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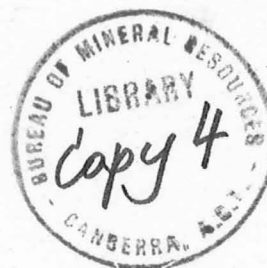
DEPARTMENT OF
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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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Record 1971/52



GOOGONG DAM SITE - QUEANBEYAN RIVER N.S.W. -
FEASIBILITY INVESTIGATIONS 1970 and 1971

by

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SUMMARY

Geological investigations to study in detail the feasibility of a dam near Googong Homestead, 8 km south of Queanbeyan on the Queanbeyan River, commenced in April 1970. The dam is required to supplement Canberra's existing water supply. In 1954 and 1961 the site was examined but the Googong site was rejected, in favour of the Bendora and Corin dam sites respectively.

The present investigations confirm that the site is suitable for a proposed rockfill dam, about 57.5 m high.

The geology of the site is complex but is now well established. The local rock is a sequence of metasediments and dacite of Upper Silurian age, both strongly sheared and striking 020° . The dacite is intruded by the Googong Granite of Siluro-Devonian age.

Although shearing and jointing in the foundation rock is pronounced, permeability is low. No major leakage or grouting difficulties are expected.

No major weaknesses in the foundations have been found in the investigation.

The proposed preliminary spillway/quarry design in general suits the geological conditions at the site. The dacite in the spillway section is fresh to moderately weathered; it is expected to be sound enough to be used as rockfill without having to reject unacceptably large amounts as waste. The granite in the lower part of the spillway might give some fragmentation problems as the rock is massive and poorly fractured.

The site would require special treatment for a thin arch structure because of the general shearing and fracturing of the bedrock and particularly because of the existence of fracture zones in the right abutment.

The foundations of the proposed earth embankment in the Phalaris Saddle, a low saddle to the northeast of the main dam, consist of slate and dacite, both of which are greatly weathered and fractured. No major leakage or foundations problems, are however, expected.

The storage area has been geologically mapped by G.B. Simpson (1972), and is considered to offer no leakage problems.

INTRODUCTION

The Googong dam site is on the Queanbeyan River, 8 km south of Queanbeyan, N.S.W. (Fig. 1). The 1:50 000 Military Sheet grid reference is Bungendore 274262.

The present investigations were started in April 1970, as a result of a request from the Commonwealth Department of Works (CDW) for a detailed feasibility study of the Googong dam site, one of several alternative sites for a fourth dam to augment the water supply for Canberra and Queanbeyan.

Previous Investigations

During the 1920s the present Googong dam site was considered as a possible dam site. Between 1920 and 1939 the site was studied and explored by several shafts, adits and auger holes; the locations of the excavations still accessible are indicated on Plate 4.

In 1954 the Googong site was considered again and BMR provided more geological information on the site as requested by CDW. G.M. Burton and M.A. Randal mapped the site under the supervision of L.C. Noakes. Noakes & Burton (1955) reported on the investigation. However, the Bendora site was preferred and selected for Canberra's second dam.

In 1961 CDW asked the Bureau to prepare feasibility studies on the Googong dam site and the Corin dam site (Cotter River); the proposed height of the dam was increased to 150 feet (45 m). Burton mapped the site in greater detail than in 1954. Some costeans were dug by hand, and four diamond drillholes (totalling 727 feet) were drilled by a team from the Snowy Mountains Authority. The geology of the Phalaris Saddle (400 m northeast of the proposed dam) was also mapped and described by Burton; he reported on the complete investigation (Burton, 1963).

Two seismic surveys were carried out in 1961 and 1962 by Wiebenga and Kirton (Wiebenga & Kirton, 1962; Kirton & Wiebenga, 1962) of the Geophysical Branch of BMR. The 1962 survey included two traverses on the Phalaris Saddle (1962b). The locations of the traverses at the dam site are shown on Plate 4.

Of the two alternatives in 1963, the Corin site was chosen as the more suitable.

Present Investigations

The writer, assisted by Field Hand G.A. Greenwood, and later in the year by Geologist G.B. Simpson, carried out the present investigations under the supervision of Burton and E.K. Carter. The height of the proposed dam was increased to approximately 190 feet (full supply water level RL2175 feet).

When the present investigations started, a rockfill dam was envisaged and most of the testing was directed towards a rockfill dam with a combined spillway and quarry on the right bank of the river. The approximate outlines of the design can be seen on Plates 3 and 4.

The position of the spillway as shown is a relocation to the north that was made for hydraulic reasons during the investigations. Consequently the testing, drillholes, and seismic surveys do not now give the intended coverage of the final area of the spillway-quarry and additional seismic traverses have been planned to supplement the earlier data.

Drilling

Eighteen diamond drillholes (numbered D5 to D21) were drilled by an SMA team: fifteen at the dam site and the spillway/quarry section; D19 in the Phalaris Saddle; and D20 and D21 in the proposed quarry/stilling pond area in the granite on the right bank (Plate 4). All holes were water-pressure tested. Geological logs of the drillholes, with water pressure test results, are included in Appendix 2.

Mapping

The dam site and environs were mapped on aerial photographs (scale: 1:1920 approx.) taken in August 1970. The field data plotted on the photographs were transposed to Plate 1 (scale: 1:3840, reduced from drawing CD70/422B of CDW).

The original outcrop map of the dam site, made by Burton in 1962 by plane table, was extended on the right bank to include the spillway section (N.R. Baczynski assisted in this mapping). Drawing CD70/510B was used as the base map, scale: 1:960 (See Plate 3).

The storage area has been mapped by G.B. Simpson at scale 1:2400 using base maps prepared by SMA in 1961 from aerial photographs. No major leakage problems are expected. A separate report has been written (Simpson, 1972).

Seismic Refraction Survey

The Compagnie Generale de Geophysique (CGG) carried out, under contract to the Department of Works, a seismic refraction survey in May and June 1970. The survey consisted of 2850 m of traverses (Plate 4), approximately 1800 m being in the then proposed spillway section and 600 m on the proposed tunnel-line on the left bank.

Costeaming

Eleven costeams were dug, nine by bulldozer and two by hand (C1 to C11, Plate 4); some of the traverses are outside the area covered by Plate 4.

PHYSIOGRAPHY

The Queanbeyan River and its tributaries have cut a valley approximately 1.5 km wide upstream of the dam site and narrowing to the south. The valley has a gently to strongly rolling topography and is almost entirely underlain by Upper Silurian metasediments and volcanics, both intruded by Siluro-Devonian granite.

Hilltops consist mainly of quartzite, sandstone, and granite. The lower parts of the valley are generally underlain by slate. The dacite, being resistant to weathering, tends to form ridges.

The east side of the valley is bound by the Queanbeyan Fault which forms a fault scarp. The fault is a high angle reverse fault with a possible throw of about 900 m (Burton, 1963). The course of the Queanbeyan River is probably determined partly by a zone of increased shearing due to the proximity of this major fault. Its valley is parallel to the fault between London Bridge and Queanbeyan.

The west side of the valley is partly marked by a fault in the Colinton Volcanics and the London Bridge Formation. The fault, established during mapping by Simpson, is probably an eroded or relatively mature fault scarp.

The dam site lies within a ridge of dacite striking 020° . The river has cut a narrow and steep gorge through the dacite ridge; the valley widens out immediately upstream in the storage area, where dacite interbedded with softer metasediments underlies the valley floor.

The profile of the dam site is asymmetrical. The right abutment is formed by a steep, convex slope. The steeper part of the slope has two dacite cliffs, one (upstream) 25 m wide, the other (downstream) 30 m wide; they are separated by a 15 m zone which is steep and without outcrops. As there is no difference in lithology, the lack of outcrop is probably due to more intense shearing thereabouts.

The left abutment is not as steep as the right. It is more deeply weathered than the right abutment, and slightly more soil and scree cover is present.

REGIONAL GEOLOGY

The dam site and the storage area lie in a belt of Palaeozoic metasediments and volcanics intruded by granite and porphyry (Fig. 2).

The most likely order of age is, from youngest to oldest:

1. Googong Granite, which lies immediately northwest of the dam site. Granite of the same age occurs in the extreme south-east of the storage area. (Siluro-Devonian)
2. The Keewong Quartz Porphyry, in the extreme west and south-west of the storage. (Upper Silurian)
3. Colinton Volcanics, cropping out at the dam site and in the northwest part of the storage. (Upper Silurian)
4. London Bridge Formation, which underlies by far the largest part of the storage area. (Upper Silurian)
5. Undifferentiated metasediments forming the horst on the east side of the Queanbeyan Fault. (Ordovician)

Undifferentiated Ordovician metasediments form the westerly part of the Cullarin Horst. They consist of a series of fine to medium-grained feldspathic greywacke interbedded with slate. Only minor parts of the storage are underlain by this formation.

The London Bridge Formation consists of fine to medium-grained quartzite and sandstone of light colour. Interbedding with dark grey slate is common. Limestone lenses, partly silicified (Veevers, 1953) occur in the top of the sequence. Small granitic intrusions, not shown on Figure 2, are numerous; most of them are concordant with the meridionally striking sediments.

The Colinton Volcanics consist of dacite with interbeds of slate, quartzite, and limestone. They are described in more detail later. The volcanics underlie most of the proposed rockfill dam. The nature of the contact between them and the London Bridge Formation is not completely clear, but it appears to be conformable, at least at the dam site.

The deformation in the Ordovician and Silurian rocks is complex; Stauffer (1964) was able to distinguish four different phases, all occurring during the Bowring Orogeny. Near the dam site and storage area the bedding and cleavage strike approximately north-south and dip steeply or vertically. The grade of metamorphism is low (quartz-albite-muscovite-chlorite sub-facies).

The Keewong Quartz Porphyry was first described by Sharp (1949) and is named after the trig. station situated on it. It shows well developed schistosity, striking approximately 020° and dipping vertically. Veevers (1951) regards the porphyry as a crystal tuff.

The Googong Granite crops out downstream of the axis of the proposed dam; it is described in detail later. Granite of the same age occurs in the extreme southeast of the storage area. The granitic intrusions found in the London Bridge Formation are probably also of the same age.

GEOLOGY OF THE DAM SITE

The country rock at the Googong dam site and immediate environs consists of vertical beds of dacite and metasediments (Colinton Volcanics). The volcanics are intruded by the Googong Granite of Upper Silurian to Middle Devonian age. The dacite forms the largest part of the foundations of the dam (Plate 3); the granite underlies a small part only of the proposed dam on the left bank and river section and the lower part of the spillway. Some metasediments occur in the easternmost part of the proposed spillway area on the right bank, and warrant close attention.

Joint Diagrams

Six stereographic projections of the poles of joints and cleavage planes were prepared and contoured by appropriate methods to provide joint diagrams (Figure 3) for structural analysis of the systems of rock fractures at the site.

Each diagram is based on approximately 100 readings from one of six subdivisions (Plate 4) of the site. The diagrams thus permit not only the determination of the main directions of fracture in each area but also a comparison between fracturing in each abutment and rock type.

It should be noted that in these diagrams the pole of a joint plane plots at an angle of 90° to the actual plane: thus a concentration of poles at 110° represents a system of joint planes striking 020° . Poles near the circumference of the diagrams represent almost vertical joints and those near the centre almost flat-lying joints.

Metasediments

The metasediments almost immediately east of the gauging weir are thought to be the oldest rocks at the dam site. They crop out as a V-shaped wedge in the dacite (Plate 1) and occur as vertical beds or lenses with an average strike of 020° . Interbedded in the metasediments are several dacite lenses. Three different types of metasediments can be discerned.

Sandstone: The sandstone is fine to medium-grained, light to dark grey where fresh, and yellow where weathered. Beds 2 to 30 cm thick are common. In thin section rounded to subangular quartz grains can be seen, set in an aphanitic matrix, mainly of quartz. Little feldspar is present; carbonaceous material is very common in some parts, and signs of intense deformation are frequently encountered.

The sandstone forms about half of the metasediments in the already mentioned V-shaped wedge. However, it does not underlie the dam or the spillway section as far as can be seen from outcrop, existing drillholes, and costeans.

In drillhole D6 some parts of the sandstone are calcareous; however no signs of carbonate were observed in the sandstone cropping out at the surface.

Slate: The slate is a dark grey rock which is in places (e.g. in Drillhole D6) calcareous. In thin section one can distinguish some fine-grained quartz grains set in a matrix of micaceous material, with variable amounts of carbonates. Slaty cleavage is well developed, strikes 020° and dips vertically.

Limestone: A small outcrop of grey mottled sandy limestone is found on the right bank of the river upstream of the gauging weir. In thin section, well-rounded quartz grains (up to 3 mm in size) can be seen set in an aphanitic matrix of recrystallized carbonate and some (approximately 20%) quartz. The limestone changes to slate along strike. Since no indication of faulting is observed, it is considered that this represents a facies change.

The successions found in Costeans C4 and C6 consist of alternating slate, sandstone, and dacite. Although the distance between the two parallel costeans is not more than 75 m, the two successions differ so much that no correlation could be made. Again, the change is considered to be a rapid change in facies.

Dacite: To the east and west of the metasediments dark greenish-grey dacite crops out. It would form the major part of the foundations of the proposed rockfill dam. In hand specimen quartz and feldspar phenocrysts (up to 8 mm) can be seen in a dark groundmass. In thin section a well-defined augen structure can be observed; quartz has a wavy extinction and feldspar is altered to epidote, sericite, and saussurite. The groundmass consists of aphanitic quartz, chlorite, actinolite, and possibly feldspar. In many places the dacite is highly silicified, and quartz-epidote veins are common. Sulphides are disseminated through the rock, and also in veins and fractures. In the drillholes near the river, sulphides are common, but they do not appear to be present in holes in the spillway section, where they have probably been oxidized.

The dacite cropping out at the dam site shows in general a well-developed cleavage and in some places, foliation and schistosity, both parallel to the cleavage; strike 020°, dip vertical. Between the crest of the ridge on the right bank and the contact with the metasediments to the east, some 10 m of vertical slate lenses with minor sandstone strike parallel to the cleavage.

The dacite could be either extrusive or intrusive; but the question is of little importance in this context. It was emplaced or deposited before the sequence was deformed; originally horizontal dacite overlay and was interbedded with the sediments. Later, probably during the Bowring Orogeny, the succession was folded into its present vertical position.

Burton (1963) regarded the contact between the dacite and metasediments as a fault, but this has not been confirmed by drilling, costeining, and mapping. Drillhole D6 was designed to penetrate the contact; it did not show any evidence of faulting. Although the dacite and metasediments are both intensely cleaved and possibly sheared near the contact, those features are not necessarily caused by faulting. No excessive quartz veining or hydrothermal alteration were observed near the contact.

The off-setting of the dacite-metasediment boundary in the river bed (Plate 1) gave rise to the suspicion that a fault might run approximately westerly in the river section. However, D7 and D1 indicate that there is no major fault in this section; D16 excludes the existence of a major fault across its path in the right abutment. The off-setting of the contact can be explained as a facies change or a sill of dacite cutting across the metasediments.

Googong Granite

The youngest rock at the dam site crops out mainly downstream of the axis of the proposed rockfill dam and would form part of the foundations of the dam on the left abutment. In hand specimen the granite is light coloured and shows quartz and feldspar crystals (up to 7 mm) with dark fine-grained micas. In thin section signs of strong deformation can be seen: quartz shows wavy extinction and in places is reduced by crushing to a very small grain size. Analysis of geological structures proved that the granite was affected by the deformation that induced the 020° vertical schistosity in the dacite and metasediments - not to the same degree, but enough to produce a marked set of joints, especially on the left bank.

Structural Geology

Folding: As mentioned, the general trend of the Colinton Volcanics is 020° and vertical. The most conspicuous cleavage in the dacite has this orientation, as do the slate lenses in the dacite, and the bedding and cleavage in the metasediments; it is also one of the most important joint directions in the granite. The V-shaped wedge of metasediments east of the weir also trends in the same direction.

There is evidence of a fold system, whose axial plane strikes at 020° and dips vertically, and plunges at 30° to north-northeast. In view of this, the disappearance of the wedge of metasediments to the north is explained by considering the dacite and the metasediments as forming an anticline plunging 30° at 020° beneath the overlying dacite. The metasediments would then form the core of the anticline and the dacite the outer part.

Alternatively, the metasediments may be lensing out because of a facies change, or squeezed out of the visible sequence by intense deformation.

Faulting, jointing and cleavage: The dacite is moderately jointed. The main joint direction is parallel to the 020° cleavage, as can be seen in the joint diagrams (Figure 3). A less marked contribution appears to strike between 080° and 125° .

The dacite contains numerous veins, many of which are probably fillings of old joints; the other joints are generally fairly clean, but iron-stained, and some are filled with carbonate. In the spillway section, where the groundwater level is well below the surface, joints are commonly coated with a few millimetres of white clay. Slickensides on the joints are sometimes observed.

Fracture or fault zones are common in the dacite; they are 10 cm to 3 m or more in width, and consist of seams of white or very light clay containing angular fragments of slightly weathered dacite. The zones have been identified as dacite weathered in situ. Their structure suggests that certain parts of the rock were more easily weathered than others. Since most of these fracture zones occur in dacite which is silicified, it is thought that the zones were affected by hydrothermal action, possibly from the granite intrusion.

