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GEOLOGICAL INVESTIGATION OF ADELAIDE RIVER GORGE DAMSITE No.1

NORTHERN TERRITORY, 1966

by

J.C. BRAYBROOKE

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SUMMARY

An economic evaluation of the Adelaide River drainage basin is being undertaken by the Northern Territory Administration. Any plan of development would require a dam in the Adelaide River gorge, upstream from Adelaide River township, to store water and control flooding. Following earlier investigations, No. 1 damsite was selected for detailed feasibility studies. The geological work has been carried out for the Water Resources Branch of the Northern Territory Administration.

The site is near the head of the Adelaide River, 4 miles south-west of Adelaide River township which is 72 miles south of Darwin. The site was selected because of the favourable topography and the high storage capacity provided by the widening of the valley upstream of the gorge. A 100-foot-high dam at No. 1 site would store about 300,000 acre-feet of water. Other sites lower in the gorge offer no apparent advantage in storage, volume of dam required and geological conditions.

The geological investigation was to prove the feasibility of a 100-foot-high dam, to ascertain the type of dam most suited to the site conditions, and to permit an order-of-cost estimate to be made.

Outcrop mapping of parts of the Adelaide River gorge and storage area was done at a scale of 1 inch : 8 chains. More detailed mapping of outcrops and costeans at the damsite was done at 1 inch : 200 feet and 1 inch : 10 feet, respectively; 1450 feet of diamond drilling and 1,500 feet of costeaning and pitting were also carried out.

Bedrock consists of graded meta-greywacke and phyllite of the Lower Proterozoic Finniss River Group. The rocks are moderately tightly folded, display low-grade metamorphism (greenschist facies), and are unconformably overlain by the Upper Proterozoic Tolmer Group. The Adelaide River Fault passes through the area, downfaulting part of the Tolmer Group against the Finniss River Group.

Treatment may be necessary to prevent leakage out of the storage area through the Northern and Southern saddles (see Plate 1). Both consist of phyllite.

The damsite lies within the western limb of an anticline. Material in the left abutment consists of phyllite thoroughly weathered to depths of 40 to 50 feet. The weathered phyllite has soil-like properties: it will consolidate when loaded, and will not withstand high stresses. Further, many cleavage planes and joints within the phyllite are filled with silty clay and are potential failure planes. At least 45 feet of sandy clay alluvium covers the valley floor. The right abutment consists of moderately weathered, graded metagreywacke. Close to the surface, highly weathered phyllitic interbeds are potential zones of failure; they strike normal to the proposed dam axis.

Because of expected differential settlement between abutments, it is concluded that a rock-fill dam with a wide impermeable earth core, or an earth-fill dam, would be best suited to the site. A spillway channel could be excavated in the meta-greywacke on the right bank.

Adequate quantities of rock-fill are present within the meta-greywacke sequence in the ridge forming an extension of the left abutment. Sufficient quantities of suitable earth material for either an earth-cored or earth-filled dam are believed to occur in the alluvial flats upstream of the damsite.

Recommendations for further investigations are outlined at the end of the report.

INTRODUCTION

The Adelaide River gorge has been suggested as a suitable site for a dam to provide domestic water for Darwin (Woolnough, 1936), and for hydro - electric power generation (Rosenthal, 1948).

The present investigation is part of an overall examination of the possible development and control of the Adelaide River system being carried out by the Water Resources Branch of the Northern Territory Administration (W.R.B.). An essential part of any such development would be a dam in Adelaide River gorge. Five possible sites in the gorge have been considered, and the uppermost, (No. 1), selected for a feasibility study. The dam would be used for flood control and supply of irrigation water for rice growing on the "black soil" plains of the Adelaide River basin. It could also, or alternatively, be a source of water for the Darwin town water supply.

LOCATION AND ACCESS

The site is near the head of the Adelaide River gorge, which extends from 2 to 4 miles south-west of Adelaide River township. The township is on the Stuart Highway, 72 miles south of Darwin (Plate 1).

Access is by a rough, dry-weather track, part of which was constructed by Water Resources Branch in mid-1966. It is possible, if the track is dry, to travel to the site in an ordinary vehicle, but after heavy rain creek crossings may be washed out.

PREVIOUS WORK

A brief, preliminary report, based on reconnaissance, was submitted by Woolnough (1936). The south-east part of the gorge was suggested as a possible damsite for the supply of domestic water to Darwin.

Rosenthal (1948), produced a report for a proposed hydro-electric project on Adelaide River. The site was at the outlet of the Adelaide River gorge, 2 miles from Adelaide River township. The project called for a final wall height of 170 feet. Rosenthal noted that two average wet seasons would be required to fill the storage area produced by a 100-foot-high wall.

Hays (1961) made a preliminary geological investigation of a number of alternative sites, (sites 2,3, and 4; see Plate 2), in the central part of the Adelaide River gorge.

PRESENT INVESTIGATIONS

Surveying

Water Resources Branch had contour plans of the entire proposed storage area and gorge prepared from aerial photographs. These plans are on a scale of 1 inch to 8 chains. Additional plans for the gorge area are on a scale of 1 inch to 200 feet, with 5 foot contours. Further, Water Resources Branch surveyors laid out a 400-foot grid using theodolite and steel tape. The grid includes the area of the proposed damsite and ancillary structures. The regional grid is laid out on eastings and northings while the dam grid has X and Y co-ordinates; the Y ordinate is 37 degrees west of the regional grid-north.

Geological Mapping

In June-July, 1966, E.J. Best mapped, in outcrop detail, the immediate damsite area, at a scale of 1 inch to 200 feet; and downstream of the site, on a scale of 1 inch to 8 chains. The outcrop positions were plotted directly onto the contour plans.

The present investigation started in November, 1966, and continued until mid-January, 1967. Preliminary mapping of the storage area was carried out at a scale of 1 inch to 8 chains. Further mapping of the damsite area and the prospective quarry site was done on a scale of 1 inch to 200 feet, again directly onto the contour plans (see Plates 2 and 3).

Costeaning

Costeaning and pitting was carried out before drilling began. Costeans were bulldozed on both sides of the river near the dam axis, and behind the right bank, close to the proposed spillway site. Additional costeans were excavated across the southern saddle (see Plate 2). Pitting was carried out on some of the alluvial flats, upstream of the damsite.

In addition to providing information on the lithology and structure of the area, the costeans gave an indication of the thickness of soil and detritus overlying bedrock. Those on the right bank were logged at a scale of 1 inch to 10 feet; the logs are presented as Appendix 4.

The pits were dug to check the alluvial flats as a source of earth-fill and impermeable material.

Drilling

The initial drilling programme was started at the end of July, 1966, and was completed in early February, 1967. Water pressure tests were not carried out in conjunction with the drilling programme, but have since been done. Results are not included in this report. Seven holes, totalling 1,445 feet, were drilled along the proposed dam axis. All but one, which is a vertical hole, were drilled at angles between 45 and 55 degrees to the horizontal. The angle holes were designed to intersect the bedding roughly at right angles (see Appendix 3).

Drilling was carried out by Water Resources Branch using a Mindrill rig. A NMLC, triple tube core barrel with stationary split inner tube was used in all holes; it gave very good to excellent core recovery in finely fragmented and decomposed ground. In sections of the alluvium, however, little to no core was recovered. One drill hole, ARG 5, deviated from its course. The re-drilled hole is designated ARG 5A.

All core was photographed in the core boxes; in addition, each lift from hole ARG 3 was photographed in the split tube, giving a permanent record of the core in an undisturbed state.

PHYSIOGRAPHY

The Adelaide River gorge lies within the "Uplands" physiographic division of the Northern Territory (see Malone, 1962, pp 4-6), with relief generally between 200 and 350 feet. The terrain configuration is controlled by the type of rocks and structure present. Greywacke forms long, steep-sided, rough ridges with fairly close dip-slope and scarp control; the ridges are separated by narrow valleys. Phyllite forms a more gentle, "scalloped" terrain with connecting saddles which can generally be negotiated by Landrover.

The hills flanking the gorge rise up to 360 feet above the floor of the gorge; slopes are steep, but only in one or two places are they cliff-like. The floor of the gorge is alluviated throughout. The rather sinuous course of the gorge is determined by a number of geological factors (see Plate 2). From the head of the gorge for about a mile the river is incised into, and follows the strike of, a sequence of west-dipping phyllite; the east side of the gorge is composed of underlying, resistant, meta-greywacke. The river then cuts across the phyllite, along the axis of a north-plunging anticline. The north-west trending section of the gorge is through, and across the strike of, a sequence of meta-greywacke. Where it trends north-east, the lower mile or so of the gorge is again a strike valley in soft phyllite; a branch of the Adelaide River Fault may also underlie this section of the gorge.

Alluvium has accumulated upstream of the head of the gorge. To the south-west of the damsite, ridges are separated by alluvial flats up to one mile wide.

REGIONAL GEOLOGY

The general geology of the Adelaide River area is briefly described by Malone (1958). The distribution of stratigraphic units in the catchment area is shown in Plate 1. Much of the catchment has an alluvial and partially lateritised illuvial cover overlying the moderately tightly folded meta-sediments of the Finniss River Group. The group is Lower Proterozoic in age and includes graded greywacke and siltstone of the Noltenius and Burrell Creek Formations. These sediments have undergone low-grade meta-morphism to the greenschist facies; the regional plunge of folding is 34° on magnetic bearing 010° (see Plate 7).

In the south-east and south of the area, gently dipping sediments of the Upper Proterozoic Tolmer Group unconformably overlie the Lower Proterozoic strata. The group includes the Depot Creek and Stray Creek Sandstone members of the Buldiva Sandstone, the Hinde Dolomite, and sandstone and siltstone of the Waterbag Formation. In some areas, iron has been concentrated in outcrops of ferruginous, Depot Creek Sandstone, forming a medium to high-grade, hematitic iron ore.

The Depot Creek and Stray Creek Sandstone Members are strongly jointed and many springs emerge from them. A few of the springs are perennial.

The Adelaide River Fault cuts through the area in a north-easterly direction. It is marked by a narrow zone of silicified or ferruginised fault breccia. Minor faults, and branches of the Adelaide River Fault, are also present.

RESERVOIR AREA

GENERAL

The catchment (Plate 1) covers 243 square miles of the southern border of the Northern Territory coastal plain. Within this border zone the headwaters of the Daly, Finniss, Reynolds, and Adelaide Rivers interdigitate. Two saddles limit the storage capacity; they are discussed later in the report. The planned top water level for the storage is at a reduced level (R.L.) of 264 feet above mean sea level. This gives a storage capacity of 300,000 acre-feet and a reservoir surface area of 5,450 acres (information from W.R.B.).

Mapping around the damsite revealed part of the succession within the Finniss River Group. This sequence is indicated in Figure 1. The section was drawn along a line roughly parallel to the proposed dam axis. Thicknesses indicated are only estimates based on the mapping done to date. Stratigraphic positions of engineering geological features, mentioned within the text, are indicated on the section.

POTENTIAL LEAKAGE ZONES

There appear to be four possible paths of leakage other than through the dam foundations. They are:

1) through beds within the Tolmer Group.

2) along the Adelaide River Fault.

3) through the low southern saddle.

4) through the low northern saddle.

Leakage is not expected through the steeply-dipping, metamorphosed, Finniss River Group.

Tolmer Group

Only the Buldiva Sandstone is known to crop out within the storage area, but the Hinde Dolomite and Waterbag Creek Formations may extend into the southern part. Even if cavernous carbonate rocks are present near the head of the storage, leakage through them would be unlikely because of the extremely long leakage path.

To the west of the Adelaide River Fault, Depot Creek Sandstone dips to the south-east at 10 to 12 degrees, towards the Adelaide River Fault. A few anomalous dips, in the opposite direction, occur along the fault line. Most of the sandstone is above the proposed top water level.

To the east of the Adelaide River Fault, Buldiva Sandstone dips gently (5 to 20 degrees) to the west, obliquely into the storage area. The beds abut against a branch of the Adelaide River Fault and are downfaulted against the Finniss River Group. The eastern and north-eastern sides of the reservoir would have a barrier of Lower Proterozoic rocks at all points east of the Adelaide River Fault, therefore any leakage eastwards through the Buldiva Sandstone would have to find an outlet along the Adelaide River Fault (which is discussed below). Leakage to the south, into the Daly River system, through the Buldiva Sandstone is obviated by the very long leakage path - more than 16 miles.

Adelaide River Fault

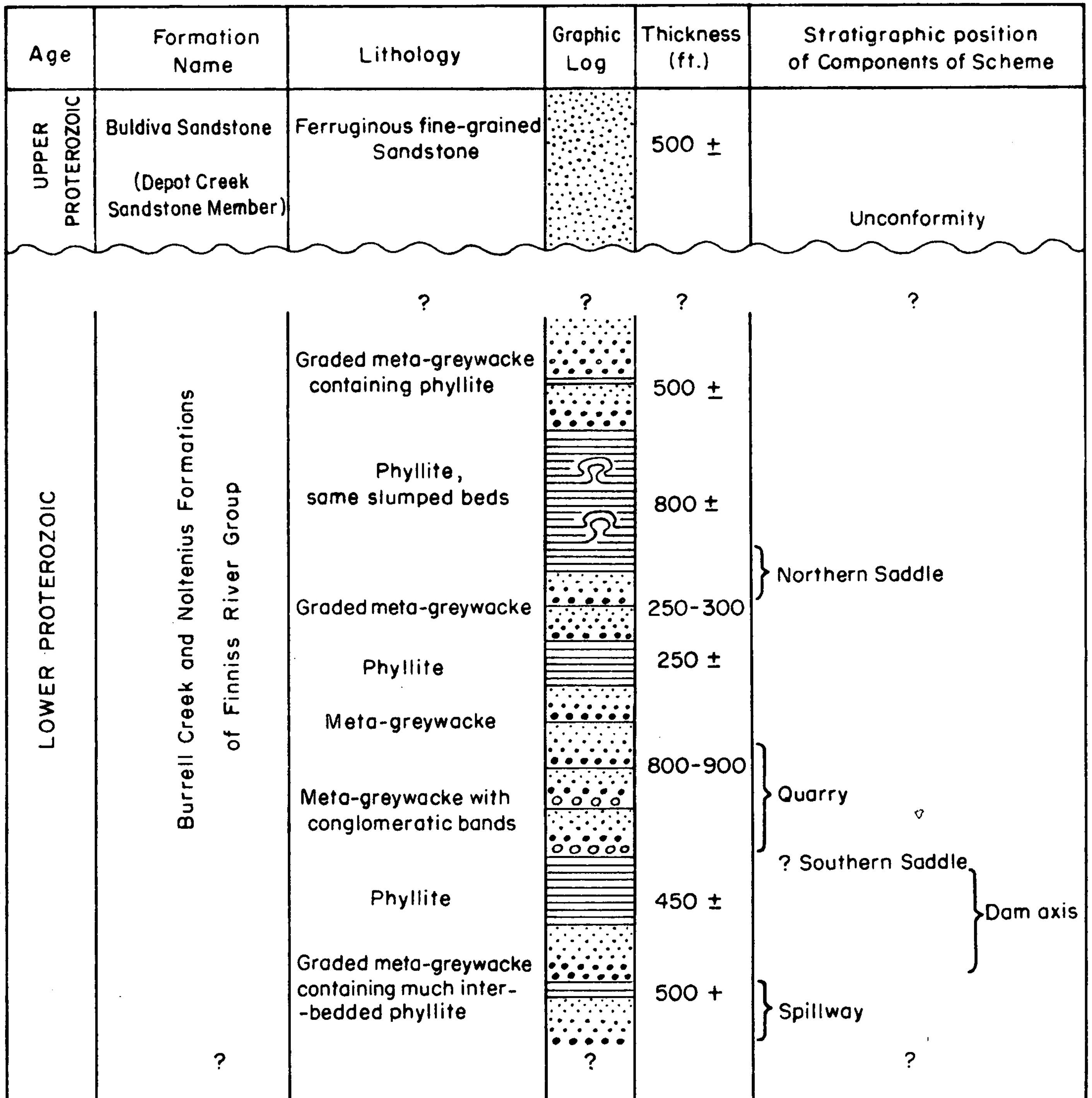
Near the southern saddle, the fault, which dips steeply to the south-east in places (035 degrees magnetic/86 degrees SE.), has downfaulted Depot Creek Sandstone against meta-siltstone and meta-greywacke of the Finniss River Group. The fault is sharply defined. To the north-west of the saddle Depot Creek Sandstone abuts against meta-greywacke. At the contact a vein of hard hematite, one to two feet wide, contains a narrow band of breccia. The latter consists of friable sandstone fragments within a hematite matrix. Thin hematite veins also occur parallel to cleavage in some areas.

