

1979/1. Geology of the area around a proposed damsite near Legana.

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Abstract

The site of a proposed ornamental dam is on top of a basalt plateau 4 km north-west of Legana. The northern, eastern and southern sides of this area are underlain by basalt talus and Tertiary sediments which have been subject to landslips. Because leakage could affect land stability downslope, water pressure testing of diamond drill holes is recommended to determine the permeability of the basalt. Tests should be undertaken on the materials forming the dam to determine their suitability. If the dam is built, the clay core should be extended to definite bedrock.

INTRODUCTION

Roelf Vos Holdings Pty Ltd plans to construct a dam on top of a basalt plateau on its property at Legana [EQ007226]. Originally, the dam wall was to be 7 m high, but this has been reduced so that the maximum depth of water at the dam wall will be 2.2 m. Much of the land between the edge of the plateau and the River Tamar to the east, Muddy Creek to the south and Atkinsons Creek to the north, has been subject to landslip movements, some obviously large scale. With the West Tamar Highway passing near the base of the plateau and houses between the highway and river, some extra attention is needed to examine whether the building of the dam will affect the groundwater conditions and thus have an influence on the stability of the area. As a preliminary to this, an examination of the surrounding geology has been made.

RELIEF AND GEOLOGY

The average slope angle of the land from the shoreline between Atkinsons and Muddy Creeks to the base of the plateau scarp is about 7 - 8°, although there are some steeper areas on the south-eastern side, where the slope angle is higher at about 10°. The land around the plateau scarp is hummocky, with some flatter and steeper areas. The base of the scarp is approximately 120 m above sea level, from where it rises more steeply for 60 m at angles up to 44°, although most sections are not as steep.

The rocks underlying the area are Tertiary sediments composed mainly of clay and sand beds and Tertiary basaltic rocks. Much of the lower sloping undulating land is underlain by the sediments, although Sutherland (1971) has mapped areas of basalt in these areas (fig. 1). Much of the plateau and the scarp are underlain at depth by the basaltic rocks. Debris from old landslips (at some locations there are recently active landslips) has covered much of the area with basalt talus, so that the underlying material cannot be observed. Overlying the basalt in some places on the plateau are areas of pisolitic iron-oxide deposits and clay derived from the weathering of the basalt. Test pits examined by a consulting engineer in the damsite area suggest that these weathering products are at least 3 m thick.

The dam and storage area is entirely within the areas underlain by basalt. Basalt crops out in each of the dam abutments and below the abutments downstream from the damsite. The basaltic rocks in the area have been previously called basalt (Longman et al., 1964), basaltic dolerite (Gulline et al., 1973) and coarse olivine basalt (Sutherland, 1971). An examination of the rocks forming the plateau indicates that there is considerable