Generally the fault zones are not straight, but curved and irregular and prone to die out from between 50 feet and 80 feet in Drillhole D9 one of these zones occurs and also shows in Costean C6. Information C6 and D9 suggests that the zone is vertical and strikes approximately east-west. However, no evidence of a feature of the same size was found in Drillholes D17 or D17A, nor was any surface expression of the zone discovered, except in Costeans C6 and 7.

The granite on the left bank, like the dacite, contains 020° , vertical joints (Fig. 3). The granite on the right bank, however, rarely shows the system. The joint diagrams of both show lower concentrations corresponding to maxima at about 080° and 140° . All systems are nearly vertical. Although younger than the dacite, the granite near the dam does not seem much less fractured. In the lower spillway section, however, there is a marked difference in degree of fracturing. Drillholes D20 and D21 reveal very little fracturing. Eight-foot runs of unbroken core were frequently recovered from granite.

Weathering

The dacite normally shows a rather predictable weathering pattern. In the lower parts of the dam site fresh or slightly weathered dacite is encountered at the surface, as can be observed in Drillholes D5, 6, 7, 8, and 16. Higher in the spillway section, where the groundwater level is deep and where recent stream erosion has not affected the surface, moderately weathered dacite generally overlies fresher rock (Drillholes D9, 10, 11, 12, 17, and 17A). Previously described fracture zones tend to disturb this regularity (note the completely weathered dacite found between 50 feet and 80 feet in D9).

The granite has a more complicated weathering pattern than the dacite. The tendency to become fresher with increasing depth is broken by the irregularity of weathering, as is common in granite.

The slate shows a very irregular weathering pattern in D18. This is the only hole in the spillway section which runs for a considerable length through slate, and no general conclusions can be drawn.

ENGINEERING GEOLOGY

Permeability of rocks at the dam site

Fresh dacite and granite within the foundations of the proposed rockfill dam do not possess intergranular permeability. Groundwater movement in these rocks takes place in fractures, joints, and weathered zones. Hence their permeability is a function of the number and type of fractures present and the nature of the weathering.

Both the dacite and granite are strongly fractured, but water pressure testing revealed only a few important zones of permeability, i.e. exceeding 1 lugeon. This is probably due to the fact that the fractures are generally tight and in some places sealed with clay. Also, the granite might have sealed some early fractures with veins of epidote, quartz and calcite, minerals which are found extensively in veins in the dacite.

Of the 2520 feet of drilling in the dam foundation and upper spillway section that were pressure tested, 475 feet had permeabilities higher than 1 lugeon (Table 1). Most of the higher permeabilities were found in sections above groundwater level. Grouting of the sections above groundwater level in rock underlying the dam seems necessary and would not present problems since the rock in these sections is generally not too weathered. Below the piezometric surface the foundation rock is almost watertight and little grouting will be needed. A few sections have permeabilities higher than 1 lugeon and may need more treatment.

Since the most prominent joint system (020° , vertical) is approximately parallel to the axis of the proposed rockfill dam, the permeability of the foundation rock is probably greater north-south than east-west. In other words the permeability may be anisotropic and the greater permeability would be parallel to the dam axis. The existence of anisotropy could be established by pump tests; if defined it could permit the establishment of a more suitable and economic grouting plan.

The fault or fracture zones found in D9 seem to have permeabilities only slightly higher than the minimum. The important fault zone encountered in Drillhole D9 unfortunately could not be tested owing to caving. In D17A a small fracture zone (1 m wide) was included in a test section of 20 feet; the full section had a permeability of 1 lugeon, when tested. Since these zones consist mainly of clay, they are not thought to present a considerable areal leakage problem; local leakage, if clay is cleaned out, would be appreciable. Although the contact zone between granite and dacite is strongly fractured (D15), no significant waterloss in the drillholes that penetrated this zone was recorded. Burton (1963) suggested the possibility of leakage through limestone lenses, which might be present under the dam foundations. In the light of the present interpretation that the metasediments dip vertically such leakage is considered unlikely.

Weakness in foundation rock

The fracture or fault zones present the major source of weakness in the foundations of the dam site. However, they are not considered to present a major problem in the construction of a rockfill dam. Near the surface the fracture zones might have to be dug out and treated. Only two zones were discovered: one in Drillhole D9 and Costean C6, and a smaller one, possibly a continuation of the other in D17A. Both are situated on the right abutment between the proposed dam and the spillway. Since any structural defect in the spillway wall should be avoided, it is important to establish the position of the zones accurately during further exploration. The spillway should be designed in keeping with a detailed knowledge of the zones. It is expected that more fracture zones will be discovered in further exploration as the site is better exposed. The existence of these zones and their irregular nature, make the site less suited for a thin arch dam.

During the early stages of this investigation a fault was thought to exist in the river bed, causing the offsetting of the contact between volcanics and metasediments. Between 39 and 42 m in D7 a fracture zone was discovered. The dacite in this zone is fresh, and slickensides were observed. However, the zone may be very weathered at shallower depth. A low angle hole under the river bed should be drilled to test this possibility.

The contact zone between dacite and granite was penetrated by Drillholes D3, 8 and 15. In D15 fracturing is strong in a section of 8 m of silicified granite above the contact zone; D3 and D8 did not show any sign of weakness near this contact.

Depth of rippable rock

In general the depth of rippable rock is dependent on the depth of weathering and to a lesser extent on the degree of fracturing of the rock. On the dam site, fresh to slightly weathered rock is encountered at the surface in the lower sections near the river, because the river has removed the erodable material. Hardly any rock needs to be removed from the lower sections, although deposits of alluvium and some soil cover will have to be cleared.

In the higher parts weathering penetrates deeper in the profile, but moderately weathered rock (i.e. sufficiently sound to be used as rockfill or to serve as foundation for a rockfill dam) is found at shallow depth. Costean C5 gives a useful indication of the depth of rippable rock. The bulldozer (a D6) used for the trenching dug to maximum possible depth. Disregarding the gully at the east side of the costean, where alluvium is more than 2.5 m thick and bedrock highly weathered, the trench is nowhere deeper than 1.5 m, with an average depth of about 1.2 m. The rock at the bottom of the trench ranges from fresh to moderately weathered.

The seismic investigations did not indicate any large-scale irregularities in depth of weathering and confirmed the pattern found in C5. Only slight evidence of the fracture or fault zones found in D9 were revealed in the seismic records.

Quality of rockfill from proposed spillway/quarry

The spillway/quarry is designed to provide rockfill for the dam from the rock that has to be excavated in the spillway section. It is intended that the dacite in the upper (eastern) part of the spillway will probably provide the bulk of the rockfill: the remainder will be supplied by the granite from the lower (western) part (stilling pond).

Once the rippable overburden is removed most of the underlying dacite should be usable as rockfill. The general pattern of weathering has already been described; thicknesses of zones of different degrees of weathering can be seen in the logs of drillholes in this area.

Slate lenses form 1 to 3% of the total amount of rock to be excavated in the spillway. The slate is unsuitable for use as rockfill, and will have to be separated during excavation.

The fault zones also are likely to yield material that would be unsuitable for use in the rockfill. Although no surface expression of the zones can be observed, the site seems sufficiently tested to warrant the prediction that fault material will not be more than 5% of the bulk of rockfill, and probably much less.

The sulphides in the dacite probably will not present a problem in the rockfill: in fresh rock in the spillway section concentrations are low; in weathered rock no sulphide was encountered, since sulphide weathers readily above groundwater level. The presence of sulphides should be examined carefully in subsequent testing.

Because the dacite is more fractured in one direction (020° , vertical) than in others, rock fragments will possibly be platy instead of equidimensional. To assess the fragmentation, and the best plan of development for the quarry, a trial quarry is recommended.

The granite shows a more irregular weathering pattern, and has to be tested further to yield sufficient information.

The possibility of zones of hydrothermal alteration within the granite should not be overlooked; since it is much less jointed than the dacite, problems are to be expected in fragmentation. Again a trial quarry would be advisable and is recommended.

Expected geological conditions along the proposed diversion tunnel

The geological conditions along the proposed diversion tunnel are as yet only partly known. No relevant drilling was carried out on the tunnel line, and the seismic traverses MM, NN, OO, and PP are the only sources of information. They reveal a smooth weathering pattern, penetrating deeper at the downstream end of the tunnel. By far the greatest part of the diversion tunnel will be in fresh rock, well out of the zone of weathered rock.

Conditions in the upstream section of the tunnel are unlikely to differ substantially from the rock to be seen in the adits on the right abutment - dacite strongly sheared and fractured, with many clean joints and a few fracture or fault zones. Fracture zones in the tunnel wider than about 30 cm will probably need treatment. The sheared rock and fractures with clean joints are considered unlikely to give serious difficulties in the dacite. However, the section of the tunnel which penetrates the contact zone between granite and dacite (approximately halfway along the tunnel) may need treatment. This zone, as encountered in Drillhole D15, is silicified and intensely fractured but not weathered.

The nature of the granite in the tunnel is more difficult to predict. At this stage of the investigations no obvious source of major trouble can be seen.

It should be noted that in both dacite and granite the major fracture system is approximately perpendicular to the direction of the tunnel except for a small section near the downstream portal.

Diamond drilling and water pressure testing

Eighteen diamond drillholes totalling 2343 feet were drilled by a crew from the Snowy Mountains Authority under the geological direction of the project geologist. During the investigations in 1961 4 holes were drilled; thus altogether 22 drillholes, totalling 3070 feet, have been drilled on the site. 10 were drilled to test the dam foundations and the possibility of leakage, and 11 to test the rock in the spillway section. One was drilled in the Phalaris Saddle to determine the nature of the foundation of the proposed saddle dam.

All holes were drilled with NMLC bits and stationary split-inner-tube core barrels. Core loss was very small. Geological logs of D5 to D21 are included in Appendix 2 (logs of D1 to D4 are included in Burton, 1963). In addition to the fracture log, in which the number of fractures per foot of hole are plotted, a rock quality designation (RQD) was used. The RQD is obtained as follows: the total length of core recovered (counting only those pieces of core which are 10 cm in length and which are hard and sound) is measured for each 1.5 m of drilling and is then expressed as a percentage of the run. Thus if the sound lengths total 0.75 m the RQD is 50. If the core is broken by handling or by drilling the fresh broken pieces are fitted together and counted as one piece provided that they form the required length of 10 cm. RQD's are shown on the extreme right column of the log sheets.

Photographs were taken of the core in the barrel and in the boxes the latter in colour as well as black and white. Copies of the photographs are available for inspection at BMR and the Department of Works, Canberra. Cores from all holes drilled are stored at the CDW Core Shed, Kingston, Canberra.

All drillholes were pressure-tested except where caved. Gauge pressures were calculated before testing so that the maximum effective pressure did not exceed 1 pound per square inch per foot of overburden. The effective pressure was calculated in the following manner.

$EP = GP + HPD - HPG - PL$, in which

EP = Effective Pressure

GP = Gauge Pressure

HPD = Hydrostatic pressure of water in drillrods

HPG = Hydrostatic pressure of groundwater at the top of the test section

PL = Pressure loss due to pipe friction

The results of the tests were expressed in two ways: (1) as water loss in gallons per minute per foot of test section for a given gauge pressure; (2) in units (lugeons) defined as the waterloss in litres per minute per metre of drillhole at a pressure of 10 bar maintained for 10 minutes. The permeability in lugeons was calculated according to SMA practice.

Seismic Investigations

CGG carried out a seismic refraction survey at the dam site. Traverses totalled 9300 feet, with geophone spacings of 10 feet. Section 1 (Plate 5) enables us to correlate the seismic markers with five drillholes; from this and general knowledge of the geology at the dam site it can be concluded that the seismic markers correspond in the following way to the weathering profile in the dacite.

- (a) Velocities up to 1250 feet/sec: soil, completely weathered and highly weathered dacite.
- (b) Velocities between 3500 and 6500 feet/sec: moderately weathered dacite.
- (c) Velocities between 11000 and 17000 feet/sec: fresh dacite.

Although the geophone spacings were only 10 feet it appears to be very difficult to detect fracture zones or slate lenses; only slight traces have so far been discovered in the time-distance curves. However, the curves should be checked more carefully in an effort to delineate possible fracture zones or slate lenses before further drilling is undertaken. General weathering conditions can be established more easily. The survey did not reveal any unexpected large-scale weaknesses in the foundation of the proposed dam or spillway, nor were any departures from the expected weathering conditions observed.

The survey did not cover the section across the river.

CONSTRUCTION MATERIALS

Alternative Quarry Site

Southwest of Googong Homestead an alternative quarry site can possibly be developed in case the spillway/quarry design does not prove feasible. The site ('1' on Fig. 2) is a steep cliff on the left bank of the river cut in a low hill immediately south-west of Googong Homestead. The bulk of the rock of this hill consists of hard, silicified dacite with little cover of scree and soil. From outcrops it was concluded that the rock is fresh or slightly weathered at the surface or very shallow depth. Interbedded with dacite are slate lenses, which could prove to be so large or numerous as to render the site unsuitable.

The advantages of the site are its proximity to the dam site and the fact that it will be covered by water when the storage area is filled. The required quantity of 1 000 000 cubic yards of rock appears to be present.

Filter Material

No borrow areas of filter material were investigated by the author. However, it appears from preliminary results of the mapping of the storage area that sand and gravel deposits are available within reasonable distance along the Queanbeyan River.

Earth Core Material

A short survey was made of the availability of earth material near the dam site. The most promising borrow area is marked by '2' on Figure 2. The material is deposited in a narrow valley east of the Phalaris Saddle, bounded on the west by the Queanbeyan Fault. The Cullarin Horst is the source area of most of the earth deposits in the valley. The Central Testing and Research Laboratories (CTRL) of CDW carried out a seismic refraction survey in this area; auger holes were drilled and some backhoe pits were dug by the same organization. The material was also tested by CTRL. A report on these investigations is being prepared by CTRL.

PHALARIS SADDLE

The Phalaris Saddle is underlain by the same rock types as the dam site. From west to east one finds dacite then slate, both strongly sheared. At the east side of the saddle the slate is intruded by a granite of the same age and type as the Googong Granite.

The map and section along Costean 8 (Plate 2) illustrate the spatial relationship between the three units. The strike of the cleavage, and most probably the bedding in the slate and the dacite, averages 350° , the easterly dip ranges from 45° to 80° . The sequence may be overturned, i.e., older slate is resting on top of the younger dacite. The contact between dacite and slate strikes 350° and dips at 70° to the east.

The slate found in Drillhole D19 is highly to completely weathered for 18 m below the ground surface, and the dacite is more weathered than has been observed elsewhere at this depth. This is probably due to the low groundwater level. Although both slate and dacite are highly weathered and sheared, both rocks are watertight, and since the proposed earth embankment is only low, the weak foundations are not expected to cause serious problems.

SEISMICITY

Ample evidence exists that the filling of reservoirs can cause increased seismicity in areas of low, or non-existent, seismic activity. Two factors seem to be involved:

- (1) The extra load of the water of a reservoir upsetting the pre-existing delicate equilibrium in the crust;
- (2) The influence of water at fault planes, causing an increase in fluid pressure, which counteracts the normal stress acting across the fault. The normal stress combined with the friction coefficient acts as the main fault-locking device.

The Googong Dam and Reservoir lie in a zone of relatively low seismic activity; in the period 1960-70 only one tremor was recorded near the Googong dam site by the Australian National University: it occurred in 1969 and had a magnitude of 2.1 on the Richter scale. The tremor may possibly have been associated with the Queanbeyan Fault. In the Snowy Mountains area a tremor of this magnitude occurs, on the average, every three months.

The Googong Reservoir will be small compared with most dams which are known to have initiated durable seismic activity. However, it is on the downthrow block of the Queanbeyan Fault, which may be still active, or made active by the load of the reservoir. The Queanbeyan Fault will be covered by the reservoir near Bradley's Creek, and water might enter the fault zone and facilitate fault movements.

The Bureau's Geophysical Branch monitored the seismicity at the Googong dam site from September to December 1971. The sensitivity of the array was sufficient to record microtremors as low as - 0.3 magnitude (Richter scale); however, no natural tremors originating from within 10 km of the dam site or along the Queanbeyan Fault were recorded.

CONCLUSIONS

- 1) The country rock of the dam site consists of a sequence of volcanics and metasediments striking 020° , and dipping vertically. The volcanics are intruded by a younger granite.
- 2) The contact between dacite and sediments is conformable. No evidence of faulting was found.
- 3) No major faults were found at the dam site. The largest fracture zone is encountered in Costean C6 and Drillhole D9. The zone represents the most important structural weakness found in the foundation rock.
- 4) More of these fracture zones may be found during further exploration.

- 5) The fracture zones do not represent major areal leakage paths.
- 6) Although the foundation rocks are fairly heavily jointed no major zone of permeability below the piezometric surface was found.
- 7) Apart from increased fracturing, no signs of deterioration of dacite and/or granite was found near the contact between the two rocks.
- 8) The Googong dam site is suitable for a rockfill dam 56 m high.
- 9) The site would require special treatment to support a thin arch structure, because of the presence of the fracture zones; the treatment would add considerably to the cost of an arch dam.
- 10) The dacite in the spillway section appears to be of good quality for use as rockfill for the dam: no excessive amount of sulphide was found, the rock is fresh to moderately weathered and fragmentation is likely to be easy; however, fragments may be jointed because of the abundance and orientation of joints.
- 11) The massiveness and lack of fracture of the granite in the spillway area might require care in quarrying rockfill to required dimensions.
- 12) The country rock at the Phalaris Saddle is highly weathered and cleaved but is considered to be of very low permeability; since the proposed earth embankment is low the foundation rock is sound enough.