To the south-west, at the contact between sandstone and meta-siltstone, there are outcrops of silicified breccia up to 30 feet wide. The breccia consists of sandstone fragments in a crypto-crystalline quartz matrix. The meta-siltstone is closely cleaved near the fault trace; in places the cleavage is contorted, elsewhere it is parallel to the fault trace.

The fault line appears tight, and has no springs associated with it (observations by the author and by D. Kneebone, Senior Technical Officer, W.R.B.). Any seepage comes out of near-horizontal fractures

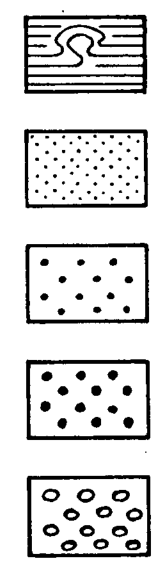
FIG. I.

Generalised Stratigraphic Column for Adelaide River Gorge Dam Site No. I and Environs



Thicknesses approximate, measured from map.

REFERENCE



Phyllite with slumped beds

Fine-grained meta-greywacke

Medium-grained meta-greywacke

Coarse-grained meta-greywacke

Pebble conglomerate

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within the Depot Creek Sandstone (also see Hays, 1961, p6). Leakage is therefore not expected along the fault. To confirm the impermeability of the fault, a drill hole should be put down to intersect the fault and water-pressure tests should be carried out, especially within the meta-siltstone near the contact (see below).

Southern Saddle (R.L. 277 feet)

The saddle lies within meta-siltstone. Its north-west edge is bounded by the Adelaide River fault-line scarp. Streams drain to the north and south with gradients of 1:30 and 1:70 respectively.

During earlier investigations, the saddle, the "Eastern Low Saddle" of Hays (1961), was considered as a possible spillway site; the need for a cut-off wall was also considered. A resistivity survey was carried out in 1960. Attempts to check the results by augering were not successful. Since then, two costeans have been bulldozed to a depth of 6 to 7 feet. The top 2 to 3 feet of soil consists of fine-grained sand washed down from the Depot Creek Sandstone to the west. Below the sand, highly weathered and lateritised meta-siltstone is present. This material has a high clay content. Form interpretation of the geophysical work, the contact between the highly weathered and moderately weathered meta-siltstone is places at a depth of 10 to 20 feet below the surface, with moderately weathered rock to at least 40 feet.

The highly and moderately weathered meta-siltstone probably has permeabilities similar to those of the phyllite in the left bank of the damsite. Two shallow holes may be needed for water pressure tests and to check the depth of weathered rock. In addition, the contact between highly weathered meta-siltstone and the Adelaide River Fault should be water-pressure tested. A grout cut-off may be needed across the saddle to make it water-tight.

Northern Saddle (R.L. 289 feet)

The northern saddle, the "Western Low Saddle" of Hays (1961), is steep sided with slope gradients ranging from 1:2 to 1:6. The saddle is on the west limb of an anticline in cleaved phyllite, which in the rare outcrops, is brittle and closely cleaved. Cleavage spacing is from $\frac{1}{4}$ to 1 inch. In the saddle, cleavage strikes 018 degrees (magnetic) and dips about 80 degrees west. The strike is almost normal to the axis of the saddle. Unless cleavage is tight at depth, it may allow leakage. Hays, (1961, p 7), noted that "joints appear to be open to a depth of between 50 and 100 feet" (in outcrop on the saddle slopes), but drilling in the left abutment of the dam indicates that the phyllite is generally tight, even close to the surface. Since the shortest potential leakage path is only 300 feet, careful water-pressure testing will be needed to determine the permeability of the phyllite. For this purpose one or two, 60 to 70 feet long, cored, diamond drill-holes will be required.

An anticlinal axis to the south-east of the saddle lies along a ridge of phyllite, capped by cleaved meta-greywacke. On the east limb of the anticline the meta-greywacke dips to the north-east at 45 to 55 degrees; the west limb is scree covered. Along the synclinal trough in the valley to the east, seepage was noted from bedding planes within the meta-greywacke.

If the water level is raised above R.L. 280 feet, water may leak along bedding planes and joints within the meta-greywacke. If a maximum top water level of 264 feet is used, water will have to pass through the phyllite to leave the storage area and the meta-greywacke capping should not present a leakage problem.

DAMSITE GEOLOGY

LITHOLOGY

The damsite area consists of graded meta-greywacke and phyllite (see Plate 3 and Fig. 1). Meta-greywacke grades from pebble conglomerate through coarse, medium, and fine grained greywacke to phyllite, but not all gradations are present in every graded bed. Beds range in thickness from 1 to 40 feet and crop out as elongate, steeply dipping ribs and sloping slabs.

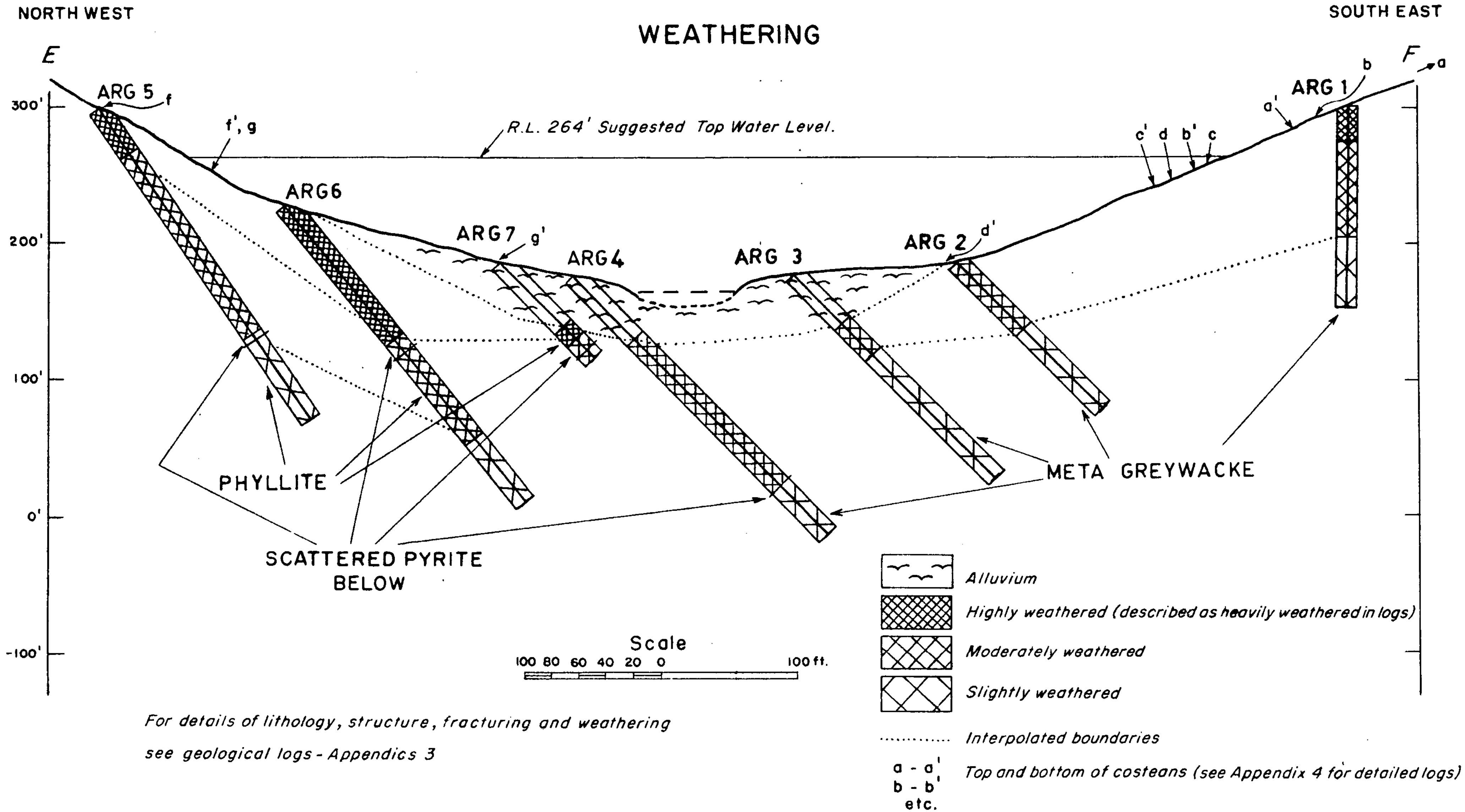
Conglomerate bands, many of which are very friable at the surface, are composed of rounded quartz pebbles. Most of the pebbles are between ½ and 2 inches in diameter. In places, the pebbles are sheared and ovoid. Bands are not everywhere continuous but tend to pinch and swell. Shallow scour channels in underlying, fine-grained beds are commonly partly filled with conglomerate. The conglomerate grades upwards into a quartz-greywacke. In places there is no transition and sharp contacts occur between coarse and fine bands.

The meta-greywacke consists of angular to sub-rounded quartz grains set in a fine groundmass of sericite, quartz and minor quantities of green chlorite. Under polarised light, most quartz grains show undulose extinction, caused by strain; some are granulated, some are partially recrystallised. Within the finer bands, fine cross-bedding is common.

ADELAIDE RIVER GORGE DAM SITE No.1.

FIG. 2.

Section E-F. Parallel to Dam Axis looking downstream (see Plate 3).



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Outcrops of phylliteare sparse; they occur as closely cleaved blocks and slabs protruding from a shallow soil cover. The blocks are very susceptible to soil creep. The phyllite has a fine-grained groundmass of quartz, sericite, and light-green chlorite. In places, quartz porphyroblasts are present. Holes ARG 4 and 6 intersect bands which consist of contorted, black, chloritic "slate", with highly polished shear faces.

Phyllite beds were originally siltstone, shale, or mudstone. Bands within the sequence still show soft-rock structures such as load-casts, ball and pillow structures, and fine cross and graded bedding.

Outcrops of both meta-greywacke and phyllite are locally silicified, especially close to quartz veins.

ALLUVIUM

Alluvium is at least 45 feet thick in the main stream. It consists of sand, gravel, and stiff, impermeable, sandy clay, silty clay, and clay. Close to the valley sides, scree boulders are present.

In the watercourse into which it is proposed that the spillway should discharge, alluvium is from 4 feet to greater than 25 feet thick. The top few feet of clay is underlain by weak, highly weathered and lateritised gravel.

STRUCTURE

Folding

Both left and right banks of the damsite are on the moderately steeply dipping (40 to 60 degrees) east limb of a syncline, (Fig. 3). The synclinal axis follows the top of the ridge which forms the left side of the valley and plunges north-north-east between 20 and 30 degrees. The anticlinal axis of a minor fold is exposed on the right bank, in a costean at R.L. 330 feet, near the proposed centre-line of the dam. Another anticlinal axis is exposed in the spillway costean, on the east side of the right bank.

Faulting

Apart from minor dislocations, (displacements of 1 to 6 inches), along fractures, there is no surface evidence of faulting within the damsite. A number of shear zones were intersected by drill holes, especially within the phyllite (see Appendix 3 and Fig. 3). In addition, one or two areas of silicified breccia, up to 1 foot thick, were intersected.

Drill hole ARG 7 passed through a possible shear zone from 45 to 73 feet (28 to 40 feet, vertical depth), directly below the alluvium. Core recovery was poor; the material recovered is fine, white clay containing angular phyllite fragments and five fragmented quartz veins. From 73 to 85 feet (slope distance), the hole passed through finely fragmented and sheared phyllite.

The presence of contorted, fragmented, slaty zones in the phyllite also indicates shearing. These zones were intersected by drill hole ARG 6 at depths from 128 to 256 feet (74 to 144 feet, vertical depth), and by drill hole ARG 4 at depths from 69 to 200 feet (40 to 125 feet, vertical depth). All fracture faces are polished and have a vitreous lustre.

Jointing

Jointing characteristics of greywacke differ from those of phyllite. In the phyllite, cleavage is the most prominent parting; it appears to parallel bedding. Cleavage spacing ranges from $\frac{1}{4}$ to 2 inches, near the surface, to greater than 8 inches at vertical depths of 100 feet. Cleavage planes are normally clean; some are slickensided or penetrated by thin, ($\frac{1}{4}$ to 1 inch wide), quartz veins. Near the surface thin clay seams, formed by weathering, are present along cleavage planes.

