensity of defects (jointing). In

general terms, the more fractured or closely jointed the rock mass, the lower the velocity, given the same degree of weathering. The velocity plots indicate that variable subsurface conditions can be expected across the site over relatively short distances.

A summary of the seismic refraction survey results is presented in Table 1. The layer depth figures should not be regarded as absolute but rather as average depth values based on the various interpretation methods used.

EXCAVATION CONDITIONS

The rippability guide chart (fig. 3) 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. Velocities in excess of these figures are considered to represent material that is non-rippable.

Typically, dolerite has highly variable weathering characteristics which result in rapid changes in the nature and strength of the rock mass over short distances. Bedrock materials are likely to vary considerably from a more highly weathered low strength rock (1350 m/s) through to isolated zones of hard, high strength, slightly weathered dolerite (>2000 m/s).

It is the weathering, strength and joint (defect) characteristics of the rock mass that will ultimately determine the ease of excavation of those areas of 'bedrock' encountered on site.

The results of the survey indicate that whilst 'bedrock' conditions, where encountered, are likely to vary considerably, the zones of the higher velocity material to be excavated will be rippable or be able to be

successfully worked with a traxcavator employing a hydraulic impact rock breaker to loosen the material.

From the survey results it is considered that the use of explosives is unlikely to be necessary although it is possible that minor isolated blasting may be necessary should slightly weathered to fresh dolerite kernels be encountered. This would depend on the relative size of the kernels and their relationship with the surrounding material.

SUMMARY

The reservoir site is considered to be underlain by an irregularly weathered dolerite body.

The geophysical survey results and the geology indicate conditions comprising a variable soil/rock profile with possible rapid variations in the strength and the degree of weathering of the material over relatively short distances. It is possible that isolated zones may be marginal for ripping, and workability will ultimately be a product of the joint geometry and weathering characteristics of the rock mass. It is envisaged that the use of explosives is unlikely, and that the material to be excavated should be rippable or be able to be successfully worked with a traxcavator employing a rock breaker.

It is recommended that contractors take time to visit the site followed by a series of trial excavations to confirm and, if necessary, modify the above findings and predictions.

REFERENCES

HOFTO, P. 1990. *Urban Engineering Geological Mapping Project. Map 1. Engineering Geology Greater Hobart Area.* Division of Mines and Mineral Resources Tasmania.

[30 September 1992]