RECOMMENDATIONS

- 1) Several diamond drill holes should be drilled to five feet below excavation depth on the final location of the spillway, to replace Drillholes D12, 13, 14, which lie outside of the spillway, as presently planned. The holes should be drilled to obtain information about weathering and jointing conditions in the final spillway area.
- 2) The sulphide in the dacite in the spillway should be tested quantitatively: the percentage and type of sulphide in the rock should be determined.
- 3) A costean should be dug by bulldozer to establish the depth of rippable rock on the north side of the spillway section. This costean should be parallel to C5 and slightly north of the centre-line of the proposed spillway.
- 4) A small trial quarry should be made to obtain information about the nature of fragmentation of the dacite, since it may break up in flat fragments owing to close cleavage in one direction. This quarry should be placed in a part of the spillway which is closely jointed along the 020° system to give an indication of the most unfavourable conditions.
- 5) The granite in the lower spillway section should be sluiced clear to allow inspection for possible pockets of weathered rock.
- 6) A seismic survey should be carried out on the granite of the lower spillway section for the same purpose as 5.

- 7) To determine weathering and fracturing conditions in spillway section of the granite, several shallow diamond drillholes should be drilled.
- 8) To establish adequately the properties of the granite, a trial quarry should be made in the lower spillway section.
- 9) More drilling should be done across the granite/dacite contact to examine the fracturing along this contact in the diversion tunnel and spillway section.
- 10) A low angle hole should be drilled across the river to test the degree of weathering of possible fracture zones at shallow depth.
- 11) The tunnel section should be tested by additional drillholes on the completion of some further geophysical work, probably resistivity. The suitability of resistivity work for Googong is being tested.
- 12) The exact location of the fracture zone found in hole D9 should be determined by drilling. This zone is of importance for the positioning of the spillway.
- 13) Pump tests should be carried out to establish the existence of any anisotropy in the permeability of the foundations of the proposed dam.
- 14) The effect of hydrostatic pressure on the Queanbeyan Fault should be investigated in the light of danger of increased seismicity.
- 15) The area which is to be covered by the earth core should be sluiced as soon as is feasible to locate possible fracture zones.
- 16) The use of a device for orienting core should be specified for further drilling in order to collect information about the orientations of joints and fractures.
- 17) Since the refraction surveys at the Googong dam site failed to give clear indications delineating the positions of the fault or fracture zones, it is recommended that some experimental resistivity traversing and magnetometer work be done to establish a sound method of subsurface exploration for the forthcoming design phase of the investigation.

ACKNOWLEDGEMENTS

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All officers of the Department of Works associated with the survey, particularly Messrs D. Stockdill, R. Goldfinch, A. Fokkema, K. Harding, and M. Smith, were very helpful and greatly facilitated the investigation.

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APPENDIX 1

DEFINITIONS OF DESCRIPTIVE TERMS

Weathering

Fresh	Rock shows no discoloration, loss of strength, or any other effect of weathering.
Slightly weathered	Rock is slightly discoloured, but not noticeably lower in strength than the fresh rock.
Moderately weathered	Rock is discoloured and noticeably weakened, but 2-inch diameter cores cannot be broken by hand across the rock fabric.
Highly weathered	Rock is usually discoloured and weakened to such an extent that 2-inch diameter cores can be broken readily by hand, across the rock fabric. Wet strength usually much lower than dry strength.
Completely weathered	Rock is discoloured and entirely changed to a soil, but the original fabric of the rock is mostly preserved. The properties of the soil depend on the composition and structure of the parent rock.

Grainsize (igneous rocks)

Over 3 cm	Very coarse-grained
5 mm - 3 cm	Coarse-grained
1 mm - 5 mm	Medium-grained
0.33 mm - 1 mm	Fine-grained
Under 0.33 mm	Aphanitic

TABLE I. RESULTS OF WATER PRESSURE TESTING

No. of Hole	Section in Feet	Permeability in Lugeons	Total Footage Pressure Tested	Total Footage with loss higher than one Lugeon
D1	46 - 61	5	167	15
D2	30 - 40	11	185	40
	47 - 57	65		
D2	69 - 89	2		
D3	13 - 23	250	140	75
	23 - 33	70		
	30 - 40	34		
	39 - 54	37		
	54 - 64	3		
	65 - 85	2		
D4	12 - 24	49	143	50
	26 - 46	10		
	44 - 64	4		
D5	9 - 19	85	91	52
	19 - 29	20		
	29 - 39	14		
	39 - 49	5		
	81 - 93	3		
D6			224	0
D7	9 - 19	2.5	192	20
	29 - 39	5-20?		
D8			189	0
D9			193	0
D10	9 - 19	80	65	41
	19 - 30	60		
	30 - 50	9		
D11	53 - 74	3		
	72 - 92	6		
	89 - 109	2.5		
	104 - 123	18		
D12			30	0
D13			45	0
D14			32	0
D15	20 - 30	2	124	30
	30 - 40	2		
	40 - 50	2		
D16	19 - 29	16	211	10
D17	26 - 38	3	129	22
	48 - 58	2		
D17A			131	0
D18			32	0
D19			80	0
			2520	475

FIGURE 1

LOCALITY MAP
GOOGONG DAM SITE
QUEANBEYAN RIVER, N.S.W.

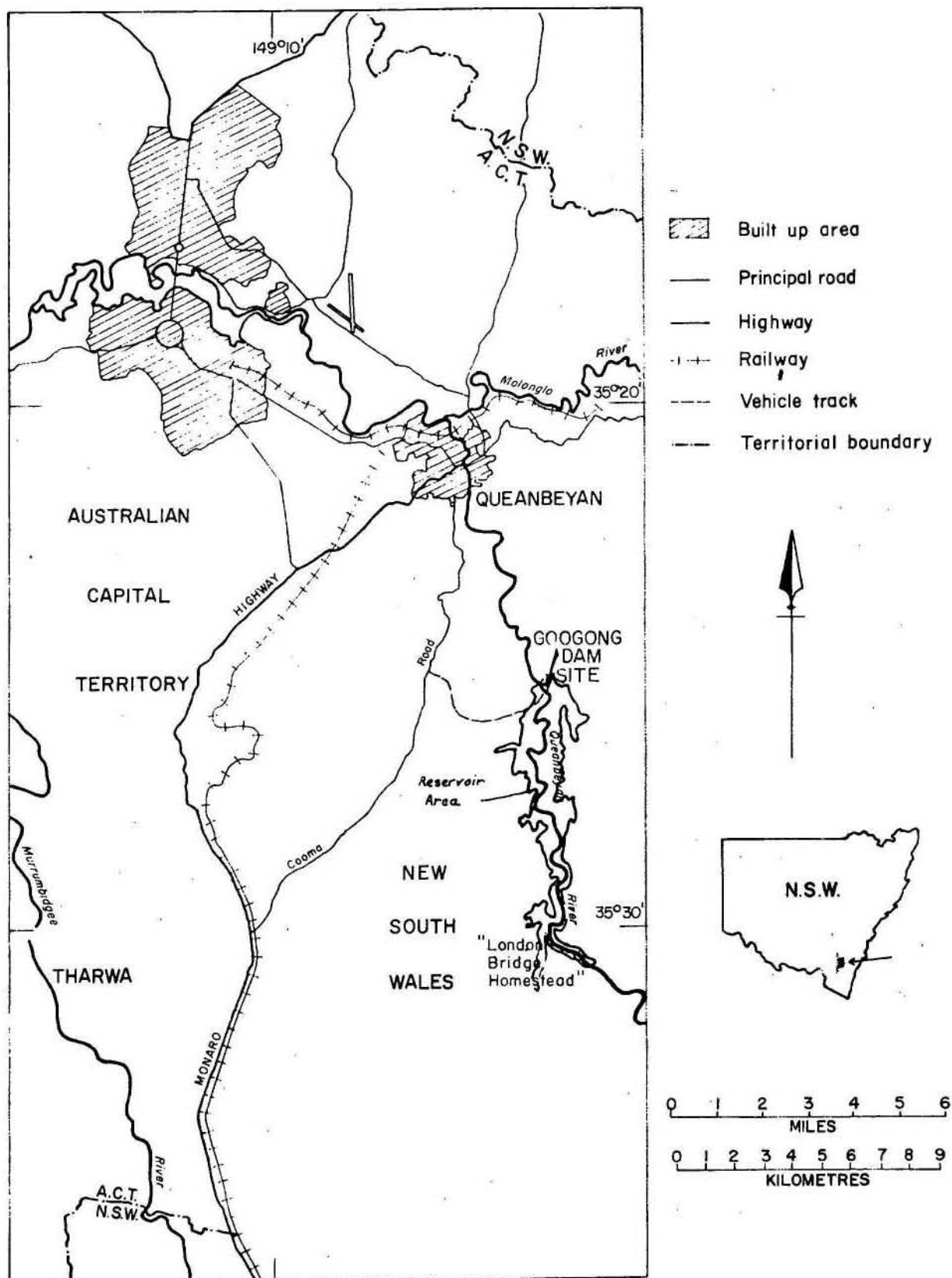
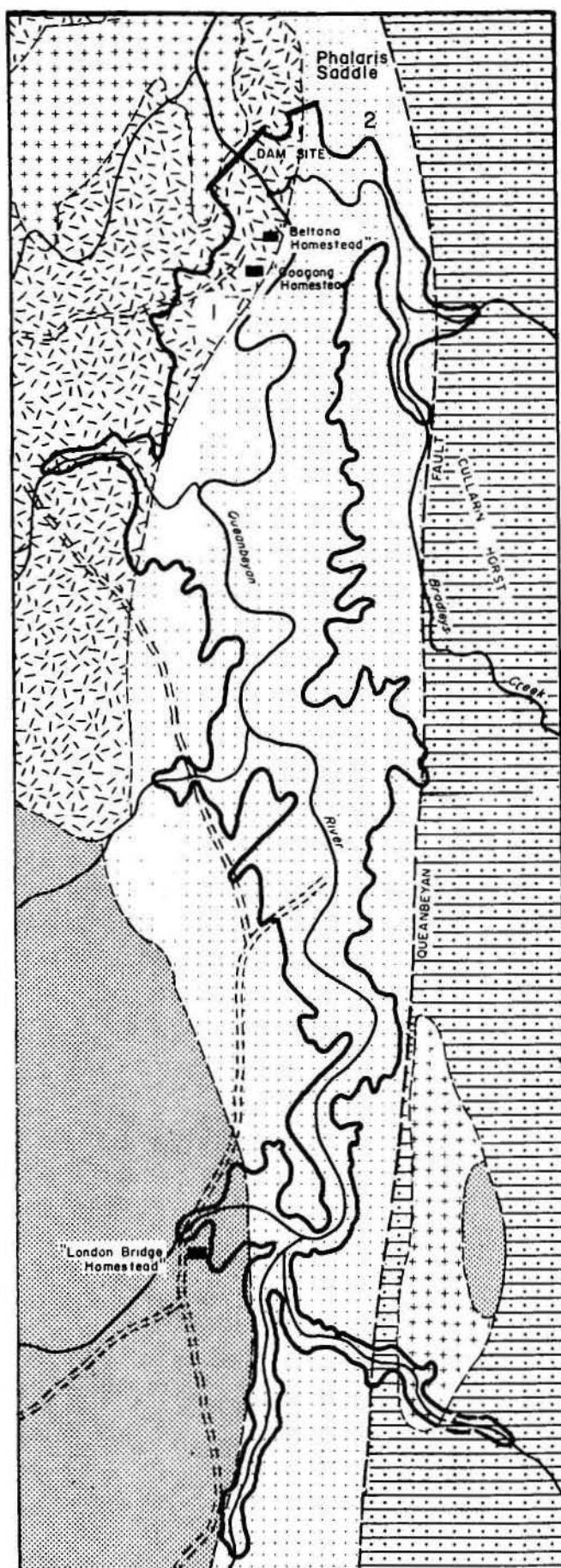
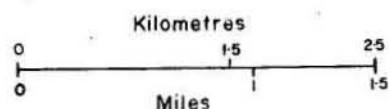


FIGURE 2

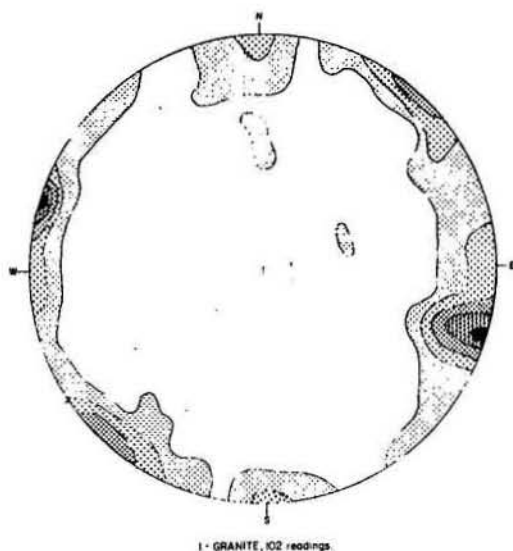


GOOGONG DAM SITE
QUEANBEYAN RIVER
N.S.W.
GENERAL BEDROCK GEOLOGY
OF STORAGE AREA

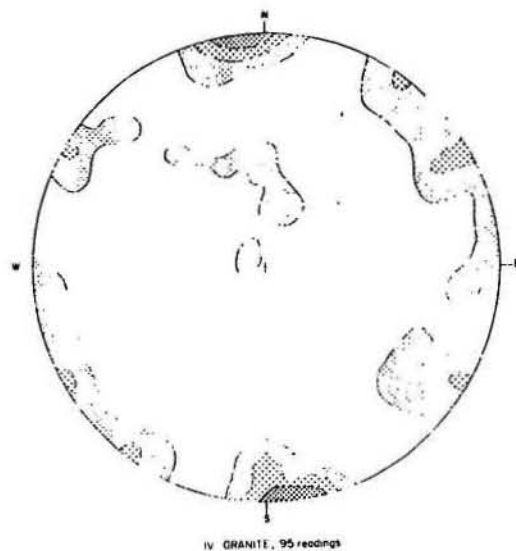
- Googong Granite and other granites.
Silurian-Devonian
- Keewong Quartz Porphyry.
Upper Silurian
- Colinton Volcanics.
Upper Silurian
- London Bridge Formation.
Upper Silurian
- Undifferentiated meta sediments
Upper Ordovician
- Geological boundary
- Fault,
Position approximate
- Top level of storage area
- Vehicle track
- 1 Alternative quarry site
- 2 Core material borrow area



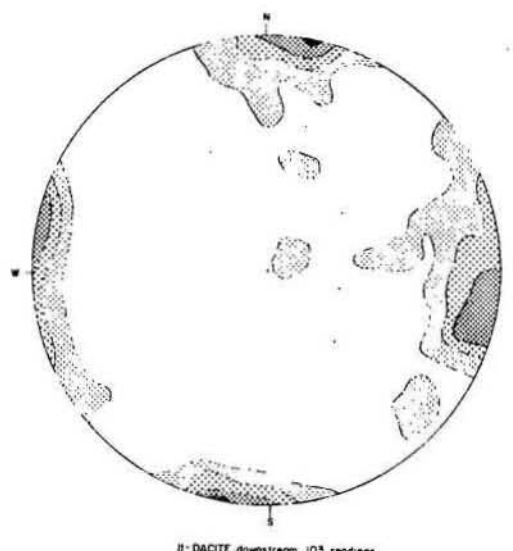
Geology modified from
CANBERRA 1:250,000
SHEET SI 55-16



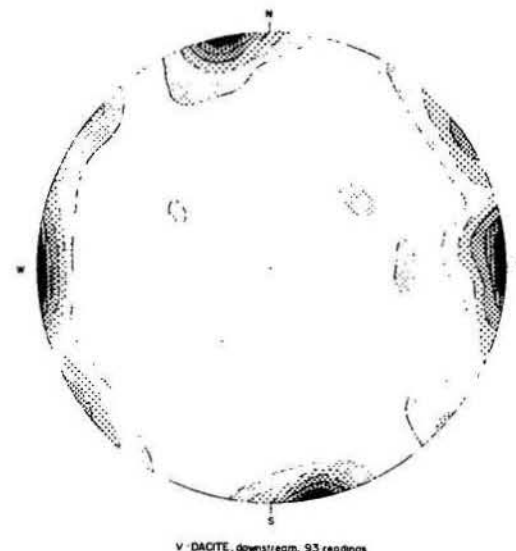
I - GRANITE, 102 readings



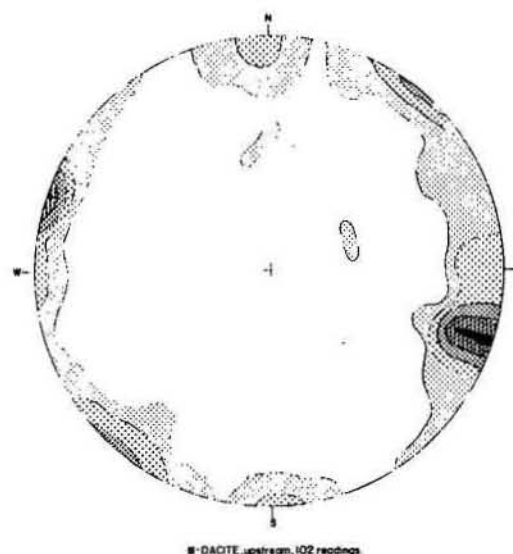
IV - GRANITE, 95 readings



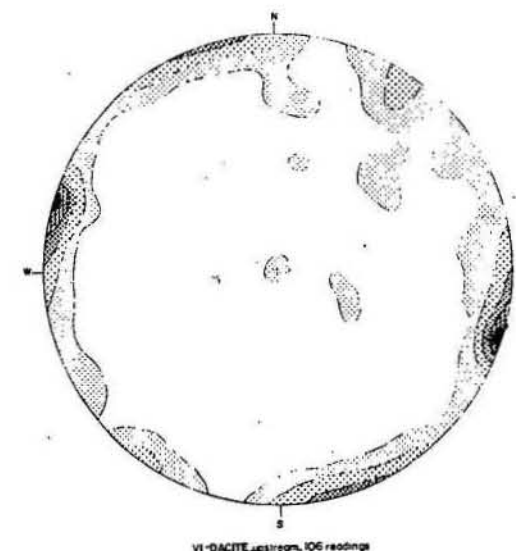
II - DACITE, downstream, 103 readings



V - DACITE, downstream, 93 readings



III - DACITE, upstream, 102 readings



VI - DACITE, upstream, 106 readings

LEFT BANK

Number of poles per one percent of area

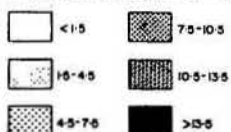


Diagram numbers refer to locations on map

RIGHT BANK

GOOGONG DAM SITE
QUEANBEYAN RIVER
N.S.W.