From observations of drill core, a set of joints dips at 30 degrees in the opposite direction to bedding. Joint faces are clean; at depth some are chloritic and highly polished, and a few are coated with smears of pyrite. Another joint set dips at 60 to 70 degrees to the core axis in inclined holes. Near the surface, faces of this set are iron-stained and many have thin clay films. At depth, they are commonly coated with pyrite; slightly open joints contain small quartz and pyrite crystals.

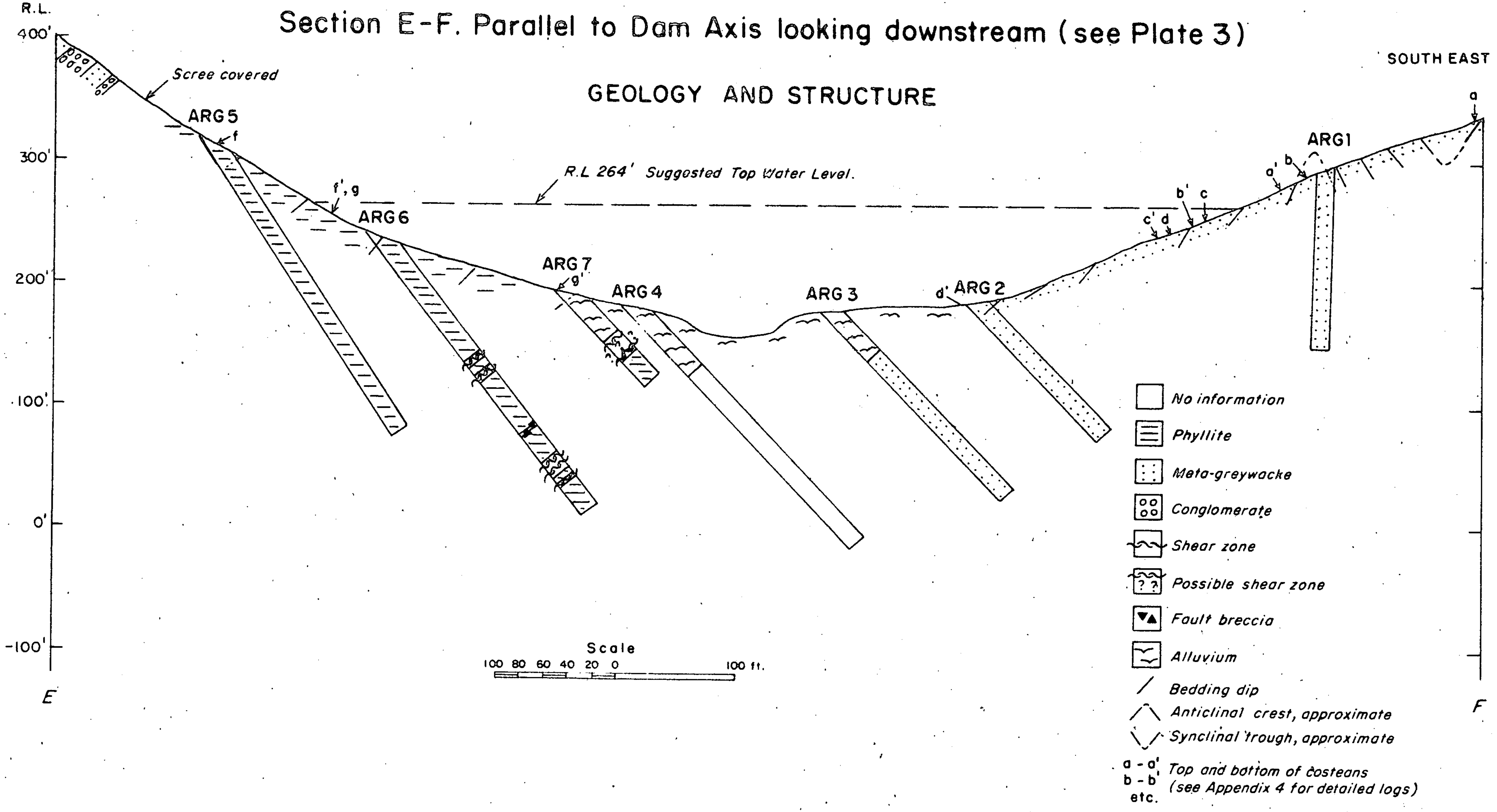
Many bedding contacts between phyllite and coarse or medium grained, meta-greywacke are slickensided; bedding joints within the meta-greywacke are generally clean and tight, but many are iron-stained. Within the meta-greywacke, close to very close, ($\frac{1}{2}$ to 12 inch spacing), steeply dipping, (75 to 90 degrees), cleavage planes are arranged radially about fold axes, especially anticlinal crests. Other partings are more

FIG. 3.

ADELAIDE RIVER GORGE DAM SITE No. 1.

Section E-F. Parallel to Dam Axis looking downstream (see Plate 3)

GEOLOGY AND STRUCTURE



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widely spaced than in the phyllite. In 30 measurements, the maximum and minimum joint spacings were 5 feet, and 1 inch, the average spacings being between 21 inches and 5 inches.

From 160 joint measurements in the meta-greywacke, the major sets strike and dip:

$$012\text{-}071^\circ/16\text{-}48^\circ \text{ E, especially } 024\text{-}049^\circ/20\text{-}40^\circ \text{ E.}$$

with a complementary set at $027\text{-}037^\circ/37\text{-}45^\circ$ W. Further sets are:

$002\text{-}011^\circ/44\text{-}51^\circ$ E,
$069\text{-}086^\circ/44\text{-}56^\circ$ S,
$098\text{-}120^\circ/58\text{-}66^\circ$ N,
$106\text{-}112^\circ/30\text{-}34^\circ$ S.

(all bearings are magnetic).

In drill core, joints at 30 to 45 degrees to the inclined core axis are the most common. Near the surface many of them have thin clay infillings. Steeply dipping joints commonly have interconnecting voids, (1/10 to ½ inch wide), containing quartz crystals with pyramidal ends. Some fractures within fine-grained bands are slickensided and covered with bright-green chlorite. (After two or three months in the atmosphere, the chlorite breaks down into a green-white powder).

WEATHERING

Two classes of soil and scree covered areas have been distinguished; their distribution is shown in Plate 3. In one class, soil cover is less than 3 feet thick, rock outcrop is scattered, and coarse, blocky scree occurs in places. Rock does not crop out in the other class of area; soil and scree cover is at least 3 feet, and in places is over 7 feet thick. Near the base of slopes, scree material is partially lateritised, the rock fragments being completely decomposed and cemented by a weak, ferruginous, sandy clay matrix.

On the upper left bank there is only a thin soil cover with large scree blocks present. This thin cover extends down to the break in slope, slightly below the hidden meta-greywacke, phyllite contact. Below the break in slope scree increases in thickness both towards the base of the slope, (there is over 7 feet of lateritised scree in the bottom costean), and downstream of the dam axis.

The right bank has a thin soil cover. Near the base, and upstream of the dam axis, there is only a narrow band of scree, generally 3 to 4 feet thick, which thins downstream.

The degree of weathering has been divided into a number of classes based on the breaking response of the rock to hammer blows:

Table 1 Classification of Degrees of Weathering

Class	Rock Properties
Completely weathered	Relict rock fabric; behaves mechanically as soil
Highly weathered	Much clay associated with siltstone and phyllite which crumbles when crushed in hand; meta-greywacke friable and can be broken across the fabric by unaided hands.
Moderately weathered	Clay along fractures in phyllite; phyllite crumbles under a 2lb geological hammer blow. Meta-greywacke breaks under a moderate hammer blow; some of rock may withstand hard hammer blows.
Slightly weathered	Rock slightly discoloured and stained along fractures; kernels of fresh rock between fractures. Strength slightly reduced from that of fresh rock.
Fresh	Rock dark to light grey; no iron staining. Phyllite may bruise and break along cleavage planes when struck by a 2lb geological hammer. Meta-greywacke rings when struck by hammer.

The effect of weathering and depth to which weathering extends depends markedly on the lithology. In phyllite on the left bank, spacing of cleavage partings is dependent on weathering: partings are closer spaced in the more highly weathered zones. In drill hole ARG 5, highly weathered phyllite extends to 20 feet below the surface; in ARG 6 it extends to 70 feet below the surface, (see Fig. 2). Below these zones there is moderately to slightly weathered phyllite. Even at 140 feet below the surface, in drill hole ARG 6, phyllite is still moderately weathered in bands.

Meta-greywacke in the right bank is not as weathered as the phyllite. There is less than 30 feet of highly weathered meta-greywacke in the top of drill hole ARG 1. The zone of moderate weathering decreases in thickness towards the valley floor; from 100 feet below the surface in ARG 1, to 65 feet in ARG 2, and 65 feet in ARG 3. As on the left bank, the meta-greywacke is still slightly weathered 200 feet below the alluvial flats.

Weathering can be expected to extend deeper in anticlinal and synclinal cores than on the limbs of folds.

ENGINEERING GEOLOGY

From topographic considerations, five possible damsites were selected within the Adelaide River Gorge, (see Plate 2). Sites 2, 3 and 4 were previously investigated by Hays (1961); the height of a dam at site 4 is limited by a low saddle with a R.L. of 221 feet; sites 2 and 3 may warrant further investigation before a final decision is made about the present site, but preliminary mapping indicates that phyllite underlies much of the foundation areas for both sites.

The location of the present damsite, (site 1), was selected because of favourable topography at the site, and because of the high storage capacity available, as a result of the widening of the river valley just upstream from the site.

The initial investigation was planned to:

a) determine whether the site is suitable for the construction of a 100-foot-high dam, and if so to:

b) provide enough geological information to enable a fairly accurate cost analysis to be carried out. This is needed to determine the economic feasibility of the scheme.

FOUNDATIONS

Left Bank

Little, to no, rock crops out on the left bank in the position of the proposed dam axis. Only above R.L. 375 feet, where a conglomerate and meta-conglomerate sequence overlies the phyllite, is outcrop apparent. However, only a comparatively shallow cover of soil and scree overlies the phyllite. The cover ranges from 2 feet thick, half way down the slope, to 7 feet thick at the base of the slope. Phyllite is exposed in two costeans, at drill sites ARG 5 and 6, and along bulldozed tracks leading to the sites. Near the surface, phyllite is affected by soil creep. The rock is mainly soft, weak, closely cleaved and fragmented. During the investigation, water running intermittently over a period of weeks, cut a trench 18 inches deep in parts of the costeans. In drill hole ARG 6, the first 120 feet, (75 feet, vertical depth), is in highly weathered phyllite. The phyllite is represented by a sericitic and chloritic silt and silty clay for much of the first 50 feet (30 feet, vertical depth).

Soil testing procedures will be applicable for the highly weathered material which has a low cohesion (c) and probably a low angle of friction (ϕ). (This opinion is based on tests by the Commonwealth Department of Works on fill material consisting of highly weathered phyllite of the Noltenius Formation from Fort Hill, Darwin (see Braybrooke, 1967). Results from the tests were: c : 0-6 pounds per square inch (p.s.i.) and ϕ: around 26 degrees). As the phyllite is soft, it can be easily ripped and excavated using bulldozers or scraper dumpers.

The material will compact and settle when loaded, and will not withstand high stresses; however, a rock or earth fill dam, 100 feet high, should not impose high loads on the foundations. A potential failure surface may exist along the contact between highly weathered and moderately weathered phyllite. Phyllite readily parts along cleavage planes and joints, many of which have clay material associated with them. Since the cleavage dips into the hillside, it will probably be less of a problem than the joint planes.

Results of water pressure tests are not available but it is expected that the phyllite may be more permeable at depth than near the surface; the silty and clayey material at shallow depths should make the upper zone comparatively water-tight. However, during drilling of holes ARG 5 and 6, complete loss of drilling water was recorded at depths up to 30 feet, (15 feet vertical). Water was seen draining out of the hill side below the drill sites. If leakage does occur through the left abutment, because of the silty material, there is a danger of piping in the top 80 feet.

At about R.L. 140 feet in drill holes ARG 5, 6 and 7 pyrite occurs as joint infillings. This would tend to oxidise to sulphate radicles in the presence of cement grout and will attack the cement. Hence, if cement grouting is to be used below R.L. 140 feet in the phyllite zone, sulphate resistant cement should be used.

River Bed

Results from drill holes ARG 3, 4 and 7 indicate at least 44 feet of alluvium overlying weathered bedrock.

Table 2 Depth of Alluvium in Drill Holes ARG 3, 4 and 7.

Hole ARG	Distance to weathered bedrock (feet)	
	Inclined	Vertical
7	65 (possibly sheared bedrock below 43)	40 (28)
4	66	40
3	53	44

In ARG 7, most of the core recovered to 43 feet (28 feet vertical) is a leached and mottled, stiff, impermeable sandy clay with a few phyllite fragments, quartz, and meta-greywacke pebbles and boulders. From 43 to 51 feet (28 to 32 feet, vertical distance), there is a stiff, white clay with a few phyllite fragments; between 51 and 65 feet no core was recovered. Broken quartz veins and stiff, white clay occur from 65 to 72 feet (40 to 45 feet, vertical distance), then to 84 feet, (50 feet, vertical), there is highly weathered phyllite.

Little core was recovered from the first 66 feet of ARG 4. What core there is, consists of sandy clay and pebbles of meta-greywacke and quartz.

Core recovery from drill hole ARG 3 was also poor. The driller's shift reports indicate: 10 to 14½ feet (7 to 11 feet vertical)-silty clay; 14½ to 30 feet (11 to 24 feet vertical)-clayey sand and river gravel with quartz pebbles and greywacke boulders. Directly below the alluvium, there is moderately to slightly weathered meta-greywacke.

The drilling results suggest that a shear zone may have been intersected by ARG 7 between 43 and 72 feet; further exploration will be needed to confirm this. Further, it appears that the river may have preferentially cut deeper along the contact between the meta-greywacke and the phyllite, than elsewhere. This contact, which was intersected by drill hole ARG 4 at 212 feet, shows minor shearing of the phyllite.

Since sand and gravel beds may occur randomly within the alluvium, providing potential leakage paths, the alluvium may have to be excavated to sound bed-rock or an impermeable cut-off provided in the alluvium. Percussion drilling and geophysical work will be needed to define the distribution of the alluvium accurately. If the alluvium is excavated, it may be usable as part of the fill material.

If it is decided not to remove the alluvium, a slurry trench cut-off composed of bentonite or a bentonite-cement mixture, or an upstream impervious blanket, (see Sherard, et. al., 1963, pp 304-308), may be applicable. Sheet-piling, with closure by cement grouting, could also possibly be used.