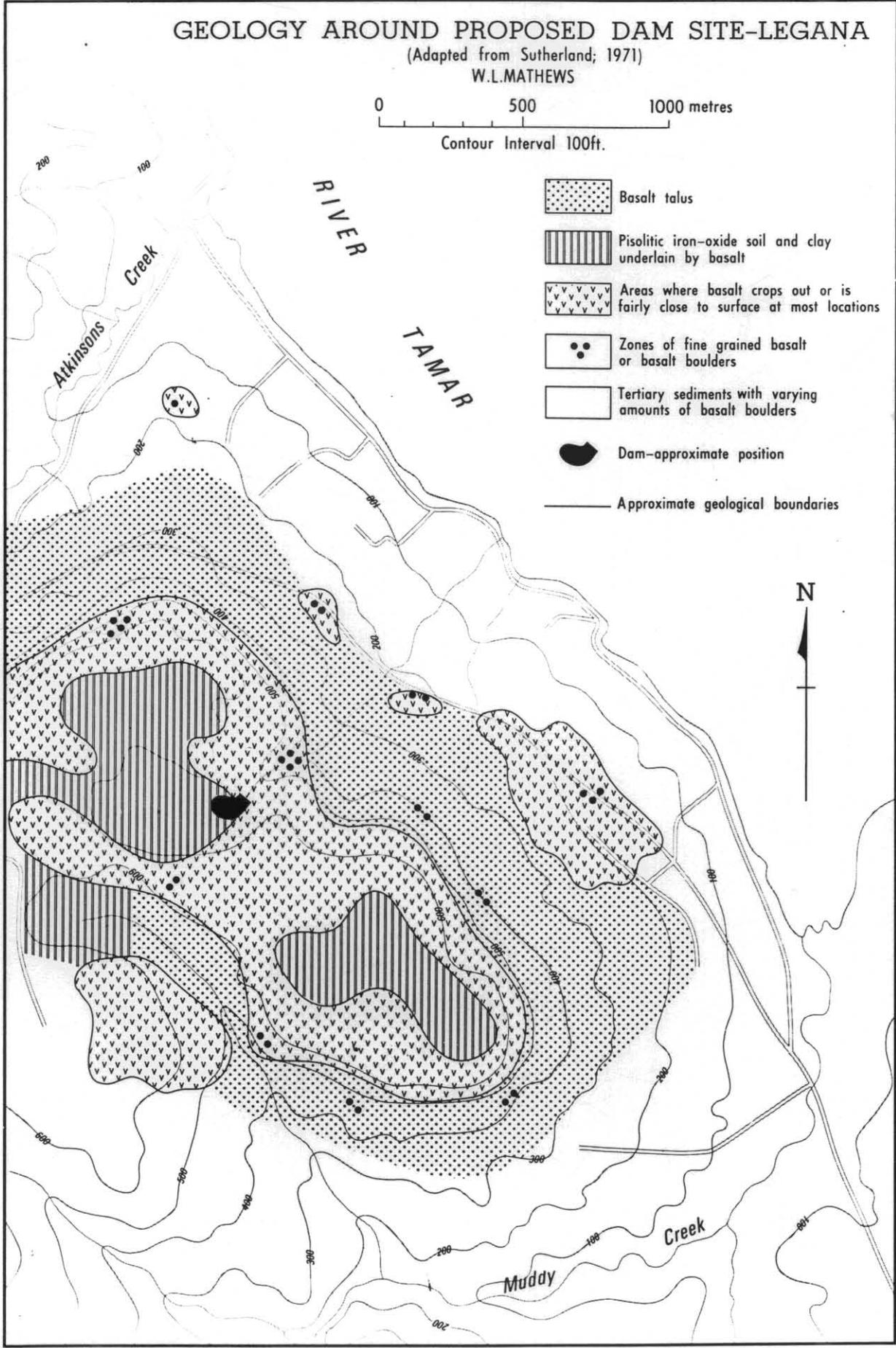


Figure 1.

variation in grainsize, with fine-grained basalt, often with a few zeolite filled vesicles, almost invariably occurring towards the base.

The fine-grained basalt is occasionally columnar and usually closely jointed, with boulders occurring around the base of the plateau in many areas. From field inspection only, these do not appear to be very different from some of the isolated areas of basalt near the highway mapped by Sutherland (1971), these being mainly represented by boulders. Areas where the fine-grained basalt has been located are shown on Figure 1. As the top of the plateau is approached, the grainsize of the basalt increases to medium-grained, the jointing to widely spaced and in isolated areas the rock becomes quite coarse-grained. It is not known whether the plateau consists of 2 flows i.e. one fine-grained and one coarse-grained, or whether it consists of one thick flow which has been cooled quickly near its contact with Tertiary sediments, the upper levels in the flow having cooled more slowly resulting in the growth of coarser crystals. The lower part of the section in the creek where the dam is proposed appears to have a gradational change in grainsize, suggesting only one flow. There is a gap of about 5 m in the middle of the section, the basalt on the low side being much finer than on the upper side. In other areas of the plateau scarp where outcrop is less complete than in the creek, there is fine-grained basalt towards the scarp base and coarse-grained basalt towards the top with a bench between the exposures, suggesting the possibility of two flows.

PROBLEMS IN DAM BUILDING

The main factors which are of concern in such an area are possible leakage of the dam either through the base or through the wall and failure of the dam. In either event, excess water may affect areas that have the potential to become unstable. For these reasons some extra investigations should be undertaken to examine the possibility of leakage.

Tertiary basalt in other areas tends to be closely jointed and fairly permeable. The coarser upper basalt appears to have fairly widely spaced joints and may not be particularly permeable. However because of the sensitive nature of the area, it would be advisable to test the permeability in diamond drill holes drilled to about 15 m depth. Three such holes should be sufficient to gain an initial indication of the permeability. Assessment of the results of these holes would determine whether any further drilling was necessary.

Testing of the material that will make up the dam wall is necessary to ensure that it is suitable for the purpose. Failure of the dam, particularly in a wet period, could promote instability in the Tertiary sediments between the base of the plateau and the River Tamar.

As indicated in a presentation of the results of 18 test pits dug in the damsite area (E.R. England, letter to Director of Mines, 18 September, 1978), it is proposed to extend the clay core to bedrock. However it should be ensured that bedrock is struck in the cut-off trench and not boulders. Test pit 7, near the centre of the dam wall, ended in yellow clay at a depth greater than 3 m while hole 14, on the south abutment, ended in gravelly clay at about 3 m depth. It is apparent that the basalt is deeply weathered or has a deep accumulation of unconsolidated material in some locations and bedrock may be deeper than these levels. Test pits close to these holes suggest that bedrock may not be much deeper than holes 7 and 14 were dug.

CONCLUSIONS AND RECOMMENDATIONS

The proposed dam is situated in an area underlain by basalt with a

probable thickness of at least 50 m. Joints in the upper coarse-grained rock are widely spaced, but the lower, finer-grained rock is more closely jointed.

A varying thickness of soil, pisolitic iron-oxide gravel and clay overlies the basalt in the damsite area.

Three diamond drill holes should be drilled to about 15 m depth in the damsite area to determine the water tightness of bedrock.

The material to be used to form the dam should be tested for its suitability, as failure of the dam could seriously affect stability of land downslope.

The cut-off trench should be extended to definite bedrock.

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