FIG. 3

Lower Hemisphere stereographic projection
of poles of joints and cleavage planes.

APPENDIX 2

Geological logs of diamond drillholes and water pressure testing.

(All core was photographed in both black and white and colour.)

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>000004 DAM SITE, Queanbeyan River N.S.W.</u>		HOLE NO <u>D5</u>	
GEOLOGICAL LOG OF DRILL HOLE		LOCATION <u>Left Bank Near Hanging Weir</u>		SHEET <u>1</u> OF <u>2</u>	
ANGLE FROM HORIZONTAL <u>40°</u>		DIRECTION <u>-</u>		COORDINATES <u>754009R150 22986E 32372N</u>	
COORDINATES <u>754009R150 22986E 32372N</u>		R.L. <u>2062 ft.</u>		WATER LEVEL	
DEPTH FEET	DEPTH METERS	LITHOLOGY DESCRIPTION	STRUCTURE FRACTURES, VEINS, SEAMS, FAULTS, CRUSHED ZONE	WATER LEVEL	ROD
0	0	DACITE S.W. yellowish grey.	0-1' Very broken.		55
1	0.3		4-10' Fractures mostly 0°-25°, few 45°		65
2	0.6				80
3	0.9	Py			75
4	1.2		14-20' Most fractures 45° or less.		40
5	1.5				14
6	1.8	Py			44
7	2.1		26.5'-31.5' Core broken into fragments by many 45° and 70° fractures.		50
8	2.4		27'-28' Fracture zone: open fractures.		85
9	2.7		31.5'-39' 70°-40° Fractures prevailing		75
10	3.0		To 39' Most fractures Fe. stained.		100
11	3.3		Generally no Fe. stains on parting plane, but Ca coating (1mm)		85
12	3.6	Ep			70
13	3.9		60'-65' 45°-60° Fractures prevailing		45
14	4.2	Py			75
15	4.5				66
16	4.8	Py			15
17	5.1	Ep			
18	5.4				
19	5.7				
20	6.0				
21	6.3				
22	6.6				
23	6.9				
24	7.2				

DRILL TYPE Mindrell F.S.S.

FEED Hydraulic

CORE BARREL TYPE Split

tripole tube

DRILLER M.R. Parcell

COMMENCED 6/7/72

COMPLETED 16/7/70

LOGGED BY J.A. SALTET

VERTICAL SCALE 1 inch = 10 feet

NOTES

FRACTURE LOG: Number of fractures per foot of core. Zones of core loss are blocked.

BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the bore axis.

Co. Carbonate.

S.W. Slightly weathered.

Py Pyrite

Q. Quartz.

Ep Epidote.

Fe Iron.

R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per 5 feet.

WATER PRESSURE TESTS

PICKER TYPE Mechanical

SUPPLY LINE N. Rods

VERTICAL SCALE 1 inch = 100 psi

FIGURES GIVEN ARE BRIDGE PRESSURES

TEST SECTIONS ARE NOT CORRECTED GRAPHICALLY BY BRIDGING IN STRIPS

PHOTOGRAPH REFERENCE SYSTEM

B. BOX AND WHITE B.N.R. Film Reference

M/1173. frames 2-3

M/11048. frames 2-15

COLOUR M/1183 3-4

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GORGONG DAM SITE, Quannbeyan River N.S.W.</u>		LOCATION <u>Left Bank Near Gauging Wair</u>		HOLE NO <u>D5</u>	
GEOLOGICAL LOG OF DRILL HOLE		ANGLE FROM HORIZONTAL <u>90°</u>		DIRECTION <u>-</u>		SHEET <u>2</u> OF <u>2</u>	
COORDINATES <u>75600 98150 222986 588378N</u>		R.L. <u>2062 ft</u>					
ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT % CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot
<u>Fresh DACITE.</u> ↓	Hole ends 101'9"		25 26 27 28 29 30 31 32 EP 100 32	85'-86' Fracture zone A.F.S. 20mm. 99'-99'9" Silicified zone 100' Q. veins cutting across Ep. veins, ergo, Q. veins younger than Ep. veins.	3 4 1 Layer 1 Layer	26 30 34 38 42 46 50 54 58 62 66 70 74 78 82 86 90 94 98 102 106 110 114 118 122 126 130 134 138 142 146 150 154 158 162 166 170 174 178 182 186 190 194 198 202 206 210 214 218 222 226 230 234 238 242 246 250 254 258 262 266 270 274 278 282 286 290 294 298 302 306 310 314 318 322 326 330 334 338 342 346 350 354 358 362 366 370 374 378 382 386 390 394 398 402 406 410 414 418 422 426 430 434 438 442 446 450 454 458 462 466 470 474 478 482 486 490 494 498 502 506 510 514 518 522 526 530 534 538 542 546 550 554 558 562 566 570 574 578 582 586 590 594 598 602 606 610 614 618 622 626 630 634 638 642 646 650 654 658 662 666 670 674 678 682 686 690 694 698 702 706 710 714 718 722 726 730 734 738 742 746 750 754 758 762 766 770 774 778 782 786 790 794 798 802 806 810 814 818 822 826 830 834 838 842 846 850 854 858 862 866 870 874 878 882 886 890 894 898 902 906 910 914 918 922 926 930 934 938 942 946 950 954 958 962 966 970 974 978 982 986 990 994 998 1002 1006 1010 1014 1018 1022 1026 1030 1034 1038 1042 1046 1050 1054 1058 1062 1066 1070 1074 1078 1082 1086 1090 1094 1098 1102 1106 1110 1114 1118 1122 1126 1130 1134 1138 1142 1146 1150 1154 1158 1162 1166 1170 1174 1178 1182 1186 1190 1194 1198 1202 1206 1210 1214 1218 1222 1226 1230 1234 1238 1242 1246 1250 1254 1258 1262 1266 1270 1274 1278 1282 1286 1290 1294 1298 1302 1306 1310 1314 1318 1322 1326 1330 1334 1338 1342 1346 1350 1354 1358 1362 1366 1370 1374 1378 1382 1386 1390 1394 1398 1402 1406 1410 1414 1418 1422 1426 1430 1434 1438 1442 1446 1450 1454 1458 1462 1466 1470 1474 1478 1482 1486 1490 1494 1498 1502 1506 1510 1514 1518 1522 1526 1530 1534 1538 1542 1546 1550 1554 1558 1562 1566 1570 1574 1578 1582 1586 1590 1594 1598 1602 1606 1610 1614 1618 1622 1626 1630 1634 1638 1642 1646 1650 1654 1658 1662 1666 1670 1674 1678 1682 1686 1690 1694 1698 1702 1706 1710 1714 1718 1722 1726 1730 1734 1738 1742 1746 1750 1754 1758 1762 1766 1770 1774 1778 1782 1786 1790 1794 1798 1802 1806 1810 1814 1818 1822 1826 1830 1834 1838 1842 1846 1850 1854 1858 1862 1866 1870 1874 1878 1882 1886 1890 1894 1898 1902 1906 1910 1914 1918 1922 1926 1930 1934 1938 1942 1946 1950 1954 1958 1962 1966 1970 1974 1978 1982 1986 1990 1994 1998 2002 2006 2010 2014 2018 2022 2026 2030 2034 2038 2042 2046 2050 2054 2058 2062 2066 2070 2074 2078 2082 2086 2090 2094 2098 2102 2106 2110 2114 2118 2122 2126 2130 2134 2138 2142 2146 2150 2154 2158 2162 2166 2170 2174 2178 2182 2186 2190 2194 2198 2202 2206 2210 2214 2218 2222 2226 2230 2234 2238 2242 2246 2250 2254 2258 2262 2266 2270 2274 2278 2282 2286 2290 2294 2298 2302 2306 2310 2314 2318 2322 2326 2330 2334 2338 	

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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GOOPOONG DAM SITE, Queendaryan River N.S.W.</u>		HOLE NO. <u>D.6.</u>	
		LOCATION <u>Right Bank Near Weir.</u>			
GEOLOGICAL LOG OF DRILL HOLE		ANGLE FROM HORIZONTAL <u>45°</u>		DIRECTION <u>120°</u>	
		COORDINATES <u>7553037990. 223322E 588636N</u>		RL <u>2027 ft</u>	
				SHEET <u>2</u> OF <u>3</u>	

DATE	TIME	WEATHERING	DESCRIPTION COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC SIZE OF CORE	DEPTH LOG	FRACTION LOG	RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TESTS Loss in grains per cubic foot	CORRECTION LOG	R.Q.D.
			Fresh Dacite		25			80'-100' Most Ep. Q. veins (90% not more than 2mm) between 20'-40'. Almost all fractures show Py.				70
					26			98'-96' Broken zone due to several 60° fractures.				50
					27			98' Rock fresh but Ep. veins look weathered.				20
					28							40
					29							35
					30							85
					31							85
					32			102'-109' Silicified dacite with many Ep. veins.				70
					33			102'-104' Ep. Q. almost 100% (light green very hard)				10
					34			104'-105' Dacite, broken due to parallel 60° fractures				20
					35			112'-116' 2 Q. veins 60° 1cm wide				35
					36			112'-116' 90% Q. Ep. Light green. (mesh structure)				70
					37			116'-122' Many light green (5mm) Ep. Q. veins decreasing in quantity to depth.				10
					38			122'-125' Broken zone due to few vertical and many low angle fractures except for the fractures in Ep. Q. zone, most fractures coated with Ca.				20
					39			126'-127' Very broken zone A.F.S. 10mm. Ep. Q. vein 126' 3" thick.				35
					40							27
					41							55
					42							100
					43							20
					44							70
					45							20
					46							70
					47			151'-156' Parted bedding planes are counted as fractures in shale. Very broken zone due to 0° fractures.				20
					48			156'-160' Only one fracture not parallel to bedding, all others parallel.				70

DRILL TYPE <u>B.B. 8.2</u> FEED <u>Hydraulic</u> CORE BARREL TYPE <u>Split</u> <u>Twiple Tube.</u> DRILLER <u>M. Dziwulski</u> DOWNEHOLE <u>151170</u> COMPLETION <u>511170</u> LOGGED BY <u>J.A. SALTET</u> VERTICAL SCALE <u>1 inch = 10 feet</u>	FRACTURE LOG Number of fractures per foot of core. Zones of core loss are blocked in. BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis. A.F.S. Average fragment size S.W. Slightly weathered. Py. Pyrite. Ca. Carbonate. Ep. Epidote. Q. Quartz. Fe. Iron. R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per 5 feet.	WATER PRESSURE TESTS PACKER TYPE <u>Mechanical</u> SUPPLY LINE <u>N. Rods</u> VERTICAL SCALE <u>1 inch = 50 PSI</u> PHOTOGRAPH REFERENCE SYSTEM BLACK AND WHITE <u>B.M.R. Film Reference</u> <u>M/1173, frames 6-8</u> COLOUR <u>M/1183 7-9</u>
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155/AIG/751

[illegible]

[illegible]

155/A16/753

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GODGONG DAM SITE, Queanbeyan River NSW</u> LOCATION <u>Right Bank Near River</u>						HOLE NO D.8.	
		GEOLOGICAL LOG OF DRILL HOLE						SHEET <u>3</u> OF <u>3</u>	
ANGLE FROM HORIZONTAL <u>45°</u> COORDINATES <u>7517037825. 222918E. 588468N. R.L. 2092.71</u>		DIRECTION <u>306°</u>							
ROCK TYPE & NATURE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST LBS in gallons per minute per foot	ROD
Dacite without phenocrysts. ↑ GRANITE ↓ GRANITE	162' q' Rock gets more coarse and starts developing phenocrysts. (sample taken 165') 172' 45° layering or foliation in fine grained dacite. 176'. Ditto. 176' q' - 200' Granitic rock at contact with dacite, rock has porphyritic structure Q. and feldspar phenocrysts (-4mm) bedded in light groundmass. Py. abundant. This granite porphyry is gradually changing into a granite with proper granitic structure, average grain size 5mm 190' Change to granite complete. End of hole 201'		49 50 51 170 53 54 180 56 57 190 59 60 200	167' q' Q. vein 1' 70° 172' Q. vein 5" 60° 169' - 182' 5" Fracture zone. 180' - 181' Rock M.W. very little clay and no Fe. staining. 191' q' - 199' 6" Fracture zone, rock M.W.	100 42 100 75 47 76 33 62				

DRILL TYPE Boyles BB52
 FEED Hydraulic
 CORE BARREL TYPE Split
Triple tube
 DRILLER M.Dziwulski
 COMMENCED 26/1/70
 COMPLETED 9/9/70
 LOGGED BY J.A. SALTET
 VERTICAL SCALE 1 inch = 10 feet

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

Q. Quartz.
 Ep. Epidote.
 A.F.S. Average fragment size.
 Co. Carbonate.
 Py. Pyrite
 M.W. Moderately weathered.
 Fe. Iron.
 R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per 5 feet.

WATER PRESSURE TESTS

PACKER TYPE Mechanical
 SUPPLY LINE M.Rods.
 VERTICAL SCALE 1 inch = 80 p.s.i.
 Figures given are gauge pressures.
 Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE 8mm Film Reference
M/1173 frame 18
m/1002 " 12-20
 COLOUR M/1183 19

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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS GEOLOGICAL LOG OF DRILL HOLE		PROJECT <u>GOOGONG DAM SITE, Queanbeyan River N.S.W.</u> LOCATION <u>Right Bank Spillway Section.</u>				HOLE NO. <u>D.9.</u> SHEET <u>1</u> OF <u>2</u>	
		ANGLE FROM HORIZONTAL <u>45°</u> DIRECTION <u>304°</u> COORDINATES <u>7534597410 222968E 588593N</u> R.L. <u>2127ft</u>					
NO. TYPE & DEPTH OF WEATHERING	DESCRIPTION (FACIES, COLOUR, STRENGTH, HARDNESS, ETC)	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT TO CORE RECOVERY	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)	WATER PRESSURE TEST (LOSS IN POUNDS PER SQUARE INCH PER FOOT)
M.W. Dacite S.W. Dacite, but gradually becoming fresher. Fresh Dacite Fault Zone Fresh Dacite Fault Zone Fault Zone	In general no Py 0-80 feet	NK N.M.L.C. QEp Py. 	0 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	Open fractures, fractures Fe stained, fragments average 2". 70° fracture, filled with 2mm clay. a. Ep. Airt, heavily fractured A.F.S. 10mm. 70° fracture filled with 3mm clay. Fracture zone, A.F.S. 10mm. Fracture zone, A.F.S. 10mm. 49'-4" - 81'. Fault zone. A.F.S. 10mm. Fragments are coated with white clay, angular, S.W. on edges and fresh in core. The clay is in situ weathered dacite. Weathering is probably due to fracturing. 56'-58'-6" Clay forms 70% of core. Crushed dacite which is not yet weathered, but weathering has already set in.	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	
DRILL TYPE <u>Mindril F.S.S.</u> FEED <u>Hydraulic</u> CORE BARREL TYPE <u>Triple split type</u> DRILLER <u>M.B. Percell</u> COMMENCED <u>4.8.70</u> COMPLETED <u>20.8.70</u> LOGGED BY <u>J.A. Salter</u> VERTICAL SCALE <u>1 inch = 10 feet</u>		NOTES FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in. BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis. A.F.S. Average fragment size. Fe. Iron. Q. Quartz. Ep. Epidote. S.W. Slightly weathered. M.W. Moderately " Py. Pyrite. R.Q.D. Rock quality designation expresses the percentage of core larger than 4 inches per 5 feet.				WATER PRESSURE TESTS PACKER TYPE <u>Mechanical</u> SUPPLY LINE <u>N. Rods</u> VERTICAL SCALE <u>1 inch = 60 p.s.i.</u> PHOTOGRAPH REFERENCE SYSTEM BLACK AND WHITE <u>B.M.S. Film Reference</u> <u>M/1172 frames 19-20</u> <u>M/1061 " 6-29</u> COLOUR <u>0-50' M/1123 20</u> <u>50'-70' Missing</u>	