Right Bank

Elongate outcrops of graded meta-greywacke, dipping towards the river, occur on the right bank. Between outcrops, particularly over fine-grained meta-greywacke and phyllite bands, there is a thin soil cover. The cover ranges from 1 foot, near the proposed dam crest, to 4 or 5 feet thick at the base of the slope; hence little stripping will be necessary to expose the bedrock fully.

Near the surface, fine-grained meta-greywacke and phyllite bands are very closely fractured to fragmented. In the phyllite, clay-filled crush zones are common near the surface. At shallow depths, slickensides in phyllite are prevalent, indicating differential movement between competent and incompetent beds, during folding.

Medium-grained meta-greywacke is closely fractured near the surface, but generally the rock is moderately strong to strong at depths of 5 feet or less. Near the dam crest, there may be 10 feet of highly weathered meta-greywacke, (see Fig. 2).

No bearing capacity problems are anticipated on this bank although there may be some compaction of phyllite bands. Phyllite bands are also important as potential planes of weakness, especially since the bedding strikes almost normally to the dam axis. If high horizontal stress components are applied to the foundations on the right abutment, sliding downstream could occur along one or more of the weathered phyllite bands.

A set of joints within the meta-greywacke, dipping at 45 degrees, are open in part and have interconnecting cavities. They constitute a potential leakage path. Careful grouting would be needed to make the right abutment water-tight. Since bedding dips at 50 degrees, blanket holes may have high takes owing to grout passing out of the surface zone, down bedding planes.

Design Considerations

The profile of the proposed axis is suitable for a concrete buttress, earth or rock-fill dam. Because of poor foundations, cost of cement and the probable lack of suitable aggregate and sand, a concrete dam appears to be uneconomical. Hence the choice lies between a rock-fill dam with an impermeable core or an earth-fill dam. Sufficient quantities of rock-fill are present and pitting has indicated that large quantities of earth-fill are probably also present near the site.

Since highly weathered phyllite on the left bank will probably compact to a marked degree under the load of the embankment, the dam foundations should be wide. Also, because of the difference in rock types on either bank, differential settlement of the two sides is likely to occur, even if the left bank foundations were excavated to fresh phyllite.

These considerations call for either a rock-fill dam with a wide core-zone, or an earth-fill dam. Soil mechanics studies should be made on foundation material to determine the safe load and other design criteria.

SPILLWAY

The proposed spillway site is in graded meta-greywacke, on the right bank. A minor anticlinal crest is exposed at R.L. 300 feet on the line of the dam axis. This is close to the proposed spillway crest position. The spillway channel will probably slant down the back slope of the right bank, running across the strike of the bedding at a shallow angle. A spillway channel in this location would pass over an anticlinal crest near the base of the slope.

The right wall of the spillway cut will have to be cut at an angle no steeper than the bedding dip of 50 degrees. Material excavated from the spillway may be usable as rock-fill.

Shallow drilling will be needed along the spillway centre line and at the site of the energy dissapator, wherever positioned, to determine the depth of weak, weathered rock.

CONSTRUCTION MATERIALS

ROCK-FILL

If a rock-fill dam is decided on, between 500,000 and 1,000,000 cubic yards of rock will be needed (the Figures are very approximate; they are based on estimates by W.R.B.). Available sources are:

a) the meta-greywacke of the Noltenius Formation; and

b) the Depot Creek Sandstone.

Noltenius Meta-greywacke

Geological Succession and Structure

The ridge that forms the extension of the left abutment consists of a folded sequence of meta-greywacke beds. The beds are from 4 to 40 feet thick and grade from a quartz-pebble conglomerate through coarse, medium, and fine grained greywacke to phyllite. The sequence, which is 800 to 900 feet thick, occurs stratigraphically between thick sequences of phyllite. A synclinal trough extends along the centre of the ridge, with an anticlinal crest on the western edge and a probable synclinal trough half way down the western slope, (see Plate 3 and 5).

Outcrop is generally sporadic and the western dip slope is almost completely scree-covered, but conglomeratic bands provide useful members for correlation of beds. A number of sections paced across areas of fairly continuous outcrop have been interpolated and projected onto sections A-B and C-D. From these, a composite stratigraphic column of beds in the quarry site has been built up (see Plate 6). The thickness of beds in this column has been reduced to true thickness. Since individual beds lens and swell, the sequence presented in the column is generalised and approximate. Above the succession in section C-D, there is another 400 feet of meta-greywacke which is closely cleaved in outcrop. This lies outside the proposed quarry limits, (see Appendix 2).

Suitability for Rock-fill

Meta-greywacke: At the surface the meta-greywacke varies in quality. In places it is strong and partly silicified; in other areas, especially where it is close to fold axes and where it is fine-grained and micaceous, the meta-greywacke is closely cleaved, highly weathered and friable. Further, the matrix of conglomerate and very coarse-grained sand bands tends to be weathered, producing a friable material.

Some of the mica-rich meta-greywacke may have poor aggregate shear-strengh characteristics. When wetted, both its compressive strength and its sliding friction angle are expected to decrease. (When wetted, the sliding friction angle of mica decreases markedly, see Horn and Deere, 1962). Samples will have to be submitted to the appropriate strength and durability tests.

Phyllitic Interbeds: Phyllite is very weak at the surface. Information from drill holes ARG 1,2,3 and 4 indicate that phyllitic interbeds are also weak and fragmented at depth. Hence, on working, it will produce excessive fines.

Jointing: Pronounced jointing in meta-greywacke, within the area, produces natural blocks from 1 to 10 cubic feet in volume. The blocks range in shape from plates and elongate blocks to cubes; elongate and platey blocks predominate. From measurements of 60 natural blocks taken at random, the average ratio of diameters was 1:1.6:2.5.

Near fold axes, meta-greywacke at the surface is closely cleaved, with plates down to half an inch thick.

Bulk Properties: Using information from Fig. 4, the section has been divided into four rock-type divisions. For each rock type, the cumulative thickness, percentage of section, comments, and likely properties as rock-fill, are given in Table 3.

Table 3 Likely Volumes and Properties of Rock Type Divisions within Proposed Quarry in Meta-greywacke.

Rock Type	Cumulative thickness in section (feet)	Percentage of total section thickness	Comments	Likely Properties as rock-fill *
Phyllite	20	4	Little outcrop. Very closely fractured to finely fragmented at depth.	Weak; will crush on working, producing fines.
No Outcrop	75	16		Probably mainly weak rock producing excessive fines on working.
Fine-grained meta-greywacke, friable at surface	105	23	Commonly highly micaceous with poor bond strength. Moderately to closely fractured at depth.	Weak to moderately strong. On working will produce blocks and moderate fines.
Fine-grained meta-greywacke to conglomerate	260	57	Moderately to closely fractured at surface and at depth.	Moderately strong. On working will produce blocks and some fines.
	460	100		

* (Opinions based on observations from outcrops and core; will need confirmation by drilling and suitable tests).

Quantities of Rock-fill

Assuming the proposed quarry floor to be at R.L. 250 feet, the quarry site, (see Appendix 2), should contain 1,000,000 cubic yards of rock-fill. The site mainly lies within the east limb of a syncline. It also has an anticlinal axis running through its centre, (see Plate 5). To prove the quarry, using geological deduction, 580 feet of drilling and 800 feet of costeaning is needed, (see Appendix 2 for detailed recommendations).

Should the volume of suitable material be inadequate, the proposed quarry could be extended horizontally in any of three directions, or the floor deepened, and still remain within the meta-greywacke sequence. Phyllite would probably be encountered in the quarry floor if the anticlinal axis is followed too far towards the south.

Large blocks suitable for rip-rap are expected in sufficient quantities, but they would probably have to be stockpiled as produced.

Depot Creek Sandstone

Along the Adelaide River Fault there are a number of scarps up to 90 feet high in Depot Creek Sandstone. The rock is a well-bedded, strong, partly silicified, fine-grained quartz sandstone. Though no estimate has been made of the volume of rock present, the sandstone could possibly be used as rock-fill. However, the silicification may be a superficial phenomenon. If so, the sandstone at a fairly shallow depth is possibly too soft and friable to be used for rock-fill. Drilling would be required to check this. Further, owing to pronounced bedding, the sandstone would possibly break into platy blocks when blasted.

IMPERVIOUS MATERIAL

The only suitable material for use in an impervious core is the sandy clay alluvium that occurs extensively in the valley of the Adelaide River. Large alluvial flats, of an unknown thickness (possibly up to 40 feet thick in places), have been formed above the head of the gorge. A number of them have been pitted to determine the quality and quantity of the material. From a superficial examination, the alluvium ranges from clay to a well graded (?) sandy clay with moderate to high cohesive strength. In most pits the top 1 to 2 feet consists of a grey-black, non cohesive soil, underlain by red to pink sandy clay. The alluvial deposits have been investigated by engineers of Water Resources Branch.

The volumes present have not been estimated but more than enough material has been proved for an impermeable core. If an earth-fill dam is decided on, there would probably be adequate supplies of alluvium within a mile of the damsite.

If alluvium at the damsite is removed, this may be usable as earth-fill material. That recovered from coring is a stiff, sandy clay to clay and appears impermeable.

Since there may be sandy lenses within the alluvium, it would have to be thoroughly mixed to prevent a permeable zone being formed inadvertently. Representative samples will have to be subjected to the usual laboratory tests.

SAND

No suitable sand deposits have been found near the damsite. Deposits of fine-grained, pink quartz sand form flats below the Adelaide River Fault. This sand is derived from the Depot Creek Sandstone. It appears to be too fine-grained for use in concrete without blending, but no grading tests have been done on the sand, and no estimate has been made of the volume of sand available.

Suitable sand is reported to have been located in the bed of the river, below Adelaide River township.

AGGREGATE

The most suitable source of aggregate appears to be crushed, silicified, Depot Creek Sandstone or crushed meta-greywacke. If these sources prove unsatisfactory, commercial sources, such as the 'Australian Blue Metal' quarry at Acacia Creek, may have to be used.

CONCLUSIONS

From geological considerations, the construction of a 100-foot-high rock or earth-fill dam at Site No. 1 is feasible.

The depths of alluvium and highly weathered phyllite, which form the left abutment and foundation below the river, are the main disadvantages of the site; they are up to 45 feet thick. The right abutment is composed of strong, elastic meta-greywacke. Therefore, differing response to loading by the dam embankment, across the site, will require a design and embankment material which will accept differential foundation settlement.

As water pressure tests were not carried out in conjunction with the drilling programme, no conclusions can be reached as to the permeability of the foundations.

Testing will be necessary to determine whether leakage will occur through the Northern and Southern saddles.

Ample rock and earth-fill materials appear to be available close to the site.

If the profiles of Sites 2 and 3 suggest that volumes of embankment would be similar to that required for Site 1 or that any added embankment volume for Sites 2 or 3 would be fully offset by the cost of excavation and foundation treatment at the No. 1 site, further geological investigations should be carried out at Sites 2 and 3 before a final decision is made about Site No. 1.

RECOMMENDATIONS

Collar positions of the drill holes and costean centre lines should be accurately surveyed with respect to the damsite grid. If drilling is carried out in the proposed quarry site, the grid will have to be extended to cover this area. All drill holes should be preserved by cementing in stand pipes to which screw caps can be fitted, and should be clearly marked.

Should it be decided to construct a dam at Site No. 1, additional geological information will be needed on which to base the design of the dam. However, before a final decision can be made on the site, further preliminary geological investigations may be necessary of Sites 2 and 3 (see Conclusions). Information available indicates that phyllite is present within the foundation areas of both sites but that thicknesses of alluvium may not be as great as at Site 1.

The following design investigations are recommended:

1) Samples of the highly weathered phyllite on the left bank require in situ and laboratory tests to determine mechanical properties and permeability.

2) A programme of seismic work in conjunction with pattern drilling is necessary to determine the thickness of alluvium and highly weathered phyllite. At least six 50-foot percussion holes will be required initially. On the left bank, the boundary between alluvium and highly weathered phyllite will be difficult to distinguish. Excavation limit may have to be based on mechanical tests of representative samples.

3) After the seismic survey, further diamond drilling will probably be needed to test suspected shear and fault zones, or other zones of low velocity.

4) Further costeaning and sluicing of the right bank is desirable to provide more detailed information on the

amount of "dental work" (caulking of joints, minor shears and pockets of deep weathering with concrete) needed, and to determine whether a satisfactory foundation can be obtained without trimming of the rock.

5) Shallow drilling and seismic testing will be required along the spillway centre line and at the dissipator site. At least three, vertical, 30-foot diamond drill holes will be required along the channel to determine the depth of weak, weathered rock. The whole of the spillway area should be cleaned down, sluiced, and mapped in detail by a geologist.

6) Some design drilling and geological mapping will be required for any diversion works that may be required. The work necessary cannot be indicated until the nature of the diversion works, if any, is decided.

7) 580 feet of drilling and 800 feet of costeaning will be required in the proposed quarry site in the meta-greywacke, (see recommendations in Appendix 2). Samples will have to be subjected to appropriate strength and durability tests. Further drilling may be needed for contractual purposes.

8) The necessary quantity and quality of earth-fill material will have to be proved by the appropriate field and laboratory studies.

9) The permeability and thickness of highly weathered phyllite will have to be determined in both the Northern and Southern saddles. This will require one or two diamond drill holes in each saddle. These holes should reach a depth of 60 to 70 feet and be water-presure tested.

10) At least one hole should be drilled through the Adelaide River Fault and be thoroughly water-pressure tested.

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APPENDIX 1

DEFINITIONS OF SEMI-QUANTITATIVE DESCRIPTIVE TERMS

Grade Scale

Pebble	4 to 64 mm
Very-coarse-grained sand	2 to 4 mm
Coarse-grained sand	1 to 2 mm
Medium-grained sand	$\frac{1}{4}$ to 1 mm
Fine-grained sand	$\frac{1}{2}$ to $\frac{1}{4}$ mm

Fracture Spacing

Very wide fracturing	$>$ 10 feet
Wide fracturing	3 to 10 feet
Moderate fracturing	1 to 3 feet
Close fracturing	4 inches to 1 feet
Very close fracturing	1 inch to 4 inches
Fragmented	$\frac{1}{2}$ inch to 1 inch
Finely fragmented	$<$ $\frac{1}{2}$ inch

Hardness

Hard to very hard	Impossible to scratch with knife blade.
Moderately hard	Shallow scratches with knife blade.
Soft	Deep scratches with knife blade.