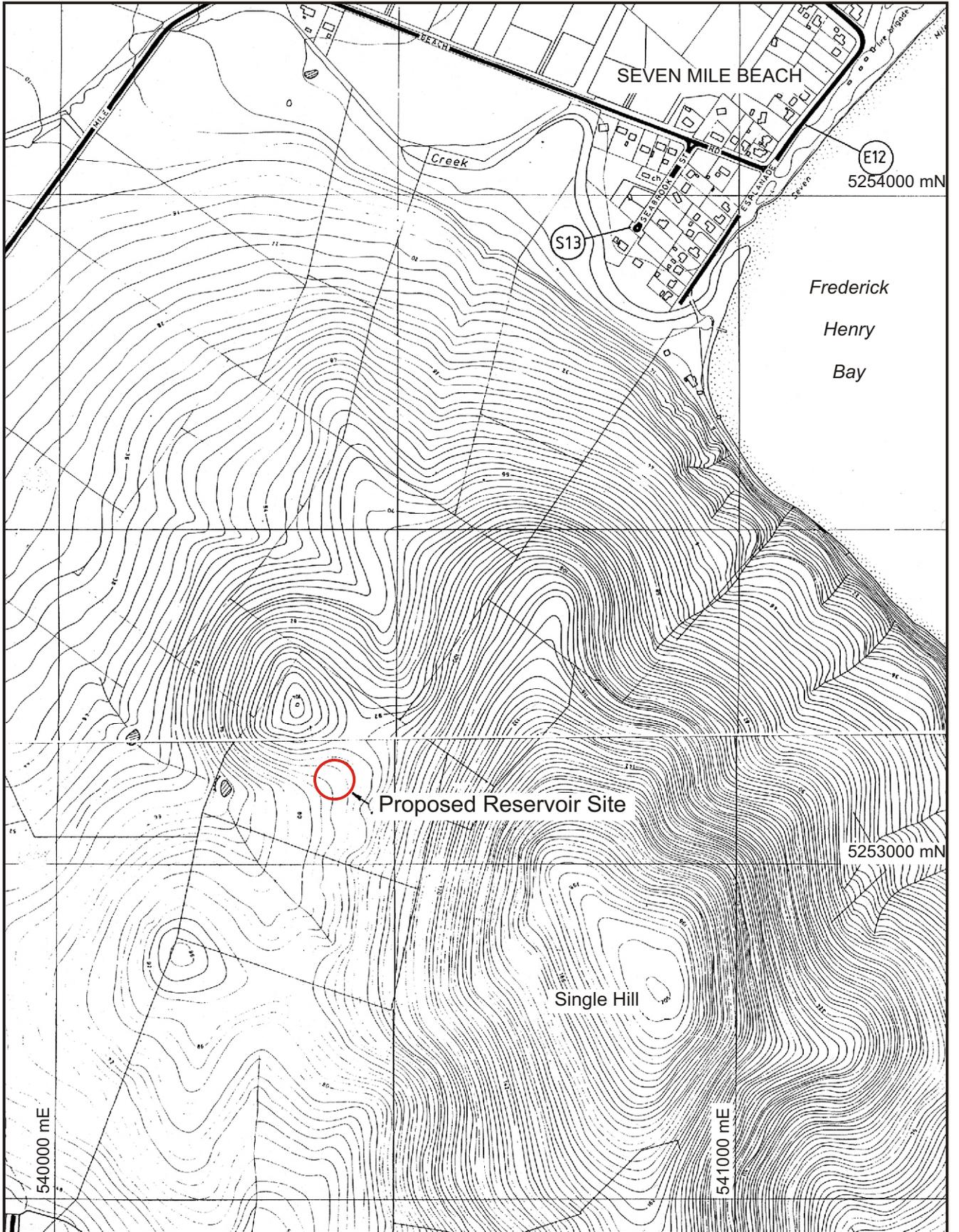


Figure 1
Location of proposed reservoir area

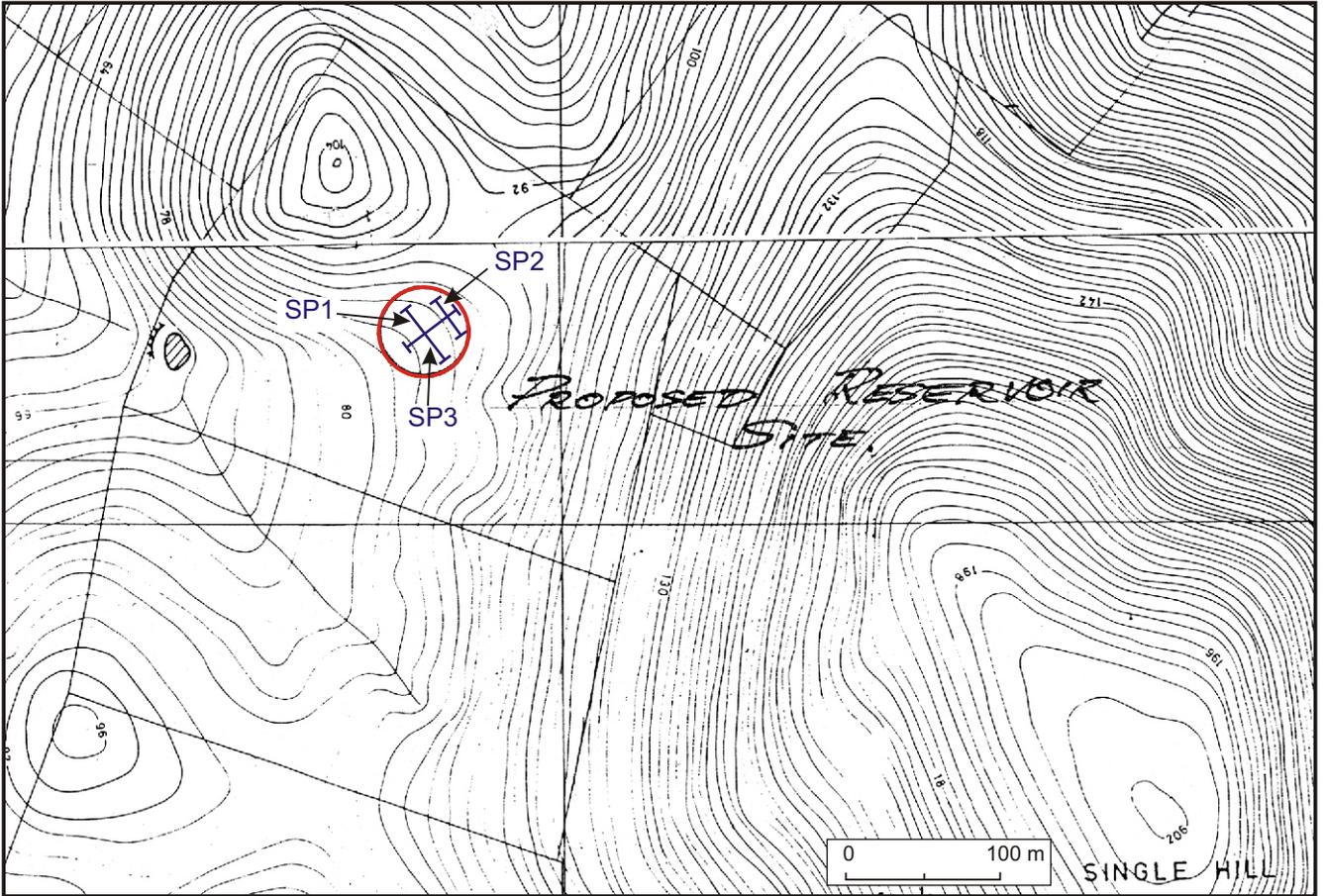


Figure 2
Location of seismic refraction spreads

TABLE 1
Seismic refraction survey

Rock Type	Velocity Layer	Velocity (m/s)	Depth (m)	Thickness (m)	Geological interpretation
<i>Spread 1</i>					
Dolerite	V ₁	300-400	1.0-2.4	1.0-2.4	Surface soil profile – unconsolidated clay (CH)
	V ₂	850-1400	5.0-7.0	4.0-4.6	Clay and boulders and/or EW-HW bedrock
	V ₃	2000-3000+	-	-	SW-FR bedrock, joints generally closed
<i>Spread 2</i>					
Dolerite	V ₁	320-360	1.1-1.2	1.1-1.2	Surface soil profile – unconsolidated clay (CH)