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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS GEOLOGICAL LOG OF DRILL HOLE		PROJECT <u>GOOGONG DAM SITE, Queanbeyan River N.S.W.</u> LOCATION <u>Right Bank Seilway Section</u> ANGLE FROM HORIZONTAL <u>45°</u> DIRECTION <u>204°</u> COORDINATES <u>7594597, 30. 222968E. 588593N.</u> R.L. <u>2187.1</u>				HOLE NO <u>D.9.</u> SHEET <u>2</u> OF <u>2</u>						
		ROCK TYPE & DEGREE OF WEATHERING		DESCRIPTION (MIN. LG., COLOUR, STRENGTH, HARDNESS, ETC)		GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot
Fault Zone Fresh Dacite ↑ ↓ Fresh Dacite		Hole ends at 116.5 feet.		Py 25 26 27 28 29 30 31 32 33 34 35 100 110 120		Fractured dacite, but not as badly as higher up. clay seams occur but not commonly. Clay in fractures. 3" Clay filled fracture zone A.F.S. 5mm. Fractures tight and clean.		0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 15 15.5 16 16.5 17 17.5 18 18.5 19 19.5 20 20.5 21 21.5 22 22.5 23 23.5 24 24.5 25 25.5 26 26.5 27 27.5 28 28.5 29 29.5 30 30.5 31 31.5 32 32.5 33 33.5 34 34.5 35 35.5 36 36.5 37 37.5 38 38.5 39 39.5 40 40.5 41 41.5 42 42.5 43 43.5 44 44.5 45 45.5 46 46.5 47 47.5 48 48.5 49 49.5 50 50.5 51 51.5 52 52.5 53 53.5 54 54.5 55 55.5 56 56.5 57 57.5 58 58.5 59 59.5 60 60.5 61 61.5 62 62.5 63 63.5 64 64.5 65 65.5 66 66.5 67 67.5 68 68.5 69 69.5 70 70.5 71 71.5 72 72.5 73 73.5 74 74.5 75 75.5 76 76.5 77 77.5 78 78.5 79 79.5 80 80.5 81 81.5 82 82.5 83 83.5 84 84.5 85 85.5 86 86.5 87 87.5 88 88.5 89 89.5 90 90.5 91 91.5 92 92.5 93 93.5 94 94.5 95 95.5 96 96.5 97 97.5 98 98.5 99 99.5 100 100.5 101 101.5 102 102.5 103 103.5 104 104.5 105 105.5 106 106.5 107 107.5 108 108.5 109 109.5 110 110.5 111 111.5 112 112.5 113 113.5 114 114.5 115 115.5 116 116.5 117 117.5 118 118.5 119 119.5 120 120.5 121 121.5 122 122.5 123 123.5 124 124.5 125 125.5 126 126.5 127 127.5 128 128.5 129 129.5 130 130.5 131 131.5 132 132.5 133 133.5 134 134.5 135 135.5 136 136.5 137 137.5 138 138.5 139 139.5 140 140.5 141 141.5 142 142.5 143 143.5 144 144.5 145 145.5 146 146.5 147 147.5 148 148.5 149 149.5 150 150.5 151 151.5 152 152.5 153 153.5 154 154.5 155 155.5 156 156.5 157 157.5 158 158.5 159 159.5 160 160.5 161 161.5 162 162.5 163 163.5 164 164.5 165 165.5 166 166.5 167 167.5 168 168.5 169 169.5 170 170.5 171 171.5 172 172.5 173 173.5 174 174.5 175 175.5 176 176.5 177 177.5 178 178.5 179 179.5 180 180.5 181 181.5 182 182.5 183 183.5 184 184.5 185 185.5 186 186.5 187 187.5 188 188.5 189 189.5 190 190.5 191 191.5 192 192.5 193 193.5 194 194.5 195 195.5 196 196.5 197 197.5 198 198.5 199 199.5 200 200.5 201 201.5 202 202.5 203 203.5 204 204.5 205 205.5 206 206.5 207 207.5 208 208.5 209 209.5 210 210.5 211 211.5 212 212.5 213 213.5 214 214.5 215 215.5 216 216.5 217 217.5 218 218.5 219 219.5 220 220.5 221 221.5 222 222.5 223 223.5 224 224.5 225 225.5 226 226.5 227 227.5 228 228.5 229 229.5 230 230.5 231 231.5 232 232.5 233 233.5 234 234.5 235 235.5 236 236.5 237 237.5 238 238.5 239 239.5 240 240.5 241 241.5 242 242.5 243 243.5 244 244.5 245 245.5 246 246.5 247 247.5 248 248.5 249 249.5 250 250.5 251 251.5 252 252.5 253 253.5 254 254.5 255 255.5 256 256.5 257 257.5 258 258.5 259 259.5 260 260.5 261 261.5 262 262.5 263 263.5 264 264.5 265 265.5 266 266.5 267 267.5 268 268.5 269 269.5 270 270.5 271 271.5 272 272.5 273 273.5 274 274.5 275 275.5 276 276.5 277 277.5 278 278.5 279 279.5 280 280.5 281 281.5 282 282.5 283 283.5 284 284.5 285 285.5 286 286.5 287 287.5 288 288.5 289 289.5 290 290.5 291 291.5 292 292.5 293 293.5 294 294.5 295 295.5 296 296.5 297 297.5 298 298.5 299 299.5 300 300.5 301 301.5 302 302.5 303 303.5 304 304.5 305 305.5 306 306.5 307 307.5 308 308.5 309 309.5 310 310.5 311 311.5 312 312.5 313 313.5 314 314.5 315 315.5 316 316.5 317 317.5 318 318.5 319 319.5 320 320.5 321 321.5 322 322.5 323 323.5 324 324.5 325 325.5 326 326.5 327 327.5 328 328.5 329 329.5 330 330.5 331 331.5 332 332.5 333 333.5 334 334.5 335 335.5 336 336.5 337 337.5 338 338.5 339 339.5 340 340.5 341 341.5 342 342.5 343 343.5 344 344.5 345 345.5 346 346.5 347 347.5 348 348.5 349 349.5 350 350.5 351 351.5 352 352.5 353 353.5 354 354.5 355 355.5 356 356.5 357 357.5 358 358.5 359 359.5 360 360.5 361 361.5 362 362.5 363 363.5 364 364.5 365 365.5 366 366.5 367 367.5 368 368.5 369 369.5 370 370.5 371 371.5 372 372.5 373 373.5 374 374.5 375 375.5 376 376.5 377 377.5 378 378.5 379 379.5 380 380.5 381 381.5 382 382.5 383 383.5 384 384.5 385 385.5 386 386.5 387 387.5 388 388.5 389 389.5 390 390.5 391 391.5 392 392.5 393 393.5 394 394.5 395 395.5 396 396.5 397 397.5 398 398.5 399 399.5 400 400.5 401 401.5 402 402.5 403 403.5 404 404.5 405 405.5 406 406.5 407 407.5 408 408.5 409 409.5 410 410.5 411 411.5 412 412.5 413 413.5 414 414.5 415 415.5 416 416.5 417 417.5 418 418.5 419 419.5 420 420.5 421 421.5 422 422.5 423 423.5 424 424.5 425 425.5 426 426.5 427 427.5 428 428.5 429 429.5 430 430.5 431 431.5 432 432.5 433 433.5 434 434.5 435 435.5 436 436.5 437 437.5 438 438.5 439 439.5 440 440.5 441 441.5 442 442.5 443 443.5 444 444.5 445 445.5 446 446.5 447 447.5 448 448.5 449 449.5 450 450.5 451 451.5 452 452.5 453 453.5 454 454.5 455 455.5 456 456.5 457 457.5 458 458.5 459 459.5 460 460.5 461 461.5 462 462.5 463 463.5 464 464.5 465 465.5 466 466.5 467 467.5 468 468.5 469 469.5 470 470.5 471 471.5 472 472.5 473 473.5 474 474.5 475 475.5 476 476.5 477 477.5 478 478.5 479 479.5 480 480.5 481 481.5 482 482.5 483 483.5 484 484.5 485 485.5 486 486.5 487 487.5 488 488.5 489 489.5 490 490.5 491 491.5 492 492.5 493 493.5 494 494.5 495 495.5 496 496.5 497 497.5 498 498.5 499 499.5 500 500.5 501 501.5 502 502.5 503 503.5 504 504.5 505 505.5 506 506.5 507 507.5 508 508.5 509 509.5 510 510.5 511 511.5 512 512.5 513 513.5 514 514.5 515 515.5 516 516.5 517 517.5 518 518.5 519 519.5 520 520.5 521 521.5 522 522.5 523 523.5 524 524.5 525 525.5 526 526.5 527 527.5 528 528.5 529 529.5 530 530.5 531 531.5 532 532.5 533 533.5 534 534.5 535 535.5 536 536.5 537 537.5 538 538.5 539 539.5 540 540.5 541 541.5 542 542.5 543 543.5 544 544.5 545 545.5 546 546.5 547 547.5 548 548.5 549 549.5 550 550.5 551 551.5 552 552.5 553 553.5 554 554.5 555 555.5 556 556.5 557 557.5 558 558.5 559 559.5 560 560.5 561 561.5 562 562.5 563 563.5 564 564.5 565 565.5 566 566.5 567 567.5 568 568.5 569 569.5 570 570.5 571 571.5 572 572.5 573 573.5 574 574.5 575 575.5 576 576.5 577 577.5 578 578.5 579 579.5 580 580.5 581 581.5 582 582.5 583 583.5 584 584.5 585 585.5 586 586.5 587 587.5 588 588.5 589 589.5 590 590.5 591 591.5 592 592.5 593 593.5 594 594.5 595 595.5 596 596.5 597 597.5 598 598.5 599 599.5 600 600.5 601 601.5 602 602.5 603 603.5 604 604.5 605 605.5 606 606.5 607 607.5 608 608.5 609 609.5 610 610.5 611 611.5 612 612.5 613 613.5 614 614.5 615 615.5 616 616.5 617 617.5 618 618.5 619 619.5 620 620.5 621 621.5 622 622.5 623 623.5 624 624.5 625 625.5 626 626.5 627 627.5 628 628.5 629 629.5 630 630.5 631 631.5 632 632.5 633 633.5 634 634.5 635 635.5 636 636.5 637 637.5 638 638.5 639 639.5 640 640.5 641 641.5 642 642.5 643 643.5 644 644.5 645 645.5 646 646.5 647 647.5 648 648.5 649 649.5 650 650.5 				

BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

PROJECT GODGONG DAM SITE, Queanbeyan River N.S.W.

LOCATION Right Bank Spillway Section

HOLE NO

D10

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL 90°

DIRECTION —

COORDINATES 75600 97220 223035 E. 588656 N.

R.L. 2212 ft.

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRAC- TURE LOG	LIFT & % CORE RECOVERY	STRUCTURES JOINTS, VENS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO- GRAPH NO.	R.Q.D.
DACITE M.V. light green.	7'-24' Minor tuff bands common, often as schlieren. low and high angle. 10'-11' Dark green tuff band 65° 12'-12' 6" Dark green tuff band 65° (Sample taken)		NX. NMLC 2 10 4 20 7 8 30 10 11 40 13 15 15 17 18 60 19 20 21 70 22			0-63' Most fracture Fe. stained. 6' 75° Fracture filled with 4mm light brown clay. 11'-12' Fracture zone A.F.S. 5mm. 23'-23' 9" Clay filled seam A.F.S. 3mm. (light brown). 25'-27' Fracture zone due to vertical fracture and low angle fractures. 27'-27' 6" 65° Fracture filled with 30 mm clay and weathered rock fragments. 57'-3" Low angle fracture zone 20mm. wide A.F.S. 10mm 59'-60' Shear zone. 68' Onwards; most Fractures clean. 68'-70' Shear zone, rock fragments can be hand crushed. Due to broken zone, 70'-71' Broken zone due to vertical fracture			M/1173 090/141 20 240 330 465 560 660 730 830 940 990 1085 1192 1240 1325 1415	
DACITE increasingly fresh, dark green										
DACITE	Hole ends 74'									

DRILL TYPE Minacill F55

FEED Hydraulic

CORE BARREL TYPE Split

Sciple tube

DRILLER M.R. Pocuell

COMMENCED 18/7/70

COMPLETED 23/7/70

LOGGED BY J.A. SALTET

VERTICAL SCALE Linch: 10 feet

NOTES

FRAC-
TURE LOG Number of fractures per foot of core. Zones of core loss are blocked in.
BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis

M.V. Moderately weathered.

A.F.S. Average fragment size.

Py. Pyrites.

R.Q.D. Rock quality designation expresses the percentage of core
longer than 4 inches per 5 feet.

Fe. Iron

WATER PRESSURE TESTS

PACKER TYPE Mechanical

SUPPLY LINE N. Rods

VERTICAL SCALE Linch: 50 p.s.i.

Figures given are gauge pressures
Test sections are indicated graphically by blocked in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE B.M.R. Film Reference

M/1173 frames 22-23

M/1060 n 2-14

COLOR M/1184 2-3

M(P1)122

155/A10/755

BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

PROJECT GOOGONG DAM SITE, Gungahyeh River NSW
LOCATION Right Bank Spillway Section.

HOLE NO

011

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL 4.5° DIRECTION 114°
COORDINATES 25 720 37050 223080E 588709N R.L. 2232 ft.

SHEET 2 OF 2

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE	PHAC/LRE LOG	LIFT & % CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gals per minute per foot	REMARKS	DEPTH IN FEET
SHALE	79'3"-81'3" Shale highly weathered to dip (brown). 82'-84' Moderately weathered brown shale. 84'-85' Completely weathered brown shale. 85'-90'9" Moderately weathered brown shale.	25 26 27 90			81'3"-82' Ep. vein, fracture zone A.F.S. 4. 85'-86'6" Fracture zone A.F.S. 4. 87'3"-88'3" Fracture zone A.F.S. 4-12.			6 Logson	0 34 20 35 25 36
DACITE	90'9"-92'6" Completely weathered brown shale. 92'6"-93'3" Moderately weathered brown shale. 93'3"-95' Moderate to highly weathered brown shale. 95'-100' Moderately weathered dacite, weathering decreasing (brown). 100' Green, slightly weathered with brown patches. 99'6" Sample taken of sandstone nodule. 100'-109' Slightly weathered Ep 109'-123'9" Fresh.	29 30 100 32 33 110 35 36 120 37			96'4" Sample taken. 98'3" Q.Ep. vein 1/4. Tuff or shale inclusion in dacite. Not parallel bedding. 102'3" Q.Ep. vein 1/4. 30° 102'9" Q.Ep. vein 1/4. 104' Q. vein 1/4 20° 105'6" Q. vein 1/4 irregular. 106'3" Q. vein 1/4 45° 108'-108'8" Fracture zone A.F.S. 1 1/4. 60° 108'6" Clay filled seam of 1/4 45° 123'9" Two 50° fractures, fractures 2" apart, slightly weathered.			2.6 Logson 18 Logson	37 55 1 2 46 26 9 4 94 5 85
	End of hole 123'9"	130							

DRILL TYPE Mindrill F55
FEED Hydraulic
CORE BARREL TYPE Split
triple tube
DRILLER M.R. Porced
COMMENCED 24/7/70
COMPLETED 3/8/70
LOGGED BY J.A. SALTAT
VERTICAL SCALE 1 inch = 10 feet

FRACTURE LOG Number of fractures per foot of core. Zones of core loss are blocked in.
BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.
A.F.S. Average fragment size.
Q. Quartz.
Ep. Epidote.
Fe. Iron.
R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per foot.