Percussive Strength of Rock

Strong to very strong	Not broken by repeated blows with a 2lb geological hammer.
Moderately strong	Rock broken by 3 or 4 heavy blows with a 2lb geological hammer.
Weak	Rock broken by one blow (includes brittle, fissile, friable, and flaky rocks)

APPENDIX 2

QUARRY SITE, ADELAIDE RIVER GORGE

Assuming the proposed quarry floor to be at R.L. 250 feet and using geological deduction, 580 feet of drilling and 800 feet of costeaning should prove an adequate volume of rock-fill material (about 1,000,000 cubic yards).

There will be sufficient drill core to allow an estimate of the volume of fine-grained material present and to indicate the effects of cleavage at depth. The core will have to be logged and samples subjected to appropriate strength and durability tests.

To prove an adequate volume of rock-fill for contractual purposes, an extra 420 feet of vertical drilling may be desirable. This drilling, however, would presumably be undertaken at the design investigation stage.

Should there be an inadequate volume of suitable material, the proposed quarry could be extended horizontally in any of three directions, or the floor deepened, and still remain within the greywacke sequence. However, phyllite would probably be encountered in the quarry floor if the anticlinal axis is followed towards the south.

The drill sites and specifications in the attachments differ from those previously set out on the ground.

ARG 8: This position is the same as that already blazed and pegged as 8.

ARG 9: This position is situated immediately above a conglomerate band about half-way between pegged positions 11 and 12.

ARG 10: This position is fifty feet downhill from that blazed and pegged as 10.

Costean h-h', 200 feet long, is to locate the fold axis and to try to locate a conglomerate marker band on the west side of the anticline.

Costeans j-j' (100 feet long) and k-k' (500 feet long) are to expose the sequence in the area of no outcrop, to locate any possible faults and to locate the known anticlinal fold axis and any other fold axis that may be present lower down the hill.

SPECIFICATIONS FOR DRILLING

DRILL HOLE No. ARG 8 TEMPORARY FINAL

TYPE OF DRILLING: Diamond drilling with NMLC stationary triple split inner tube

LOCATION: Quarry Site

OBJECTIVES OF DRILLING: To determine the stratigraphic sequence

SITE INDICATED BY: Peg painted red and blazed trees

DRILL SITE PEG, CO-ORDINATES: E 1226000
N 9935050

METHOD OBTAINED: From photogrammetric contour plan C & L 430/D

DRILL SITE PEG, R.L. OF GROUND SURFACE: 390'

METHOD OBTAINED: From contour plan as above

DIRECTION OF HOLE: 278° Mag. INDICATED BY:

REQUIRED SLOPE (ANGLE FROM HORIZONTAL): 45°

REQUIRED SIZE: NMLC

REQUIRED DEPTH (IN TERMS OF OBJECTIVES): Drill through the stratigraphic sequence in the area of no outcrop.

ANTICIPATED DEPTH: 130 feet

ANTICIPATED DRILLING CONDITIONS (STRATA, STRUCTURES): Conglomerate, greywacke and phyllite : Hard, abrasive drilling

WATER PRESSURE TESTING REQUIRED: No

SPECIAL REQUIREMENTS: Core to be photographed in trays. Core to be placed in trays and kept in good condition for future reference - preferably wooden trays.

SITE SET OUT BY: DATE:

J.B. Braybrooke

ENGINEERING GEOLOGIST

SPECIFICATIONS FOR DRILLING

DRILL HOLE No. ARG 9 TEMPORARY FINAL

TYPE OF DRILLING: Diamond drilling with NMLC Stationary triple split inner tube.

LOCATION: Quarry Site

OBJECTIVES OF DRILLING: To determine stratigraphic sequence. To investigate cleavage at depth.

SITE INDICATED BY:

DRILL SITE PEG, CO-ORDINATES: E 1225860
N 9935095

METHOD OBTAINED: From photogrammetric contour plan C & L 430/D.

DRILL SITE PEG, R.L. OF GROUND SURFACE: 414 feet

METHOD OBTAINED: From contour plan in above

DIRECTION OF HOLE: 278° Mag. INDICATED BY:

REQUIRED SLOPE (ANGLE FROM HORIZONTAL): 45°

REQUIRED SIZE: NMLC

REQUIRED DEPTH (IN TERMS OF OBJECTIVES): Drill through the stratigraphic sequence in the area of no outcrop. Drill 20' below proposed quarry floor level.

ANTICIPATED DEPTH: 270'

ANTICIPATED DRILLING CONDITIONS (STRATA, STRUCTURES): Conglomerate, greywacke and phyllite. Hard, abrasive drilling.

WATER PRESSURE TESTING REQUIRED: No

SPECIAL REQUIREMENTS: Core to be photographed in trays. Core to be placed in trays and kept in good condition for future reference - preferably wooden trays.

SIZE SET OUT BY: DATE:

J.C. Braybrooke

ENGINEERING GEOLOGIST

SPECIFICATIONS FOR DRILLING

DRILL HOLE No. ARG 10 TEMPORARY FINAL

TYPE OF DRILLING: Diamond drilling with NMLC Stationary triple split inner tube.

LOCATION: Quarry Site

OBJECTIVES OF DRILLING: To determine stratigraphic sequence. To investigate cleavage at depth. To determine plunge of anticline.

SITE INDICATED BY:

DRILL SITE PEG, CO-ORDINATES: E 1225505
N 9935080

METHOD OBTAINED: From photogrammetric contour plan C & L 430/D

DRILL SITE PEG, R.L. OF GROUND SURFACE: 340 feet

METHOD OBTAINED: From contour plan as above

DIRECTION OF HOLE: 109° Mag. INDICATED BY:

REQUIRED SLOPE (ANGLE FROM HORIZONTAL): 45°

REQUIRED SIZE: NMLC

REQUIRED DEPTH (IN TERMS OF OBJECTIVES): Drill through stratigraphic sequence. Drill into core of anticline to greywacke-phyllite contact. Drill 40' below proposed floor level.

ANTICIPATED DEPTH: 180'

ANTICIPATED DRILLING CONDITIONS (STRATA, STRUCTURES); Conglomerate, greywacke and phyllite : Hard, abrasive drilling.

WATER PRESSURE TESTING REQUIRED: No

SPECIAL REQUIREMENTS: Core to be placed in trays and kept in good condition for future reference - preferably wooden trays. Core to be photographed in trays.

SITE SET OUT BY: DATE:

J.C. Braybrooke

ENGINEERING GEOLOGIST

APPENDIX 3

GEOLOGICAL LOGS OF DIAMOND DRILL HOLES AT SITE 1

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT	Adelaide River Gorge Dam Site No.1
LOCATION	
ANGLE FROM HORIZONTAL	90°
DIRECTION	Vertical
COORDINATES	
R.L.	
HOLE NO	ARG 1
SHEET	1 OF 2
LIFT & % CORE RECOVERY	Lifts not marked

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
No Core	Collared.	NM 4'	
Moderately to heavily weathered META-GREYWACKE	Blotchy pink and white, weak to moderately strong, moderately hard, fine-grained, micaceous greywacke with some highly weathered thin (<1") phyllitic interbeds. Grades into medium-grained greywacke. pieces 1/4"–6" mode 2"	27'6"	Many fractures have 1/10"–3/10" clay infillings. Majority dip 30°–45°, some dip 10°, others dip 65°. Little cross-bedding. 16'6"–16'8": quartz-hematite vein
Moderately weathered META-GREYWACKE	Phyllite grades into pink & white, moderately strong to strong, m. hard micaceous greywacke with fine & coarse-grained gradations. F.g. patches are more blotchy in colouring. Pieces: 1"–12" mode: 5"	64'2"	28' clay filled fractures. 33'6"–34': slickensided fractures with clay zone. f.g. bed is finely cross-bedded. Fractures as above, some slickensided with a talcy texture. Incipient fractures outlined by red Fe staining. closely fractured.
	phyllite.		fine cross-bedding in f.g. greywacke.
	Coarse grained greywacke.	61'	highly fractured zone, contorted at base; micro fault with 3/10" displacement
	pink, f.g. greywackes grades into pink to grey, moderately strong to strong, moderately hard, massive c.g. (1/10") greywacke. pieces: 1"–16" mode: 6"–8"	91'	closely fractured. Some quartz veining. Fractures often outlined by limonite staining, usually tight & clean. - some are open with voids < 1/10" – 1/4". Bedding dips 60°
	highly micaceous, f.g. greywacke. pieces: 1"–10" mode: 6"	96'6"	closely fractured & slickensided.
Moderately to slightly weathered PHYLLITE			97'–97'6" closely fractured

DRILL TYPE Mindrill
FEED Hydraulic
CORE BARREL TYPE Triple split inner tube.
DRILLER G. Moniz
COMMENCED 30/7/66
COMPLETED 9/8/66
LOGGED BY J. Braybrooke
VERTICAL SCALE 1" = 10'

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

f.g., m.g., c.g. : fine, medium and coarse grained

~ : Indicates evidence of shearing.

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures

Test sections are indicated graphically by blocked in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Adelaide River Gorge Dam Site No. 1

LOCATION

ANGLE FROM HORIZONTAL 90° DIRECTION Vertical

COORDINATES R.L.

HOLE NO. ARG 1

SHEET 2 OF 2

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
Slightly weathered PHYLLITE	Green with pink blotches, moderately strong, soft to moderately hard phyllite. Contains much f.g. sericite and chlorite & is foliated. Fractures often polished & slickensided. pieces: 1" - 20" mode: 4"-6"	N.M.	Fractures often slickensided and covered with bright-green chlorite. Bedding dips 55° Some quartz veining. 115-115' 6" closely fractured. 116'9"-117' closely fractured. 121'-124': badly fractured with some clay pug. 124'-125': heavy quartz veining.
Slightly weathered Meta-Greywacke	Grey, strong, moderately hard, massive, f.g. greywacke Pieces 2"-17"	129'	Quartz veining. contact gradational over 2" dips 60°
Slightly weathered PHYLLITE	Description as above	132'6"	@ 134': 2" qtz-hematite vein dips 80°
Slightly weathered Meta-Greywacke.	Grey, strong, m. hard, massive, m.g. greywacke. Pieces: 4"- 28" mode 10"	145'6" – 150'	Some quartz veining. clean fractures.

End of Hole.

DRILL TYPE Mindrill
FEED Hydraulic
CORE BARREL TYPE Triple split inner tube
DRILLER G. Moniz
COMMENCED 30/7/66
COMPLETED 9/8/66
LOGGED BY J. Braybrooke
VERTICAL SCALE 1" = 10'

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

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1.

LOCATION:

ANGLE FROM HORIZONTAL: 45°

DIRECTION: 135° Magnetic

COORDINATES:

R.L.

HOLE NO. A.R.G. 2

SHEET 1 OF 2

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
No Core	Collared.	N.M. 4'	
Moderately to weakly weathered META-GREYWACKE	Pink and white, moderately strong to strong, soft to moderately hard, meta-greywacke.	7', 9'3", 12'5"	4'-5': Heavily fractured. 7'-8': fine cross bedding. 10'-10'6": crushed, clay filled zone. @ 11'3" 2" crushed, clay filled zone, dip ~0°
	Sequence consists of graded beds: coarse grained meta greywacke (now quartz grains in matrix of sericite and chlorite) grading up to phyllite, slightly foliated & consisting of f.g. sericite, chlorite and quartz.	16'6", 23'3", 28'5"	In greywacke bands fractures tend to be clean & rough though they are open in part; cavities are up to $\frac{3}{10}$" x $\frac{1}{10}$" and often connected. Some fractures, especially in the first 50" have thin clay infillings up to $\frac{3}{10}$" thick. Fractures usually dip 30°-50° and 75°-90°
	pieces of greywacke: 3"-30", mode 8"-10"	33'4"	32': thin ($\frac{1}{2}$") crushed zone. 35': $1\frac{1}{2}$" quartz-hematite vein dipping 75°
	pieces of phyllite: $\frac{1}{2}$"-6", mode: 3"	39'6", 46'	In phyllitic bands, fractures dip 0°-15°, some around 45°. Slickensides sometimes present.
		57'6", 60'2", 62'2", 63'6", 67'	68'3"-68'6" crushed, clay-filled zone. 70'-70'3": contorted, slickensided phyllite.
		77'9", 87'3"	@ 87' bedding dips 10°

DRILL TYPE: Mindrill

FEED: Hydraulic

CORE BARREL TYPE: Triple split inner tube

DRILLED BY: G. Moniz

COMMENCED: 11.8.66

COMPLETED: 19.8.66

LOGGED BY: J. Braybrooke

VERTICAL SCALE: 1" = 10'

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

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

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

PHOTOGRAPH REFERENCE SYSTEM

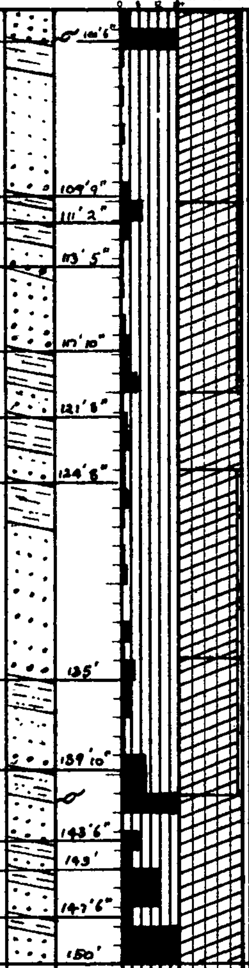
BLACK AND WHITE

COLOUR

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS	
GEOLOGICAL LOG OF DRILL HOLE	
PROJECT	Adelaide River Gorge Dam Site No. 1.
LOCATION	
ANGLE FROM HORIZONTAL	45°
DIRECTION	135° Magnetic
COORDINATES	
R.L.	
HOLE NO	ARG 2
SHEET	2 OF 2

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
Weakly weathered META-GREYWACKE	Pink-grey, moderately strong to strong, moderately hard, meta greywacke - described above. c.g. portions are very chloritic	101'6"-102': heavily fractured.
	Sharp cut-offs between graded beds.	@ 112', bedding dips 25°
	pieces: 1"-42" mode: 4"-8"	Fracturing described above. Bedding dips 10°
		@ 141'6", 2" crushed, clay-filled zone.
		145' onwards, f.g. bands badly fractured and slickensided.
	End of	Hole.

GRAPHIC LOG | DEPTH & SIZE OF CORE | FRACTURE LOG | LIFT & % CORE RECOVERY | CASING | WATER LEVEL | WATER PRESSURE TEST Loss in gallons per minute per foot | PHOTO REF. NO. CORE BOX / CORE BARREL



DRILL TYPE	Mindrill
FEED	Hydraulic
CORE BARREL TYPE	Triple split inner tube
DRILLER	G. Moniz
COMMENCED	11.8.66
COMPLETED	19.8.66
LOGGED BY	J. Braybrooke
VERTICAL SCALE	1" = 10'

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

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1.