	V ₂	570-890	3.5-3.8	2.3-2.7	Clay and boulders, possibly some EW bedrock
	V ₃	1300-1475	9.0-9.5	5.2-6.0	EW-HW bedrock, possibly some clay & boulder material
	V ₄	3000+	-	-	SW-FR bedrock, tightly jointed
<i>Spread 3</i>					
Dolerite	V ₁	230-250	1.3-1.4	1.3-1.4	Surface soil profile – unconsolidated clay (CH)
	V ₂	1250-1385	8.9-9.2	7.5-7.9	EW-HW bedrock, possibly some clay and boulder material
	V ₃	2250-2400	-	-	SW bedrock, joints open to closed

EW = extremely weathered, HW = highly weathered, MW = moderately weathered, SW = slightly weathered, FR = fresh

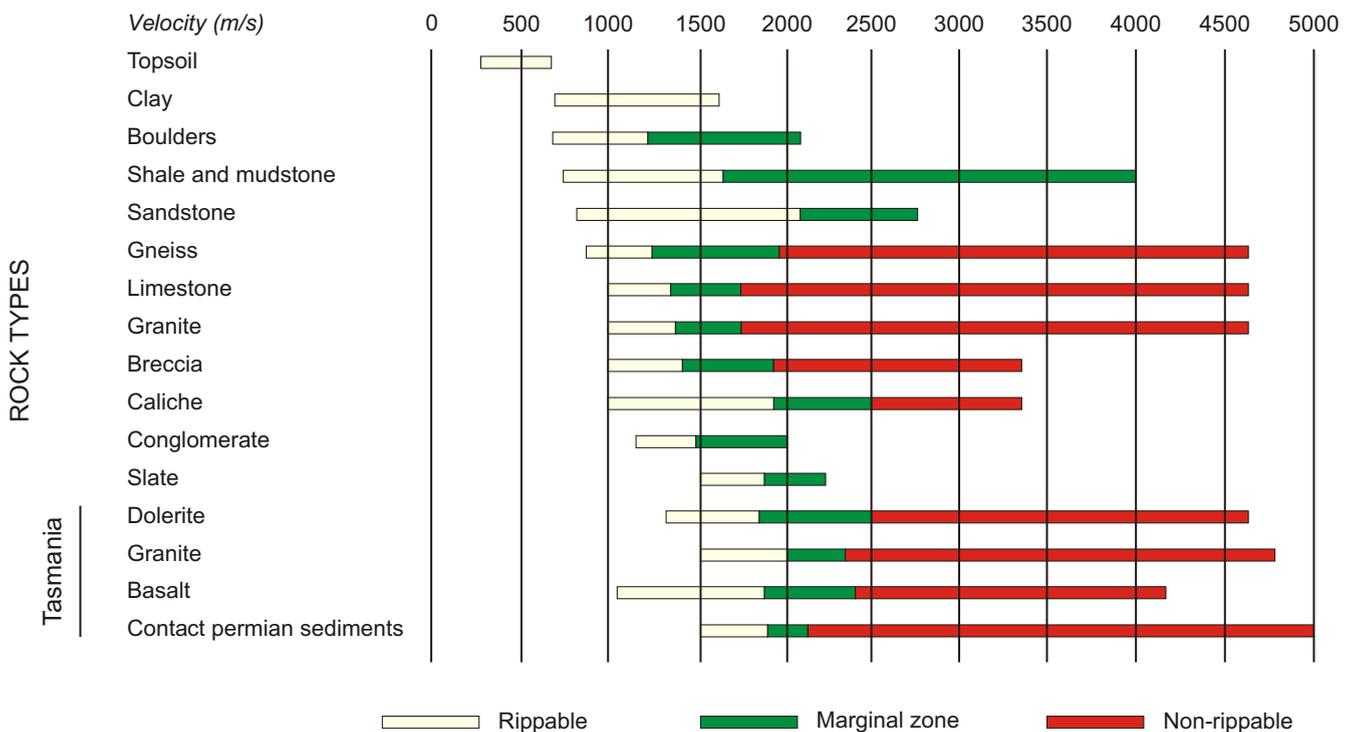


Figure 3
Guide to rippability (adapted from Soil Test Inc.)