WATER PRESSURE TEST'S
PACKER TYPE Mechanical
SUPPLY LINE M. Rods
VERTICAL SCALE lined 50 psi
Figures given are gauge pressures.
Test sections are indicated graphically by broken lines.
PHOTOGRAPHIC REFERENCE SYSTEM
BLACK AND WHITE B.M.A. Film Reference
M/1173 frames 25-26
M/1060 " 33-37
M/1061 " 1-5
Colour M/1184 5-6
M(PF) 99

155/A16/756

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GOOGONG DAM SITE, Gungahyan River N.S.W.</u>				HOLE NO. D13	
		LOCATION <u>Right Bank Spillway Section</u>					
GEOLOGICAL LOG OF DRILL HOLE		ANGLE FROM HORIZONTAL <u>90°</u>		DIRECTION <u>-</u>		SHEET <u>1</u> OF <u>1</u>	
		COORDINATES <u>75060 97200. 222983E. 588662N. R.L. 2095ft.</u>					

HOLE TYPE & DEGREE OF WEATHERING	DESCRIPTION COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot
0'-23' S.W. yellowish grey Granite, very broken.	0'-23' Due to fracturing, 20% of granite is completely weathered in certain zones. Only major weathering zones are indicated as such.		1M			6'3"-7'6" Completely weathered zone with harder fragments of granite.	
			2			9'6"-10'6" Ditto.	
			10				
			4				
			5			15'-17'3" Ditto.	
			20			20'6" Same silicification Q.Ep. vein.	
			7			21'4"-22" Ditto.	
			8				
25'-41'6" Granite. gets gradually fresher	25'-41'6" Completely weathered seams are absent although all fractures are coated with white or orange clay film.		80				
			16				
			11				
			12				
			40				
41'6"-48' C.W. Granite and sand(?)	41'6"-42'6" Completely weathered seam with hard fragments of fresh granite. 42'6"-47'9" Sand(?), most likely drill cuttings		13				
			14				
48'-75' Fresh grey Granite.	47'9"-48' C.W. granite with hard fragments. Minor amounts of Py. occur. Parallel schlieren of Fe-Mg minerals sometimes present	15			48'- Joints tight and clean not Fe stained and only minor traces of clay if any.		
		50					
		16					
		17			55'9"-70' 1" Wide fracture filled white clay and rock fragments.		
		60					
		18					
		20					
		21					
		70					
	60'-69' Fe-Mg content of rock is higher than average, rock is greener and many Fe-Mg Schlieren occur.	22					
	Hole ends at 75'						

DRILL TYPE <u>Mindril F65</u> FEED <u>Hydraulic</u> CORE BARREL TYPE <u>Split</u> <u>triplo. barrel</u> DRILLER <u>M.R. Parcell</u> COMMENCED <u>29/8/70</u> COMPLETED <u>7/9/70</u> LOGGED BY <u>J.A. SALTET</u> VERTICAL SCALE <u>1 inch: 10 feet</u>	NOTES FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in. BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis. A.F.S. Average Fragment Size. Mg - Magnesium. Q. Quartz. Ep. Epidote. Ca Carbonate. S.W. Slightly Weathered C.W. Completely Fe. Iron. R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per 5 feet.	WATER PRESSURE TESTS PACKER TYPE <u>Mechanical</u> SUPPLY LINE <u>N. Rods</u> VERTICAL SCALE <u>1 inch: 50 p.s.i.</u> Figures given are gauge pressure. Test sections are indicated graphically, by shaded in series. PHOTOGRAPH REFERENCE SYSTEM BLACK AND WHITE B.M.R. Film Reference <u>M/1173 frames 28-29</u> <u>M/1087 " 10-30</u> COLOUR <u>M/1184 8-9</u>
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155/A16/758

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GOOGONG DAM SITE, Queanbeyan River N.S.W.</u> LOCATION <u>Right Bank Spillway.</u>				HOLE NO D14	
		GEOLOGICAL LOG OF DRILL HOLE ANGLE FROM HORIZONTAL <u>90°</u> DIRECTION <u>-</u> COORDINATES <u>74970897190. 222852E. 588665N. RL 2075 ft.</u>				SHEET <u>1</u> OF <u>1</u>	
ROCK TYPE & TYPE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot
0-1'6" Soil 1'6"-5' S.W. granite, core consists of loose fragments A.F.S. 2" 5'-24'6" S.W. granite 24'6"-32' Clay seams and fracture zone 32'-34' M.-H.W. granite, increasing freshness with depth. 34'-40' S.W. granite	5'-40' Tight fractures Fe. stained. 8'-8'9" Fracture zone A.F.S. 25m some clay coating. 7'-15' Numerous Q and Ep. veins, rock partly silicified. 23'-70" Fracture filled with 2mm white clay. 24'6"-25'6" Light yellowish brown clay seam. 25'4"-26'2" Completely weathered rock very clayey with hard Q fragments A.F.S. 5mm. 26'2"-30'2" Fracture zone A.F.S. 1" fragments S.-H.W. Fe. stained. 30'2"-31'8" Clay seam, dirty brownish clay A.F.S. 8mm fragments in bedded in clay. 31'8"-32' Fracture zone A.F.S. 2mm 32'9"-2'5" Q vein 60° dip. 39'9" Q vein approximately 6° parallel to previous vein.	N/X -1 M NMLC X QEP 4 5 20 7 8 Q 9 10 Q 11 Q 12 bo	0-1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000			

DRILL TYPE Minidrill F55
 FEED Hydraulic
 CORE BARREL TYPE Triple
Split tube.
 DRILLER M.R. Parcell
 COMMENCED 8/9/70
 COMPLETED 9/9/70
 LOGGED BY J.A. SALT ET
 VERTICAL SCALE 1 inch = 10 feet

NOTES
 FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.
 BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.
 A.F.S. Average fracture size.
 Q. Quartz.
 Ep. Epidote.
 M.W. Moderately Weathered.
 H.W. Highly "
 S.W. Slightly "
 Fe. Iron.
 R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per 5 feet.

WATER PRESSURE TESTS
 PACKER TYPE Mechanical
 SUPPLY LINE N. Rods
 VERTICAL SCALE 1 inch = 50 psi
 Figures given are gauge pressures.
 Test sections are indicated graphically by blocks in strip.
 PHOTOGRAPH REFERENCE SYSTEM
 BLACK AND WHITE B.N.A. film reference
M/1173 frame 30
M/1087 " 32-37
M/116 " 1-3
 Colour M/1184 10

M(P1)122

155/A16/759

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GOOGONG DAM SITE, Quambeyan River N.S.W.</u>		HOLE NO <u>D.15</u>	
GEOLOGICAL LOG OF DRILL HOLE		LOCATION <u>Top Left Bank</u>		SHEET <u>2</u> OF <u>2</u>	
ANGLE FROM HORIZONTAL <u>55°</u>		DIRECTION		R.L. <u>2200</u>	
COORDINATES <u>74980 38510 222957E 588258N</u>		R.L. <u>2200</u>		SHEET <u>2</u> OF <u>2</u>	
DEPTH M	DEPTH F	CORRECTION M	CORRECTION F	WATER LEVEL	WATER TEMPERATURE
0	0	0	0	0	0
1	1	0	0	0	0
2	2	0	0	0	0
3	3	0	0	0	0
4	4	0	0	0	0
5	5	0	0	0	0
6	6	0	0	0	0
7	7	0	0	0	0
8	8	0	0	0	0
9	9	0	0	0	0
10	10	0	0	0	0
11	11	0	0	0	0
12	12	0	0	0	0
13	13	0	0	0	0
14	14	0	0	0	0
15	15	0	0	0	0
16	16	0	0	0	0
17	17	0	0	0	0
18	18	0	0	0	0
19	19	0	0	0	0
20	20	0	0	0	0
21	21	0	0	0	0
22	22	0	0	0	0
23	23	0	0	0	0
24	24	0	0	0	0
25	25	0	0	0	0
26	26	0	0	0	0
27	27	0	0	0	0
28	28	0	0	0	0
29	29	0	0	0	0
30	30	0	0	0	0
31	31	0	0	0	0
32	32	0	0	0	0
33	33	0	0	0	0
34	34	0	0	0	0
35	35	0	0	0	0
36	36	0	0	0	0
37	37	0	0	0	0
38	38	0	0	0	0
39	39	0	0	0	0
40	40	0	0	0	0
41	41	0	0	0	0
42	42	0	0	0	0
43	43	0	0	0	0
44	44	0	0	0	0
45	45	0	0	0	0
46	46	0	0	0	0
47	47	0	0	0	0
48	48	0	0	0	0
49	49	0	0	0	0
50	50	0	0	0	0
51	51	0	0	0	0
52	52	0	0	0	0
53	53	0	0	0	0
54	54	0	0	0	0
55	55	0	0	0	0
56	56	0	0	0	0
57	57	0	0	0	0
58	58	0	0	0	0
59	59	0	0	0	0
60	60	0	0	0	0
61	61	0	0	0	0
62	62	0	0	0	0
63	63	0	0	0	0
64	64	0	0	0	0
65	65	0	0	0	0
66	66	0	0	0	0
67	67	0	0	0	0
68	68	0	0	0	0
69	69	0	0		

[illegible]

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GOOGONG DAM SITE, Queanbeyan River N.S.W.</u> LOCATION <u>Right Bank Near River.</u>						HOLE NO. D16										
		GEOREGIONAL LOG OF DRILL HOLE						SHEET <u>3</u> OF <u>3</u>										
		ANGLE FROM HORIZONTAL <u>30°</u>		DIRECTION <u>54°</u>														
		COORDINATES <u>75460 97935 223001E 588437N</u> R.L. <u>2022 ft.</u>																
DRILL TYPE R.H. UNIT OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRAC- TURE LOG	LIFT & % CORE RECOVERY	JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot										
DACITE Fresh ↑ <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width: 15%; vertical-align: top;"> 173' Phenocrysts still conspicuous. 193' Dacite completely silicified and epidotized, or Q.Ep. vein. </td> <td style="width: 10%; text-align: center; vertical-align: middle;"> Py. Py. Q.Ep. Py. </td> <td style="width: 10%; text-align: center; vertical-align: middle;"> 165' Some Ca. on parting planes. 173' Ca. common on parting planes. 185'-199' Rock more fractured than usual. 1913' 6" Q.Ep. vein 50° 198' 60° and 30° fractures prevailing. 197' 60° and 30° fractures prevailing. 199' End of Q.Ep. vein. 203' 15° Fractures prevailing 208' 40° Fractures prevailing. 210' Ca. generally on parting planes. 212' 20° Fractures prevailing. </td> <td style="width: 10%; text-align: center; vertical-align: middle;"> 0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30 </td> <td style="width: 10%; text-align: center; vertical-align: middle;"> 0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30 </td> <td style="width: 10%; text-align: center; vertical-align: middle;"> 0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30 </td> <td style="width: 10%; text-align: center; vertical-align: middle;"> 0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30 </td> <td style="width: 10%; text-align: center; vertical-align: middle;"> 0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30 </td> <td style="width: 10%; text-align: center; vertical-align: middle;"> 0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30 </td> </tr> </table>										173' Phenocrysts still conspicuous. 193' Dacite completely silicified and epidotized, or Q.Ep. vein.	Py. Py. Q.Ep. Py.	165' Some Ca. on parting planes. 173' Ca. common on parting planes. 185'-199' Rock more fractured than usual. 1913' 6" Q.Ep. vein 50° 198' 60° and 30° fractures prevailing. 197' 60° and 30° fractures prevailing. 199' End of Q.Ep. vein. 203' 15° Fractures prevailing 208' 40° Fractures prevailing. 210' Ca. generally on parting planes. 212' 20° Fractures prevailing.	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30
173' Phenocrysts still conspicuous. 193' Dacite completely silicified and epidotized, or Q.Ep. vein.	Py. Py. Q.Ep. Py.	165' Some Ca. on parting planes. 173' Ca. common on parting planes. 185'-199' Rock more fractured than usual. 1913' 6" Q.Ep. vein 50° 198' 60° and 30° fractures prevailing. 197' 60° and 30° fractures prevailing. 199' End of Q.Ep. vein. 203' 15° Fractures prevailing 208' 40° Fractures prevailing. 210' Ca. generally on parting planes. 212' 20° Fractures prevailing.	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30	0.30 0.140 0.130 0.120 0.30 0.40 0.150 0.400 0.30										
Hole ends at 220'																		

DRILL TYPE Boyles BBS2
 FEED Hydraulic
 CORE BARREL TYPE Split triple
 TUBE 1/2"
 DRILLER M. Q. Z. W. I. S. K. I.
 COMMENCED 14/11/70
 COMPLETED 11/10/70
 LOGGED BY J. A. SALTRE
 VERTICAL SCALE 1 inch = 10 feet

NOTES

FRAC-
TURE LOG: - Number of fractures in 1' of core. Zones of core loss are blocked in.
 BEDDING AND JOINT PLANES: - Angles - measured relative to a plane normal to the core axis.

A.F.S. Average fragment size.
 Py. Pyrite.
 Si. Silicium.
 Q. Quartz.
 Ep. Epidote.
 M.W. Moderately weathered.
 Ca. Carbonate.
 Fe. Iron.

R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per 5 feet.

WATER PRESSURE TESTS

PACKER TYPE Mechanical
 SUPPLY LINE N. Rods
 VERTICAL SCALE 1 inch = 50 p.s.i.

Figures given are gauge pressures.
 Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE B.M.R. Film Reference
M/1173 frames 34-35
M/1116 " 8-20
 COLOUR M/1184 14-15

M(P1)122

155/A16/761

BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT GOORONG DAM SITE, Goorangayon River N.S.W.

LOCATION Top Right Bank

HOLE NO

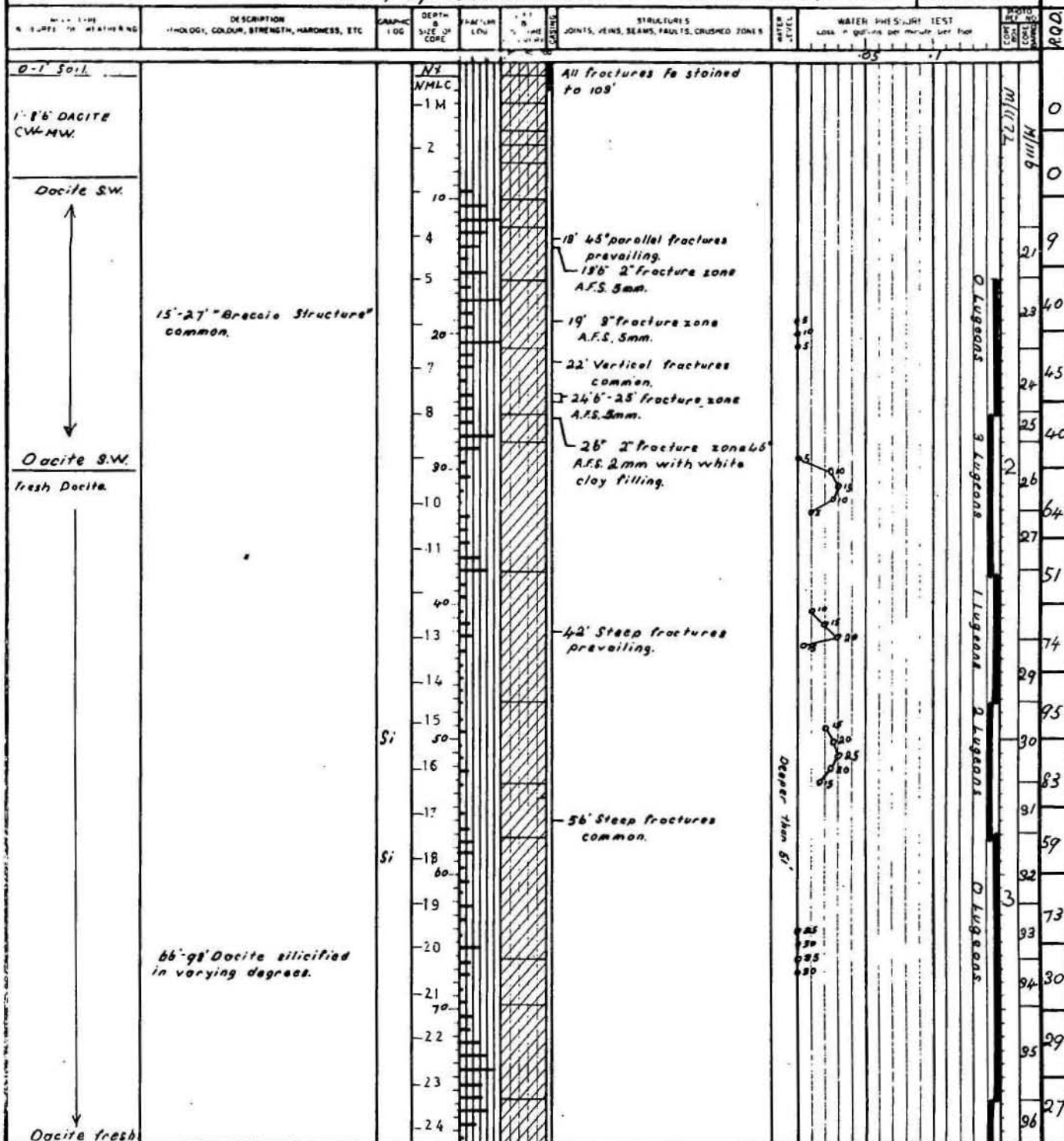
D17

ANGLE FROM HORIZONTAL 55°

DIRECTION 203°

COORDINATES 7559537485 223043E 588573N RL 2174

SHEET 1 OF 2



DRILL TYPE Boyles B.B.2.2
TEST Hydraulic
CORE BARRIS TYPE Split
Triple tube
FILE IN M. Dziwulski
COMMENCED 8/10/70
COMPLETED 15/10/70
LOGGED BY J.A. SALTET
VERTICAL SCALE 1 inch = 10 feet

FRACTURE LOG - Number of fractures per foot of core (Zones 1-10) as indicated in:
BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.
Fe, Iron.
Q, Quartz.
Ep, Epidote.
Si, Silicium.
CW Completely weathered.
MW Moderately "
A.F.S. Average fragment size.
R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per 5 feet.