LOCATION:

ANGLE FROM HORIZONTAL: 45° DIRECTION: 135° Magnetic

COORDINATES: R.L.:

HOLE NO: ARG 3

SHEET 1 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE	LIFT & % CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
River Alluvium.	Driller's Shift Report. "10'–14½': mud" (silty clay) "14½'–30': sand and river gravel" (~15% core recovery, mainly quartz pebbles and greywacke boulders) "Solid at 52½'"	N.M. 10' 14½' 30' 52½'	15% overall	
moderately to weakly weathered META GREYWACKE	Pink and grey, moderately strong to strong, moderately hard, meta-greywacke. Sequence consists of graded beds, c.g. sandstone to siltstone in grain size. The finer beds are often closely cross-bedded. Pieces : 1"–30" mode : 5"–8"	64'3" 65'6" 66'1" 74'4" 81'6" 82'9" 83'4" 84'9" 92' 98'6" 100'		@55' a 3" quartz-hematite vein dipping 75°; fine quartz veining to 59' Fractures often iron stained, dip 0°–10°, 30°, 40°–65°. Low angle fractures are more common in the f.g. rocks and follow bedding. 66'9–67'9": fine cross-bedding, right way up. many contacts between f.g. & c.g. beds are slickensided. bedding dips 5° bedding dips 0° 85'–86'6": fine cross-bedding & scour marks – right way up 87'–87'6": finely crushed, clay filled zone, dips 0° 93'9"–94'3": close, slickensided conjugate shear fractures at 130° to each other, dipping 50° & 60° in opposed directions.

DRILL TYPE: Mindrill
FEED: Hydraulic
CORE BARREL TYPE: Triple split inner tube
DRILLER: G. Moniz
COMMENCED: 24.8.66
COMPLETED: 13.9.66
LOGGED BY: J. Braybrooke
VERTICAL SCALE: 1" = 10'

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.

WATER PRESSURE TESTS

PACKER TYPE
SUPPLY LINE
VERTICAL SCALE
Figures given are gauge pressures. Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE
COLOUR

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1.

LOCATION:

ANGLE FROM HORIZONTAL: 45°

DIRECTION: 135° magnetic.

COORDINATES:

R.L.:

HOLE NO. ARG 3

SHEET 2 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS ETC	DEPTH & SIZE OF CORE	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
Slightly weathered META - GREYWACKE	Description as above.	102'3"	finely cross-bedded (right way up) from 100'-101'
			@ 102'4"- slickensided contact, dips 0°
		105'1"	
	Pebbles up to 2"×1" occur in some c.g. bands.	108'	108', slickensided contact
			109'6"-110': quartz-hematite veining, dips 0°
		115'	
	pieces: 2" - 54" mode: 6"-12"		119'6", open fracture with ended quartz.
		120'	120'3"-121': fractured & slickensided, fractures dip 10° & 70°
		123'6"	
		128'	
			@130' a slickensided chlorite covered joint dips 65°
		135'	open fracture
		146'	
		149'6"	
		150'6"	
			152'-153'6": closely fractured zone. Slickensided fracture dips 65°, has $\frac{3}{10}$" chlorite infilling. Other clean, slickensided fractures dip 0°-10°
		155'6"	
		159'3"	
		160'	
		163'	
			Contacts between c.g. & f.g. beds tend to be slickensided, marked ~
		175'6"	
		185'	
		188'	
		198'6"	198'6"-199': fine cross bedding.

DRILL TYPE: Mindrill

FEED: Hydraulic

CORE BARREL TYPE: Triple split inner tube

DRILLER: C. Moniz

COMMENCED: 24.8.66

COMPLETED: 13.9.66

LOGGED BY: J. Braybrooke

VERTICAL SCALE: 1" = 10'

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

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Adelaide River Gorge Dam Site No. 1.

LOCATION

ANGLE FROM HORIZONTAL 45°

DIRECTION 135° magnetic

COORDINATES

R.L.

HOLE NO. ARG 3

SHEET 3 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO REF NO
Slightly weathered META GREYWACKE	Description as above Pieces : 1" - 26" mode : 8"		207' 208'6"				Fractures as above 209' quartz vein - $\frac{1}{4}$" wide.			
	End of Hole.									

DRILL TYPE Mindrill
FEED Hydraulic
CORE BARREL TYPE Triple split inner tube
DRILLER G. Moniz
COMMENCED 24.8.66
COMPLETED 13.9.66
LOGGED BY J. Braybrooke
VERTICAL SCALE 1" = 10'

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.

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ADELAIDE RIVER GORGE DAM SITE
LOCATION:
ANGLE FROM HORIZONTAL: 45°
DIRECTION: 135° mag.
COORDINATES:
R.L.:
HOLE NO.: ARG. 4
SHEET 1 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE	LIFT & % CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
NO CORE		66'		
Moderately weathered PHYLLITE	Greenish grey c̄ red Fe bands & streaks; moderately strong chloritic phyllite.			67': 1" clayey & chloritic crush zone; fractures dip ~15°, & Fe bands parallel this.
Moderate to heavily weathered SLATE	Black, fairly hard, highly fractured slate; less chloritic than phyllite; in places soft, clayey, highly weathered.	83'4"	~80%	70': weak, clayey crush zone 70'8"-73': highly fractured 73'-75': fairly hard, well fractured; some Fe staining in irregular streaks 75'-83'4": numerous crush zones where material highly weathered, clayey; cleavage planes polished & slickensided 78': thin quartz vein 83': cleavage ~12°.
Moderately weathered PHYLLITE	Purplish grey phyllite c̄ green chlorite along fractures; coarser grained than above.	88'		well fractured, but cleavage not as well developed as in the slate. 85': Fe bands brecciated by small scale faults (4" zone) in the rest, bands dip 0°-5°.
Moderately weathered SLATE with three thin phyllite interbeds	Black, weak slate to moderately strong to weak	99'		88'-90': highly sheared; polished fragments. 91': cleavage 14°; bedding 12°. cleavage planes polished & slickensided.
	Moderately strong phyllite	100'6"		100': fracture surface c̄ 1/8" coating of hematite.
	Weak slate	102'		102': Fe bands dip ~40°.
	Moderately strong phyllite.	105'		103'-105': Fe bands faulted & brecciated.
	Black, weak slate to moderately strong to weak to moderately strong	126'	~95%	105'-113': generally highly fractured; cleavage surfaces polished & slickensided. 114': bedding ~13°. 113'-120': Fe bands up to 1" wide, mostly parallel to bedding, some irregular banding due to Fe deposition along irregular cracks. Some thin quartz veins. 121': small fault parallel to core axis; ~1/2" displacement of beds & Fe bands. 120': 2" crush zone. 122'-124': heavily fractured, polished & slickensided.
	To weak phyllite greenish grey c̄ red bands	129'		125': bedding 10°; cleavage ~25°. 127': phyllite shows minor faults displacing Fe bands; movement surfaces heavily chloritised.
	Black slate, moderate strength to weak	145'	Lifts not marked	129'-141': slate heavily fractured, much polishing & slickensiding; chloritic cleavage planes. 139', 139'4" & 139'9": main crush zones (each ~2"). 141'-145': Slate similar to above; well fractured, but no crush zones. Main fractures 15-25°. Fe bands // bedding (~13°); minor faults, containing quartz, displace bands.
Moderately weathered PHYLLITE	Greenish grey c̄ red bands occasionally entirely red: 149'-150', 154-157'. moderate strength to weak to moderate strength			145': brecciated & faulted phyllite; fractures c̄ hematite & chlorite. 145'-160': Fe bands & discont. Fe streaks parallel the main cleavage (15°-20°). Much faulting & brecciation, particularly 149'-155', & some flowage of phyllite. Some quartz & chlorite in faults, & @ 150', there is coarse hematite.

GRAPHIC LOG | FRACTURE LOG | CASING | WATER LEVEL | WATER PRESSURE TEST Loss in gallons per minute per foot | CORE BOX | PHOTO REF. NO.

DRILL TYPE: MINDRILL
FEED: HYDRAULIC
CORE BARREL TYPE: TRIPLE SPLIT INNER TUBE
DRILLER: G. MONIZ
COMMENCED: 12-1-67
COMPLETED: 7-2-67
LOGGED BY: M. R. DALY
VERTICAL SCALE: 1" = 10'

NOTES

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

BEDDING AND JOINT PLANES – Angles are measured relative to a plane normal to the core axis.

WATER PRESSURE TESTS

PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:
Figures given are gauge pressures.
Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:

COLOUR:

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ADELAIDE RIVER GORGE DAMSITE

LOCATION:

ANGLE FROM HORIZONTAL: 45° DIRECTION: 135°

COORDINATES: R.L.:

SHEET 2 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO REF.
Moderately weathered PHYLLITE	Similar to above. Moderately strong, except at the indicated shears. Less brecciated & faulted than above.						162': main fractures & Fe banding at ~30°. 165' fractures & Fe bands ~15°. 160'6"-161', 162'6"-163'6", 172'-174' & 175'-176': heavily fractured & crushed zones; chloritic. @162'6" & 176': quartz veins ~½" with coarse hematite.			
Moderately weathered SLATE	Black slate ē red Fe bands & patches; not much chlorite. Moderately strong except at crush & shear zones indicated.		178'		~95%		178': bedding contact 12°. 179': cleavage & Fe bands ~15°. 186': " " " ~5°. 191': " " " ~10°. 196'. 184'-184'6", 185'-186', 196'-196'6": main crush zone. In general, has very good cleavage; fractures polished & slickensided. A few thin quartz veins (<1/16"), one at 186' is ½" thick; generally at high angle. Fe becomes irregular in places, following fractures which cut the regular bands.			
Moderately weathered PHYLLITE	Greenish grey & red, moderately strong phyllite. 180-185': predominately red.		200'				202': 2" chlorite rich zone. 202-205': heavily fractured. 208-210': " " 209': 2" chloritic zone. Slickensides common & fractures contain chlorite. Chlorite & shearing greatest near contact ē greywacke			
Weakly weathered GREYWACKE	Greenish-grey to purplish; hard & strong greywacke ē some red Fe patches. (Quartz, mica, hematite, chlorite) Frequent change of grain size; from fine sand size to grains ⅛" in diam.		212'		95-100% Lifts not marked		214'-216': discontinuous Fe bands dipping ~50°. 5 thin (1/16") quartz veins, dip ~25°. 216': much Fe giving purple colour. 220-221': quite fractured, ē coarse hematite & chlorite, slickensided. 223': 2" crush zone. 233'6"-234'4": heavily fractured; slickensided & chloritic. 236': 2" heavily fractured zone. 236'-238': Less Fe, grey colour. 238'6"-239': fractures & quartz lined vugs (up to ½"); also chloritic. 239': much Fe, purplish colour. 243': bedding irregular. 245': ¼"-½" quartz vein ē hematite & chlorite; dip 80°. 247'-247'6": crush zone; clay, hematite, chlorite. 250': ⅛" quartz vein, dip 80°-90°.			
	Less Fe; predominately grey color.		255'				255': quartz vein, dip ~85°. 256': sharp contact between coarse & fine phases, bedding 10°. 258'6": 3" hematite rich; flow zone. 259' small cavity ē quartz lining.			

DRILL TYPE: MINDRILL
FEED: HYRAULIC
CORE BARREL TYPE: TRIPLE SPLIT INNER TUBE
DRILLER: G. MONIZ
COMMENCED: 12-1-67
COMPLETED: 7-2-67
LOGGED BY: M.R. DALY
VERTICAL SCALE: 1" = 10'

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.

WATER PRESSURE TEST
PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:
Figures given are gauge pressures. Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM
BLACK AND WHITE:
COLOUR:

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ADELAIDE RIVER GORGE DAMSITE
LOCATION:
ANGLE FROM HORIZONTAL: 45° DIRECTION: 135°
COORDINATES: R.L.:

HOLE NO. ARG 4

SHEET 3 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO REF. NO. CORE BOX / CORE BARREL
Weakly weathered GREYWACKE	as above.		266'		95%-100%		264'6": shear, chloritic.			

END OF HOLE

DRILL TYPE: MINDRILL
FEED: HYDRAULIC
CORE BARREL TYPE: TRIPLE SPLIT INNER TUBE.
DRILLER: G. MONIZ
COMMENCED: 12-1-67
COMPLETED: 7-2-67
LOGGED BY: M.R. DALY
VERTICAL SCALE: 1"=10'

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.

WATER PRESSURE TESTS

PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:
Figures given are gauge pressures.
Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:

COLOUR:

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Adelaide River Gorge Dam Site No. 1.

LOCATION

ANGLE FROM HORIZONTAL 55°

DIRECTION 135° Magnetic

COORDINATES

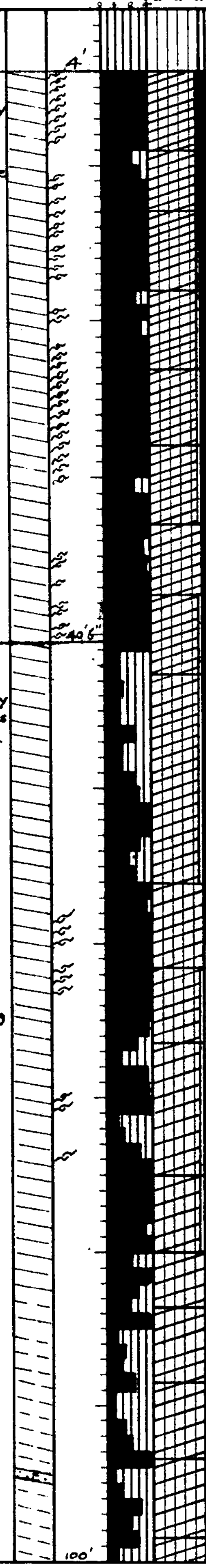
R.L.