WATER PRESSURE TESTS
PACKER TYPE Mechanical
SUPPLY LINE N.Rods
VERTICAL SCALE 1 inch = 50 p.s.i.
PHOTOGRAPH REFERENCE SYSTEM
BLACK AND WHITE B.M.A. Film Reference
M/1172 frames 2-3
M/1104 " 21-36
CORRUM M/1184 16-17
M(Pf) 99

155/A16/762

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GOOGONG DAM SITE, Queanbeyan River N.S.W.</u>				HOLE NO 17A	
		LOCATION <u>Top Spillway Section</u>					
GEOLOGICAL LOG OF DRILL HOLE		ANGLE FROM HORIZONTAL <u>40°</u>		DIRECTION <u>203°</u>		SHEET <u>1</u> OF <u>2</u>	
		COORDINATES <u>7659527485 223043E 588573N</u>				R.L. <u>2175</u>	

W.C. TYPE	DESCRIPTION	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	STRUCTURES	WATER LEVEL	ROD
Weathered dacite.	0-5' Soil and completely weathered dacite.		NX		Fractures Fe stained. 0-141'		0
Dacite M.W.	9'-13' Approx. 2 of core consists of a very dark green fine grained rock without phenocrysts, probably partly slatey. This rock is darker than dacite and contains no phenocrysts. It also occurs as layers dipping 65° and as angular dark masses in dacite M.W.		N M L C		Fracture zone A.F.S. 15mm, due to a 90° fracture and few cross fractures.		11 40
Dacite M.W.							12 15
Dacite S.W.	18'-20' Minor inclusions of same still common (10% of core) 17' Narrow bands of same parallel schistosity 60° 20' Onwards S.W.						13 82
							14 80
							15 66
							16 35
							17 67
							18 32
							19 31
							20 25
							21 16
							22 10
							23 16
							24 25
							25 25
							26 11
							27

DRILL TYPE <u>Boyes B.S.2.</u> FIELD <u>Hydraulic</u> CORE BARREL TYPE <u>Split triple</u> F.V.B. DRILLER <u>M. Dziurwulski</u> COMMENCED <u>19/10/70</u> COMPLETED <u>26/12/70</u> LOGGED BY <u>J.A. SALTET</u> VERTICAL SCALE <u>1 inch = 10 feet</u>	FRACTURE LOG Number of fractures per foot of core. Zones of line lines are blocked in BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis. Fe, Iron A.F.S. Average fragment size Q, Quartz Ep. Epidote M.W. Moderately weathered S.W. Slightly weathered R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per foot.	WATER PRESSURE TESTS PACKER TYPE <u>Mechanical</u> SAMPLE LINE <u>N Rods</u> VERTICAL SCALE <u>1 inch = 50 psi</u> Figures given are gauge pressures Test sections are indicated graphically by blocks in strips PHOTOGRAPH REFERENCE SYSTEM BLACK AND WHITE <u>3.M.K. Film Reference</u> <u>M/1172 frames 5-6</u> <u>M/1136 " 11-27</u> COLOUR <u>M/1184 - 19-20</u>
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155/A16/763

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS				PROJECT <u>GOOGONG DAM SITE, Queanbeyan River NSW</u>				HOLE NO <u>D17A</u>				
GEOLOGICAL LOG OF DRILL HOLE				LOCATION <u>Top Spillway Section</u>				SHEET <u>2</u> OF <u>2</u>				
ANGLE FROM HORIZONTAL <u>40°</u>				DIRECTION <u>203°</u>				COORDINATES <u>7559597485 223043E 588513N</u>				
WATER PRESSURE TEST				LOSS IN QUANTITY PER MINUTE PER FOOT				WATER LEVEL				
DATE	TIME	DRILLER	LOGGERS	DEPTH & SIZE OF CORE	ROCK TYPE	STRUCTURE JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE	WATER TEMP.	WATER PH	WATER SOLIDS	WATER LOSS
FRESH Dacite				25	Si	86' Vertical fractures common	0.25					
Dacite C.W.				26	Ep	88'-92' Rock very broken, some clay at 88'.	0.35					
A				27		94' Parallel 45° fractures.	0.35					
Y				28		97' Some Py. disseminated through rock.	0.35					
Fresh Dacite				29			0.35					
Fault zone, 116'-121'				30	Py		0.35					
Hole ends at 141'3"				31	Ep		0.35					
Hole ends at 141'3"				32	Py		0.35					
Hole ends at 141'3"				33			0.35					
Hole ends at 141'3"				34			0.35					
Hole ends at 141'3"				35			0.35					
Hole ends at 141'3"				36			0.35					
Hole ends at 141'3"				37			0.35					
Hole ends at 141'3"				38			0.35					
Hole ends at 141'3"				39			0.35					
Hole ends at 141'3"				40			0.35					
Hole ends at 141'3"				41			0.35					
Hole ends at 141'3"				42			0.35					
Hole ends at 141'3"				43			0.35					
Hole ends at 141'3"				44			0.35					
Hole ends at 141'3"				45			0.35					
Hole ends at 141'3"				46			0.35					
Hole ends at 141'3"				47			0.35					
Hole ends at 141'3"				48			0.35					
Hole ends at 141'3"				49			0.35					
Hole ends at 141'3"				50			0.35					
Hole ends at 141'3"				51			0.35					
Hole ends at 141'3"				52			0.35					
Hole ends at 141'3"				53			0.35					
Hole ends at 141'3"				54			0.35					
Hole ends at 141'3"				55			0.35					
Hole ends at 141'3"				56			0.35					
Hole ends at 141'3"				57			0.35					
Hole ends at 141'3"				58			0.35					
Hole ends at 141'3"				59			0.35					
Hole ends at 141'3"				60			0.35					
Hole ends at 141'3"				61			0.35					
Hole ends at 141'3"				62			0.35					
Hole ends at 141'3"				63			0.35					
Hole ends at 141'3"				64			0.35					
Hole ends at 141'3												

155/A16/763

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS GEOLOGICAL LOG OF DRILL HOLE		PROJECT <u>GOOGONG DAM SITE, Queanbeyan River N.S.W.</u> LOCATION <u>Spillway</u> ANGLE FROM HORIZONTAL <u>90°</u> DIRECTION <u>-</u> COORDINATES <u>7582597220 723113E. 588655N.</u> R.L. <u>2200</u>						HOLE NO D18 SHEET <u>1</u> OF <u>1</u>	
		DEPTH 5 FEET OF CORE						WATER PRESSURE TEST LESS THAN 100 PSI UNTIL 100 FEET	
WEATHERING N. 1/4, 1/2, 3/4, 100%	DESCRIPTION THICKNESS, COLOUR, STRENGTH, HARDNESS, ETC.	GRAIN SIZE	DEPTH 5 FEET OF CORE	FRACTURE LOG	STRUCTURE JOINTS, VEINS, SLIPS, FAULTS, MINERAL ZONES	WATER PRESSURE	WATER PRESSURE TEST LESS THAN 100 PSI UNTIL 100 FEET	PHOTO REF. NO.	
Weathering and fracturing in shale are of variable intensity. 0'-3' SW-MW 2'-4' MW-MW 4'-5' SW-MW 5'-7' SW-MW 7'-8' MW-MW 8'-13' SW-MW 13'-16' MW-MW 16'-20' SW-MW		0-20' Shale, light brown to grey, cleavage 75° DACITE S.W. 20' Onwards, slightly weathered dacite. Dacite shows schistose structure. This schistosity is parallel to cleavage in shale, 75° Hole ends 42'		NX HMLC -2 10 -4 20 -7 -8 -9 -10 -11 -12 40 50 60 70	Fracturing and weathering are correlated, with fracturing probably due to shearing parallel cleavage. No fracture log given because of very broken nature of rock and the difficulty of determining if breakage is due to cleavage or not. The broken nature of the rock is sufficiently expressed in the R.Q.D. column. (Samples taken 2' C.W. shale, 8' S.W. shale, 20' fresh shale.) Fractures in dacite are Fe. stained and often have some thin clay coating. 42' 90° fractures filled with Fe stained clay sm.		0. Lugano 0. Lugano 0. Lugano		1156 3 4 5 6 7 8 9 10 11 12 13
CORE TYPE <u>Boyles BAS2</u> FIELD <u>Hydraulic</u> CORE BARREL TYPE <u>Split triple tube</u> COLLATERAL <u>M. Dziwinski</u> COMMENCED <u>28/10/70</u> COMPLETED <u>29/10/70</u> LOGGED BY <u>J.A. SALTET</u> VERTICAL SCALE <u>Linch: 10 feet</u>		NOTES FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are bracketed in BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis. Fe. Iron. A.F.S. Average fragment size. S.W. Slightly weathered M.W. Moderately " H.W. Highly " C.W. Completely " R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per 5 feet.				WATER PRESSURE TESTS PACKER TYPE <u>Mechanical</u> SUPPLY LINE <u>N. Rods</u> VERTICAL SCALE <u>Linch: 50 psi</u> 1 gauge given air gauge pressure Test sections are indicated graphically by blocks in strip PHOTOGRAPH REFERENCE SYSTEM BLACK AND WHITE <u>B.M.R. Film Reference</u> <u>M/1172</u> Frame <u>8</u> <u>M/1156</u> " <u>3-13</u> COLOUR <u>M/1185</u> <u>3</u>			

M(PF)122

155/A16/764

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GOOGONG DAM SITE, Queenbeyan River N.S.W.</u> LOCATION <u>Saddle Area</u>						HOLE NO D19	
		GEOLOGICAL LOG OF DRILL HOLE						SHEET <u>1</u> OF <u>2</u>	
		ANGLE FROM HORIZONTAL <u>35°</u>		DIRECTION _____					
		COORDINATES <u>223445E, 589005N.</u>		RL _____					

NO. OF TESTS	TESTS	RESULTS	TESTS	RESULTS	TESTS	RESULTS	TESTS	RESULTS	TESTS	RESULTS
0'-10" Soil H-C.W. SLATE 2'-4' Light grey broken slate A.F.S. M.W. 25' SLATE light grey becoming schistose H-C.W. occasional fractured Qveins M.W. SLATE H-C.W. SLATE M.W. SLATE H-C.W. SLATE 75'-80" H-M.W. Slate. NY N M L C₁₀ 20 30 40 50 60 70 Fe. staining on parting planes. 1'6" Highly cleaved and broken slate H-C.W. cleared planes horizontal. 20' Schistose foliations in; rock highly fractured, parting planes parallel to foliation. 32' Expansive -133. Parting planes and H.W. 20' are Fe. stained 50' Onwards 45° foliation. 72'-73' kink bands. Axial plane inclination 80° 75'-80' foliation varying from 10°-50° with kink bands, fractures parallel to foliation.										

CAPS: 100 <u>Boyles BB-3-A</u> TYPE: <u>Hydraulic</u> CORE BARREL TYPE: <u>Split</u> TUBE: <u>triple tube</u> NO. IN: <u>M. Dziuwulki</u> DATED: <u>20/11/70</u> COMPLETED: <u>27/11/70</u> PREPARED BY: <u>G.R. S. J. J. J.</u> CORE LENGTH: <u>1 inch: 10 feet.</u>	FRACTURE LOG: Number of fractures per foot of core. Zones of core loss are blocked in. BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis. Fe. Iron. Q. Quartz. C. Carbon A.F.S. Average fragment size. M.W. Moderately weathered H.W. Highly " C.W. Completely " R.Q.D. Rock quality designation expresses the percentage of core longer than 4 inches per 5 feet.	WATER PRESSURE TESTS PACKER TYPE: <u>Mechanical</u> SUPPLY LINE: <u>N. Rads.</u> VERTICAL SCALE: <u>1 inch: 50 psi</u> Figures given are gauge pressures. Last sections are indicated graphically by broken - strips. PHOTOGRAPH REFERENCE SYSTEM BLACK AND WHITE: <u>B.M.R. Film Reference</u> <u>M/1172</u> frames <u>16</u> E6 18 <u>M/1100</u> " <u>13</u> - 34 EXPOSURE: <u>M/1185</u> " <u>11</u> - 12
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155/A16/765

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS		PROJECT <u>GORGON DAM SITE, Queanbeyan River NSW.</u>		HOLE NO D20
		LOCATION <u>Lower Spillway Quarry</u>		
GEOLOGICAL LOG OF DRILL HOLE		ANGLE FROM HORIZONTAL <u>90°</u>		DIRECTION _____
		COORDINATES <u>75070 36800 222993E. 588775N.</u>		R.L. <u>2129</u>
MIN. TYPE A. H. REF. TM WEATHERING	DESCRIPTION THICKNESS, COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC SIZE OF CORE	DEPTH FEET	WATER PRESSURE TEST Loss in pounds per minute per foot
Granite Fresh.	QEp	100	25	10
			26	
Granite Fresh.	QEp	100	27	10
			28	
Granite Fresh.	QEp	100	29	10
			30	
Granite Fresh.	QEp	100	31	10
			32	
Granite Fresh.	QEp	100	33	10
			34	
Granite Fresh.	QEp	100	35	10
			36	
Granite Fresh.	QEp	100	37	10
			38	
Granite Fresh.	QEp	100	39	10
			40	
Granite Fresh.	QEp	100	41	10
			42	
Granite Fresh.	QSi	100	43	10
			44	

Notes:

- Fracture Log - Number of fractures per foot of core. Zones if core rock are shaded in.
- BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.
- Q, Quartz; Ep, Epidote; Si, Silicium; Fe Iron.
- A.F.S. Average fragment size.
- R.Q.D. Rock quality designation expresses the percentage of core longer than four inches per foot.

Water Pressure Tests:

Packer type Mechanical

Supply line N.Rods

Vertical scale Linch = 50 p.s.i.

DNVIT GRAPHIC REFERENCE SYSTEM

Scale and units B.M.R. Film Reference

M/L172 frames 14-15

M/L177 35-28 M/L176 1-7

Scale M/1185 q-10

APPENDIX 3

CONVERSION FACTORS

LENGTH

1 inch = 2.540 cm

1 foot = 30.48 cm

1 yard = 0.9144 m

1 mile = 1.61 km

VOLUME

1 Imperial Gallon = 4.55 litres

AREA

1 square mile = 2.590 km²

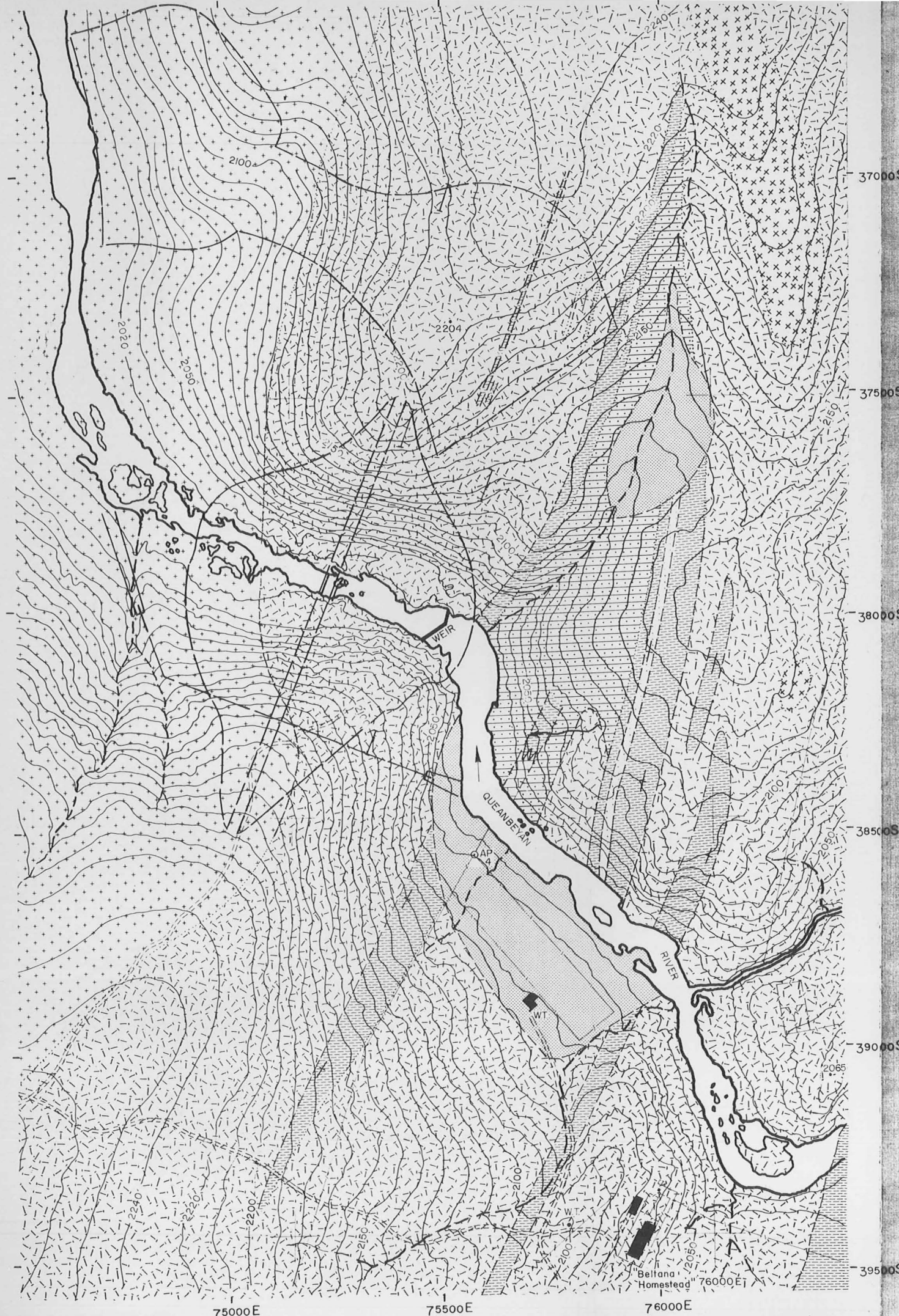
WEIGHT

1 lb = 453.5 gram

PRESSURE

1 bl/square inch = 0.068 bar.

GENERAL GEOLOGY OF GOOGONG DAM SITE AND ENVIRONS



-  Alluvium and soil cover.
-  Granite.
-  Scattered granitic outcrops in dacite.
-  Dacite.
-  Slate.
-  Sandstone.
-  Limestone.
-  Undifferentiated shale, slate and sandstone.
-  Geological boundary, approximate.
-  Geological boundary, concealed.
-  Vertical bedding.
-  Vertical cleavage.
-  Outline of proposed dam spillway and tunnel.
-  Faults and shear zones are not shown.
-  Vehicle track.
-  Fence.
-  Power lines.

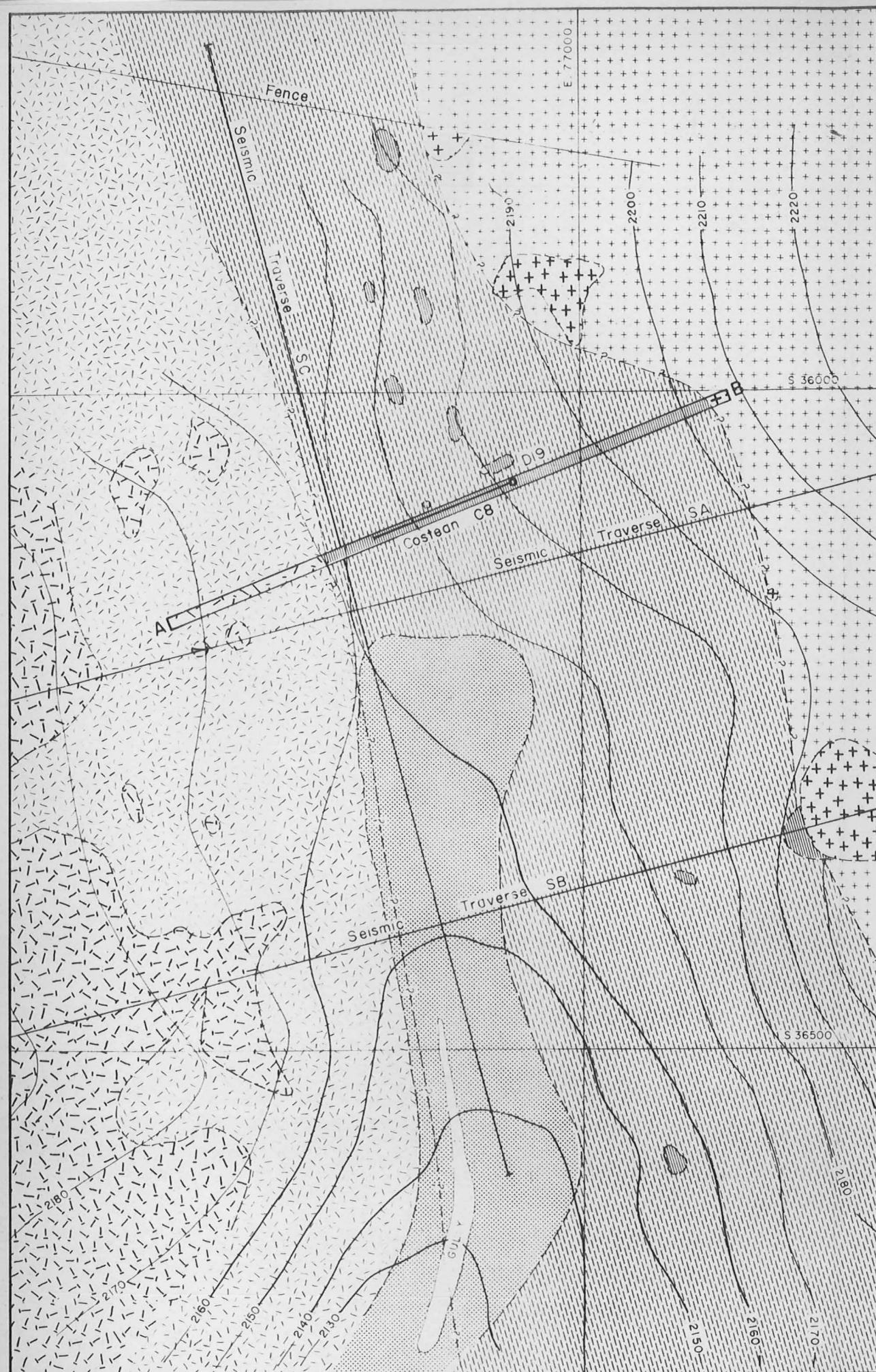
0 25 50 75 100 125 150
METRES

0 100 200 300 400 500 600
FEET

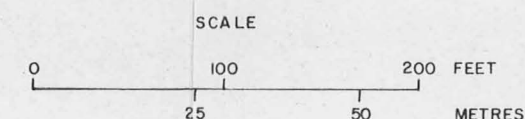
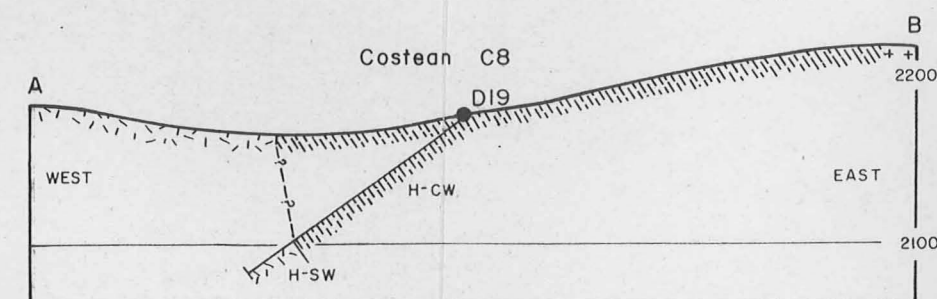
Note: Grid coordinates approximate only



GOOGONG DAM SITE
QUEANBEYAN RIVER
N.S.W.
PHALARIS SADDLE, GEOLOGY



-  Alluvium
-  Granite, soil covered
-  Granite, exposed
-  Dacite, soil covered
-  Dacite, exposed
-  Slate, soil covered
-  Slate, exposed
- Geological boundary, approximate
- p-? Geological boundary, inferred
- SW.....Slightly weathered
- MW.....Moderately weathered
- HW.....Highly weathered
- CW.....Completely weathered



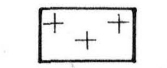
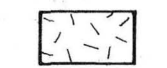
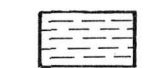
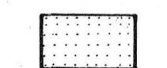
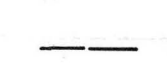
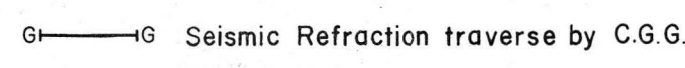
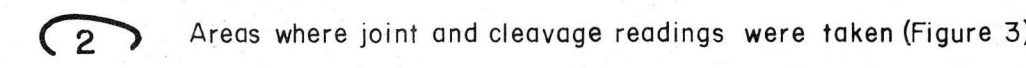
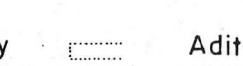
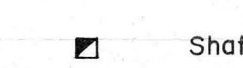
Topography and outcrop mapping modified from original by Burton 1963

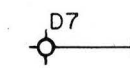
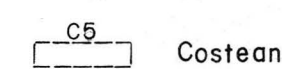
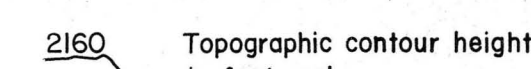
PLATE 3



GENERALISED GEOLOGY & INVESTIGATIONS GOOGONG DAM SITE QUEANBEYAN RIVER N.S.W.

PLATE 4

-  Granite
-  Dacite
-  Slate
-  Undifferentiated Metasediments
-  Generalised geological boundary
-  Outline of dam, spillway and associated works
-  Geological sections (plate 5)
-  Seismic Refraction traverse by C.G.G.
-  Seismic Refraction traverse by B.M.R.
-  Areas where joint and cleavage readings were taken (Figure 3)
-  Adit
-  Shaft

-  Diamond drill hole, projected
-  Costean
-  Topographic contour height in feet asl.

SCALE
0 25 50 METRES
0 40 80 120 160 FEET

This topographic map illustrates the Googong Dam site and its surrounding area. The map features contour lines indicating elevation, with labels such as 2160, 2170, 2180, 2190, 2200, 2210, 2220, 2230, 2240, 2250, 2260, 2270, 2280, 2290, and 2300. The Queanbeyan River is shown flowing through the area, with a 'Large Rock Outcrop' marked near the top center. The map includes various geological features and investigation points, including:

- Geological Features:** Granite (indicated by a cross-hatch pattern), Dacite (indicated by a wavy pattern), Slate (indicated by a horizontal line pattern), and Undifferentiated Metasediments (indicated by a stippled pattern).
- Investigation Points:** Numerous diamond drill holes (labeled D1 through D18) and costean points (labeled C1 through C10) are marked across the site.
- Structural Features:** The outline of the dam, spillway, and associated works is shown, along with an adit and a shaft.
- Topographic Features:** Contour lines are drawn at 10-foot intervals, with specific contour heights labeled in feet above sea level (asl).
- Geological Sections:** Several geological sections are indicated by lines labeled A through M, corresponding to the legend.
- Other Features:** A 'Gauging Weir' is located near the bottom center, and a 'Contour II' is marked near the bottom right.

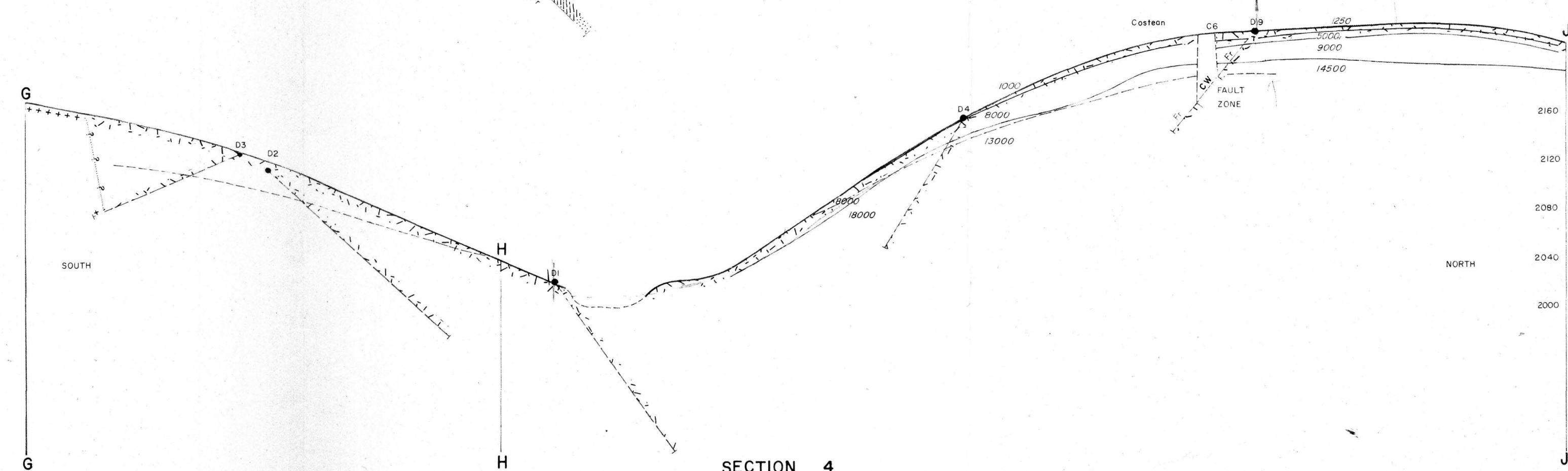
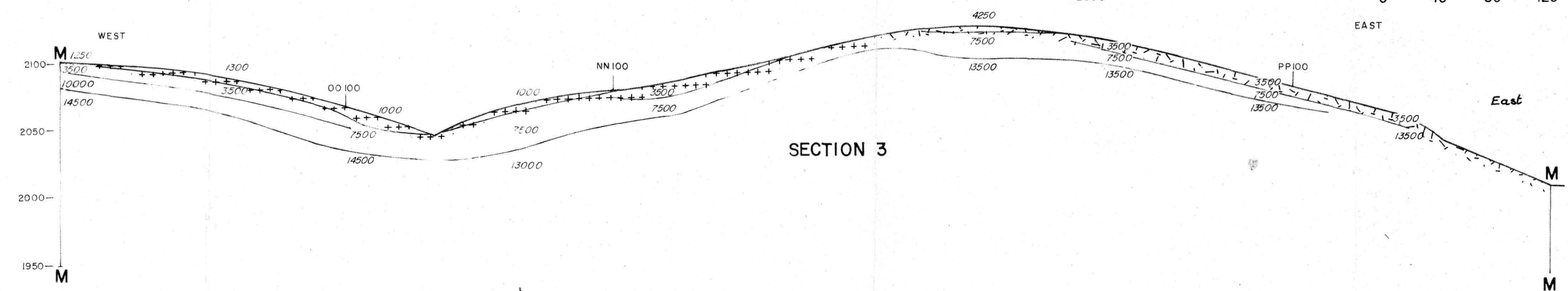
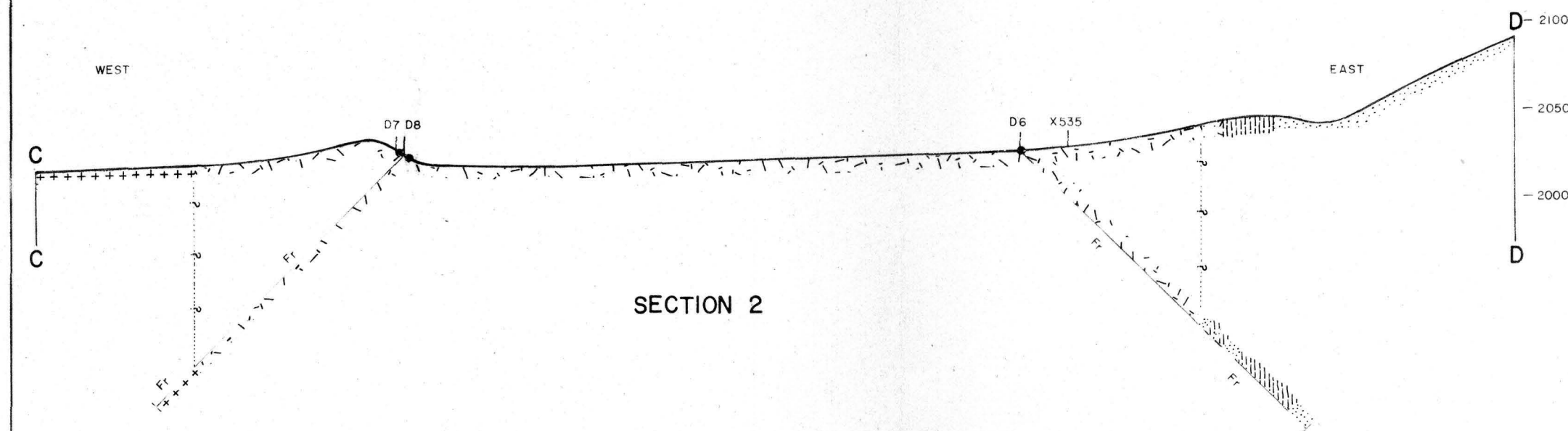
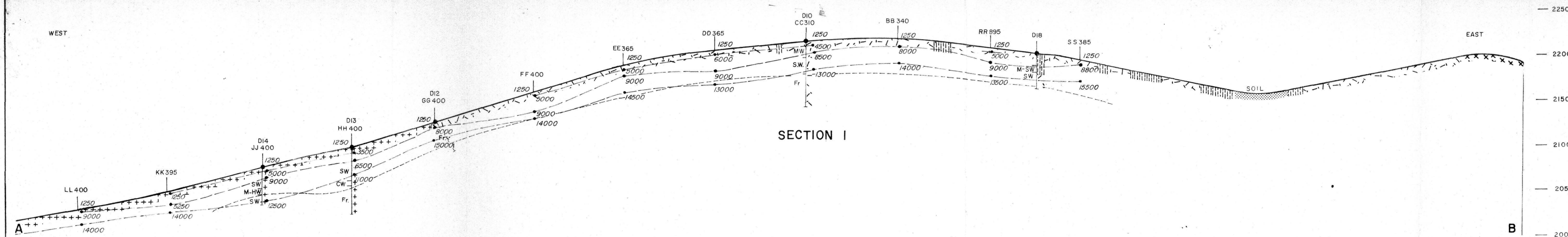
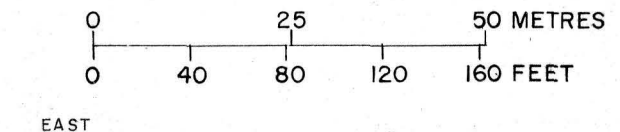
The map also includes a scale bar (0 to 160 feet / 0 to 50 metres) and a north arrow pointing towards the top right. The overall layout shows the dam site situated in a valley, with the river flowing through it.

To accompany record 1971/52

156/A16/748

PLATE 5
GOOGONG DAM SITE
QUEANBEYAN RIVER
N.S.W.

SECTIONS 1-4
 (for locations see Plate 3)
 SCALE



- Alluvium and Soil
- Granite
- Scattered granite outcrops in dacite
- Dacite
- Slate
- Sandstone

- Diamond drill hole showing degree of weathering
- Projected diamond drill hole
- Point of intersection of seismic traverse with section
- Inferred geological boundary
- Piezometric level
- Seismic refractors with velocities in feet per second
- Velocities in feet per second and approximate refractor constructed from same velocities as measured along seismic traverses at right angles with section
- Fresh
- Slightly weathered
- Moderately weathered
- Highly weathered
- Completely weathered