HOLE NO. ARG 5

SHEET 1 OF 2

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
	Collared.	4'	
Heavily weathered PHYLLITE	Grey with pink bands, weak, soft to moderately hard, heavily fractured phyllite Phyllite rich in sericite	40'6"	Closely fractured zones with associated clay @ 4' - 8'6" 11' - 11'4" 11'9" - 12'2" 13'2" - 14'6" 15'3" & 15'10" 16'2" - 17'7" 19'3" - 19'10" dips 60° 21'7" - 30'3" 30'10" - 32'2" 35' - 35'6" 36'6" 38' - 38'6" 38'9" - 40'4"
Moderately ~~weathered~~ PHYLLITE	Moderately strong, m. hard phyllite with occasional thin f.g. sandy bands and mica-rich bands Mainly grey with red-brown banding 50'-58' red-brown zone with grey banding 68½'-75½' red-brown zone with grey banding Some thin beds of f.g. sandstone showing soft-rock folding.	100'	Fractures dip :- 10°-15° - // banding - clean 25°-30° - clean 60°-70° - Fe stained, often with thin clay films 58'6"-60' closely fractured little clay 61'9"-62' closely fractured no clay 70'-71' clay zone 74'-74'4" clay zone, dip 40° 84½' - 85' clay filled fractures, dip 30° in opposite direction to bedding - latter dips 15° 94'2"-94'5" band of f.g. sandstone with dendritic Fe staining

GRAPHIC LOG | FRACTURE LOG | LIFT & % CORE RECOVERY | CASING | WATER LEVEL | WATER PRESSURE TEST Loss in gallons per minute per foot | PHOTO REF NO. CORE BOX / CORE SAMPLE



DRILL TYPE Mindrill

FEED Hydraulic

CORE BARREL TYPE Triple split inner tube

DRILLER G. Moniz

COMMENCED

COMPLETED

LOGGED BY J. Braybrooke

VERTICAL SCALE 1" = 10'

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

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1.

LOCATION:

ANGLE FROM HORIZONTAL: 55°

DIRECTION: 135° Magnetic

COORDINATES:

R.L.:

HOLE NO.: ARG 5

SHEET 2 OF 2

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO REF. NO. CORE BOX	CORE SAMPLE
Moderately weathered PHYLLITE	Description as above 97½'-122' red-brown phyllite with thin bands of f.g. sandstone showing "soft-rock structures" Core lengths 1"-8" mode 4"-5"		147'				102'4"-102'7": closely fractured, little clay 114': clay filled fracture, dips 30° 145'4"-145'10": closely fractured, little clay.				
	Hole re-drilled						from 60'				

DRILL TYPE: Mindrill

FEED: Hydraulic

CORE BARREL TYPE: Triple split inner tube

DRILLER: G. Moniz

COMMENCED:

COMPLETED:

LOGGED BY: J. Braybrooke

VERTICAL SCALE: 1" = 10'

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.

WATER PRESSURE TESTS

PACKER TYPE:

SUPPLY LINE:

VERTICAL SCALE:

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:

COLOUR:

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1

LOCATION:

ANGLE FROM HORIZONTAL: 55°

DIRECTION: 135° magnetic

COORDINATES:

R.L.:

HOLE NO. ARG 5A

SHEET 1 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	% CORE RECOVERY	CASING	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)	WATER LEVEL	WATER PRESSURE TEST (Loss in gallons per minute per foot)	PHOTO REF. NO. CORE BOX	CORE BARREL
	Hole 5.		60'								
Moderately weathered PHYLLITE	Grey with red-brown bands, moderately strong, m. hard, fractured phyllite 70' - 77': red-brown zone with thin grey banding. 79'9" - 85': red-brown zone with thin grey banding. Core lengths 1" - 14" mode 4" - 5"		79'6" 88'6" 98'6" 93'4" 98'3"				61' - 63'6": broken zone with clay coated fractures dipping 60° 70' - 70'3": finely crushed phyllite plus white clay 70'9" - 71': closely fractured clay infillings. 74' - 75'9": closely fractured clay present. 81'6" - 81'9" 82' - 82'6" 84' - 84'6" } closely fractured clay present. Clean fractures dip 15°-20° // banding & 35° Clay-filled fractures dip 30° - 60° 95'8" - 96' f.g. sandstone with dendritic Fe stains. 99'6" - 100' phyllite "gravel".				

DRILL TYPE: Mindrill

FEED: Hydraulic

CORE BARREL TYPE: Triple split inner tube.

DRILLER: G. Moniz

COMMENCED:

COMPLETED:

LOGGED BY: J. Braybrooke

VERTICAL SCALE: 1" = 10'

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.

WATER PRESSURE TESTS

PACKER TYPE:

SUPPLY LINE:

VERTICAL SCALE:

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:

COLOUR:

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1

LOCATION:

ANGLE FROM HORIZONTAL: 55°

DIRECTION: 135° Magnetic

COORDINATES:

R.L.:

HOLE NO: ARG 5A

SHEET 2 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	DEPTH & SIZE OF CORE	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)
Moderately weathered PHYLLITE	100'–102': red-brown zone, with fine, white banding.	100', 102'8"	103'3"–103'8": closely fractured, little clay.
		107'6"	
	109'10"–114'3": red-brown zone with fine, white banding. Thin bands of f.g. sandstone present	112'6"	
	117'–123': red-brown zone with fine, white bands. Thin bands of f.g. sandstone present.	117'6"	118': fractures with displacements ≤ 1/4". 118'6"–118'9": closely fractured, little clay
	Phyllite is grey in colour with red-brown bands, moderately strong, m. hard & fractured. Core lengths 1/2"–15" mode 2"–3" & 6"–8"	136'6"	Clean fractures dip 10°–15°, // banding; 30° 60° fractures usually Fe stained & have thin clay coatings.
			143'–145: closely fractured
			148'–149'4": closely fractured, little clay. 149'2"–150' Fe stained, clay coated fractures, dip 60°
	153'8"–167': red-brown zone with thin, white bands. Thin bands of f.g. sandstone present.	155', 159'10"	154'6"–156' Fe stained, clay coated fractures, dip 60°. 158'2"–158'4": closely fractured, clean
		164'8", 169'5"	
		174'	174'–174'8": closely fractured, clean.
	178'–193': red-brown zone with thin, white bands. Thin bands of f.g. sandstone present.	178'10", 183'6", 188'4", 193'4", 198'	180': chlorite filled fracture dips 15°. 181'4"–181'8": closely fractured, clean.

DRILL TYPE: Mindrill

FEED: Hydraulic

CORE BARREL TYPE: Triple split inner tube

DRILLER: G. Moniz

COMMENCED:

COMPLETED:

LOGGED BY: J. Braybrooke

VERTICAL SCALE: 1" = 10'

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.

WATER PRESSURE TESTS

PACKER TYPE:

SUPPLY LINE:

VERTICAL SCALE:

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:

COLOUR:

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Adelaida River Gorge Dam Site No. 1.

LOCATION

ANGLE FROM HORIZONTAL 55°

DIRECTION 135° magnetic

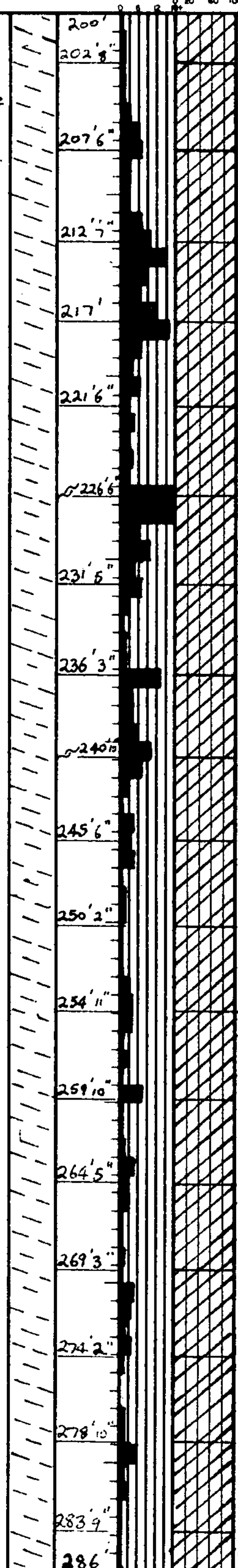
COORDINATES

R.L.

HOLE NO ARG 5A

SHEET 3 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO REF NO CORE BOX / CORE BARREL
Moderately to Weakly weathered PHYLLITE	Grey-green with red & purple-brown bands; Properties as above. Thin sandstone bands in places. Core lengths, 2"-30" mode 6"-8"						Fractures dip: 15°-20° // banding, also 30°. Many have polished, chloritic faces; some pyrite also present. Some irregular, steeply dipping (70°-80°) fractures, heavily Fe stained & often with ended-quartz infillings			
							226'6"-227'3": closely fractured - polished green chlorite on some faces, also pyrite coatings			
							230' Pyrite coatings on some fractures			
							231' thin quartz vein			
	236'6"-241'6": dark-grey zone with red-brown bands.						241': closely fractured with pyrite coatings on faces.			
	250'-254': red-brown zone with grey bands. Some soft rock folding						253'9": clay coated fracture, dips 20°			
							Some thin quartz veins ($\frac{1}{4}$") occur below 244'			
							Banding & fractures dip 30°. Thin pyrite coatings on some			
							274' Pyrite smears on fracture faces.			
	279'3"-281': red-brown zone with grey bands.									
	End of						Hole.			



DRILL TYPE Mindrill

FEED Hydraulic

CORE BARREL TYPE Triple split inner tube

DRILLER G. Moniz

COMMENCED

COMPLETED

LOGGED BY J. Braybrooke

VERTICAL SCALE 1" = 10'

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

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1.
LOCATION:
ANGLE FROM HORIZONTAL: 50°
DIRECTION: 135° magnetic
COORDINATES:
R.L.:

HOLE NO. ARG 6
SHEET 1 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE	LIFT & % CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
	Collared.	4'		
Heavily weathered PHYLLITE	Grey and pink, weak, soft, highly fractured and weathered metamorphosed shale. Sections altered to pink and cream clay. Much of core crumbles to a sericitic clay when handled. Intact pieces are well foliated and highly sericitic	21'		4'-6'6" clay & crushed phyllite. Core severely fractured and altered to clay. Fractures usually dip 0° to 30°. The latter parallel the foliation planes.
		51'	95 to 100%	30'-35' badly broken clay filled zone. @38' 4" quartz vein followed by 6" of white clay.
	Orange and white, weak, soft, highly fractured phyllite with clay filled zones	100'	Lifts not marked	42'-55' highly fractured, clay infillings. @57', 2" quartz vein. 57'6"-59' red, closely crushed zone. 60'-60'6" & 62'6"-66' white-clay filled zones. @78' foliation dips 30°. 86'-87' white-clay zone. Fractures dip 35°-45°, often clay coated. 91'6"-92' white sericitic clay - v. unctuous. 94' 1" clay zone. 96'-100' finely crushed zone with white clay gouge

WATER LEVEL — WATER PRESSURE TEST: Loss in gallons per minute per foot — CORE BOX — PHOTO REF. NO.

DRILL TYPE: Mindrill
FEED: Hydraulic
CORE BARREL TYPE: Triple split inner tube
DRILLER: G. Moniz.
COMMENCED:
COMPLETED:
LOGGED BY: J. Braybrooke
VERTICAL SCALE: 1" = 10'

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.
~ : Indicates evidence of shearing

WATER PRESSURE TESTS
PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:
Figures given are gauge pressures. Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM
BLACK AND WHITE:
COLOUR:

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1.

LOCATION:

ANGLE FROM HORIZONTAL: 50°

DIRECTION: 135° Magnetic

COORDINATES:

R.L.

HOLE NO: ARG 6

SHEET 2 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE
Heavily weathered PHYLLITE	Red and white, weak, soft, highly fractured phyllite with finely crushed and clay filled zones	101' – 103' – 128'
Fresh, black, crushed PHYLLITE	Black, moderately strong, brittle, moderately hard, contorted & highly polished chloritic phyllite.	128' – 134'6"
Weathered PHYLLITE	Red and light green, weak, fractured phyllite - as above - v. chloritic in parts. Pyrite associated with some fractures	134'6" – 139' – 142'
Fresh, black PHYLLITE	Black and black & grey banded, weak to moderately strong, m. hard, fractured, chloritic phyllite - Some fractures highly polished.	142' – 150'4"
Moderately weathered PHYLLITE	Red & white moderately strong, m. hard, banded phyllite.	150'4" –

LIFT & % CORE RECOVERY: 95%

STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES):

100'-101': broken quartz vein

101'-103' cavity

103'6"-103'9" clay zone

104'-105'6": finely crushed.

105'6"-109': ¼"-½" discs dipping 30°

112'3": thin clay zone.

118'6": ¼" quartz vein

119'-119'5": clay zone

120'3", 121'6", 125', 126', ¼"-½" quartz veins

126'-128': clay zone

128'-131': finely crushed

131'-131'3": quartz vein

133'-134': finely crushed

134'6"-135'6": quartz vein

135'6"-138': crushed zone with 1" qtz-pyrite vein at base.

139'-140': 2" qtz vein, + some pyrite, followed by crushed chloritic zone.

143'6": some pyrite.

Banding & fractures dip 15°-20°. Most fractures have a silky sheen & a lineation pitching 30°

154'9"-155': crushed zone

166': minor fault - contorted & has ¼" displacement

166'6"-167': closely fractured highly polished, chlorite rich fragments - thin quartz veining. (complete water-loss)

A few minor faults dip 45°, have ¼" displacements.

Fractures usually // banding, dip 15°-20°. Most faces rough and lineated, some have polished chlorite surface.

Thin pyrite smears on a number of faces. Some thin quartz veins (⅛" thick)

WATER LEVEL:

WATER PRESSURE TEST: Loss in gallons per minute per foot

PHOTO REF NO: CORE BOX / CORE BARREL

DRILL TYPE: Mindrill

FEED: Hydraulic

CORE BARREL TYPE: Triple split inner tube

DRILLER: G. Moniz

COMMENCED:

COMPLETED:

LOGGED BY: J. Braybrooke

VERTICAL SCALE: 1" = 10'

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

∿ : Indicates evidence of shearing.

WATER PRESSURE TESTS

PACKER TYPE:

SUPPLY LINE:

VERTICAL SCALE:

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:

COLOUR:

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1.
LOCATION:
ANGLE FROM HORIZONTAL: 50°
DIRECTION: 135° Magnetic
COORDINATES:
R.L.:

HOLE NO. ARG 6

SHEET 3 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION: LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	DEPTH & SIZE OF CORE	LIFT & % CORE RECOVERY	STRUCTURES: JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
Moderately weathered PHYLLITE	Red & white in colour. Description as above.	202', 204'6"	~95%	202'-203': contorted, green phyllite. 203-204'6": silicified fault breccia - angular fragments of green phyllite in quartz matrix. 2" contorted phyllite at base. Minor displacement and contortion of bands. Fractures follow banding. Some thin qtz veins.
		221'		
Weakly weathered PHYLLITE	Grey & black with a few red bands, moderately strong to brittle, m. hard, chloritic phyllite. In highly contorted zones, phyllite is polished & brittle forming a black slate.		marked	224-225'6": closely fractured. Fractures dip 20° - rarely polished or pyrite coated.
		233'		Finely broken, contorted, polished slate with green chlorite &/or pyrite on some faces.
		248'		
Moderately weathered PHYLLITE	Red & white in colour. Description as above.	253'	lot	250'3"-250'9": minor displacement of contorted zone: thin quartz veins.
Weakly weathered "SLATE"	Black, brittle, m. hard, highly polished contorted phyllite	256'3"		253'-253'4": crush zone
Moderately weathered contorted PHYLLITE	Red & green in colour	260'		Contorted phyllite with polished fractures & qtz. veining.
Weakly weathered PHYLLITE	Grey & black with some red bands. Description as above	286'	Lifts	264'-264'3": crushed zone. Fractures in less broken zones dip 20°-25°, usually polished. Steeply dipping fractures often have thin pyrite coatings. Some pyrite crystals in open fractures. Contorted zones broken & highly polished.
	End of			Hole.

DRILL TYPE: Mindrill
FEED: Hydraulic
CORE BARREL TYPE: Triple - split inner tube
DRILLER: G. Moniz
COMMENCED:
COMPLETED:
LOGGED BY: I. Graybrooke
VERTICAL SCALE: 1" = 10'

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
~~ : Indicates evidence of shearing

WATER PRESSURE TESTS
PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:
Figures given are gauge pressures
Test sections are indicated graphically by blocked-in strips

PHOTOGRAPH REFERENCE SYSTEM
BLACK AND WHITE:
COLOUR:

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: Adelaide River Gorge Dam Site No. 1.

LOCATION:

ANGLE FROM HORIZONTAL: 45° DIRECTION: 135° magnetic

COORDINATES: R.L.

HOLE NO: ARG 7

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	DEPTH & SIZE OF CORE	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)
	Collared	6'6"	
ALLUVIUM	Slightly mottled, red-brown, stiff impermeable sandy clay with occasional phyllite and greywacke fragments.	NM. 18'1"	
	Pink sandy clay	20'	
	Yellow to cream, stiff, impermeable sandy clay	24'	
	Greywacke boulder	26'	
	clay: No Recovery	30'	
	Cream to pink, firm, gravel-sand-clay		
	Greywacke boulder	32'	
	"Soft" clay No recovery	39'	
	mottled pink and white, stiff gravelly clay and sandy clay		
	Greywacke boulder	44'	
Heavily altered PHYLLITE (?)	Yellow to white, stiff sandy-clay & clay with phyllite fragments in places (heavily altered phyllite?)	51'	
	"soft" clay No recovery	65'	
	broken quartz vein		
	Pink & yellow clay		
	broken quartz - vein		
	clay		
	broken quartz vein	69'3"	
Heavily weathered PHYLLITE	heavily weathered phyllite		
	broken quartz vein		
	quartz phyllite		
	weathered phyllite		
	quartz	73'9"	white clay
Moderately weathered PHYLLITE	Red-brown, weak phyllite, badly broken & crushed.	85'	
	Red-brown and grey, moderately strong, moderately hard phyllite.		Banding dips 65°. Fractures: // banding (smooth), dip 30° obliquely to banding (smooth, common), dip 50-55° (rough, conjugate), dip 45° & 80° - covered with thin qtz. & pyrite coatings @98'6"; 2° quartz veining.

End of Hole

DRILL TYPE: Mindrill

FEED: Hydraulic

CORE BARREL TYPE: Triple split inner tube.

DRILLER: G. Moniz.

COMMENCED:

COMPLETED:

LOGGED BY: J. Braybrooke

VERTICAL SCALE: 1" = 10'

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.

~ : Indicates evidence of shearing

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

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

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

APPENDIX 4

GEOLOGICAL LOGS OF COSTEANS ON RIGHT BANK OF SITE 1

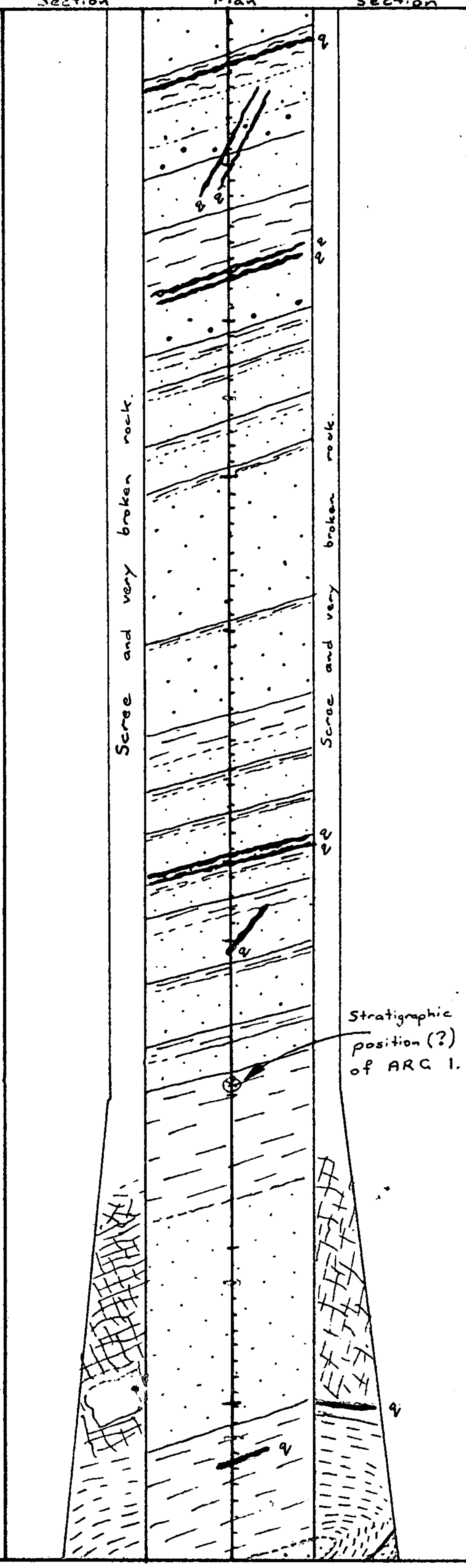
Project Adelaide River Gorge Dam Site No 1.

Costean a - a' on right bank

Sheet 1 of 2

South East.

L.H. Wall. Section | Costean floor Plan | R.H. Wall Section



Slope angle	Structure	Lithology	Strength	Fractures
0'	025/47 E undulose contact.	m.g. greywacke.	m. strong.	Spacing 4"
	quartz vein undulose contact.	contorted phyllite.	weak - m. strong	closely cleaved.
	1/4" quartz veins 171/81 N	f.g. greywacke grit	m. strong. friable.	073/55 S. clean Spacing 6"-12"
		f.g. greywacke	weak - m. strong.	
	quartz-hematite veins along bedding. 020/66E	phyllite. f.g. greywacke grit	weak m. strong.	closely cleaved and broken bedding fractures 12"-18" apart
	bedding 028/36E.	phyllite f.g. greywacke.	friable - m. strong.	cleaved
	bedding 024/52 E	phyllite f.g. greywacke		
		phyllite f.g. greywacke		
20°		phyllite purple, m.g. greywacke.	friable to m. strong.	Spacing 2"-24" mode 12" often Fe stained.
		phyllite m.g. greywacke	m. strong.	Spacing 12"
	bedding 022/56E	phyllite f.g. greywacke	weak	cleaved.
		phyllite. f.g. greywacke		
		phyllite f.g. greywacke		Spacing 2"-6" blocky.
	quartz veining follows bedding.	phyllite f.g. greywacke		
	1/4"-1/2" quartz vein 144/44 NE.	phyllite f.g. greywacke		Spacing 4" 110/40 S clean
		phyllite f.g. greywacke	m. strong.	Spacing 12" 008/33 E clean
	bedding 016/61 E	phyllite. f.g. greywacke		
74'		purple phyllite with some f.g. greywacke.	weak - m. strong	cleaved.
29°		purple f.g. greywacke with thin quartz veins.	weak - m. strong.	moderately fractured mode 6"
	quartz vein. 3" quartz vein	yellow-brown phyllite.	weak	closely cleaved
100'	anticlinal axis	m.g. greywacke.	m. strong.	massive.

Scale: 1" = 10' slope distance.

Logged by: J. Braybrooke.

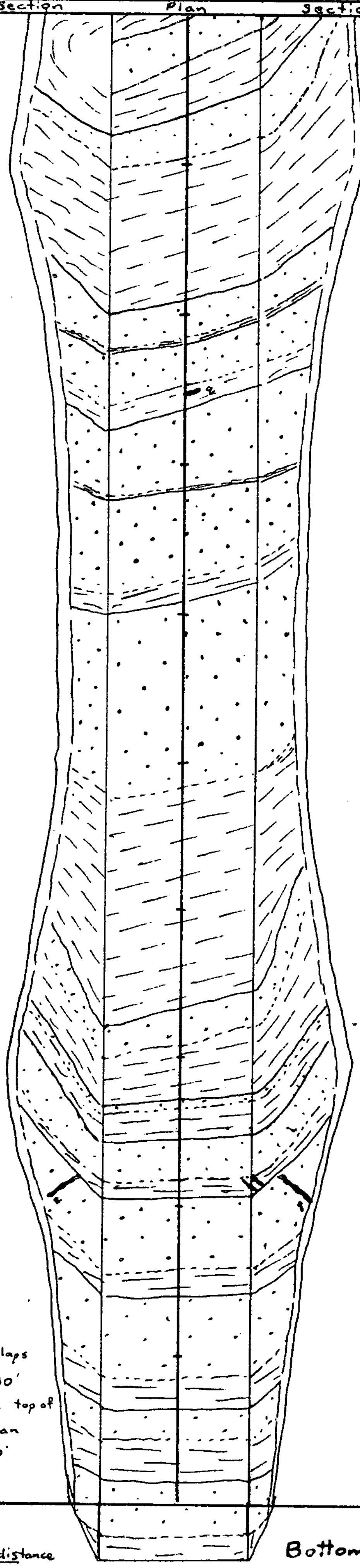
JCG

Project : Adelaide River Gorge Dam Site No 1

Costean : a - a' on right bank

sheet 2 of 2

Slope angle	Structure	L.H. Wall Section	Costean floor Plan	R.H. Wall Section	Lithology	Strength	Fractures.
29° 108'	fold axis bedding 032/66NW				m.g. greywacke. yellow-brown phyllite.	weak	
					f.g. greywacke yellow-green phyllite	weak	spacing 2"-6" closely cleaved
	bedding 029/77NW				f.g. greywacke.	m. strong.	spacing 4"-2'
13°	bedding 021/64NW quartz vein				m.g f.g. phyllite.	m. strong.	2"-12"
					m.g.	m. strong.	2"-6"
	bedding 045/52NW				m.g. f.g. phyllite.	m. strong.	2"-12" cleaved.
150' 28°	bedding 049/46NW				m.g. f.g. yellow-green phyllite	m. strong. weak	3"-12" 040/37E, occasionally quartz filled closely cleaved.
170'	bedding 043/50NW				purple, f.g. greywacke. phyllite.	m. strong.	-
					f.g.		
	2" quartz vein 044/50SE				f.g.	m. strong	
11°	bedding 039/50NW				f.g.		
		overlaps 20'-30' with top of costean b-b'			f.g.	m. strong	
					f.g.	m. strong.	
200'					f.g.		



Bottom of Costean.

North West.

Scale : 1" : 10' slope distance

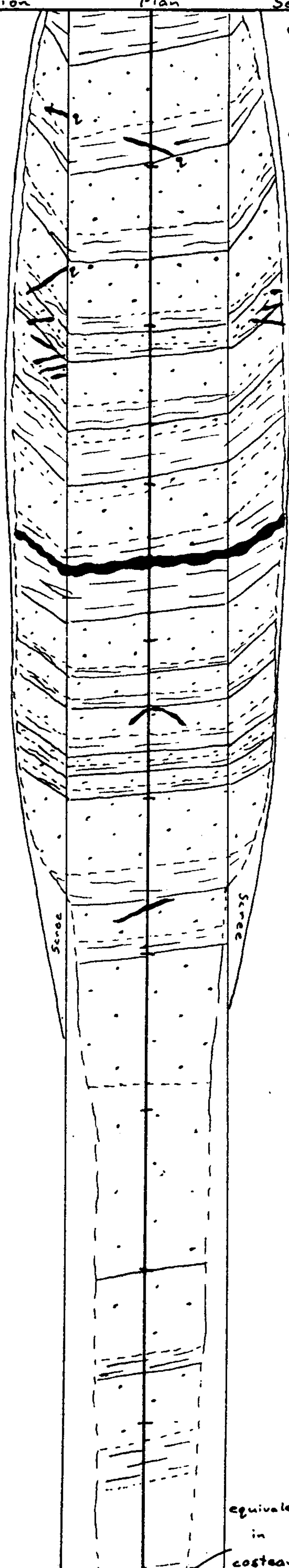
Logged by: J. Braybrooke

JCB

Project: Adelaide River Gorge Dam Site No1

Costean: b - b' on right bank

South East



Slope angle	Structure	Lithology	Strength	Fractures
0'		phyllite.	weak	very broken
	bedding 034/53NW 2" quartz vein 082/50 S	f.g. greywacke yellow-brown phyllite	m. strong. weak	
	bedding 047/51 NW	f.g. yellow-brown phyllite	m. strong weak	blocky 002/50E : 10"-15" 080/50 S : 8"-12" very broken
		f.g. - m.g.	m. strong.	blocky
	1" quartz vein 081/53 S	f.g.		
	1/8" quartz vein 096/78 S qtz veins spaced 6"- 2'	f.g. v. micaceous	m. strong.	blocky
	bedding: 040/48 NW 4"-12"	f.g. yellow-brown phyllite	weak	
13°	bedding 036/55 NW 4"-8" qtz-hematite vein 040/44 NW crenulations	f.g. mg. yellow-brown phyllite	m. strong. weak	tabular 1" blocky. 118/49E : 4"-12" 080/84 S : 6"-16" 147/69 SW : 4"-8" closely cleaved
		f.g.	m. strong.	blocky
		f.g.	m. strong	blocky
	curvilinear qtz vein 165/40E : 078/42 S	f.g.		
	bedding 032/58 NW	f.g.		
	bedding 027/57 NW	purple, f.g. greywacke.	m. strong	blocky
	1/4" qtz vein 027/27 SE	purple, f.g.	m. strong.	blocky
		f.g. - m.g. v. weathered, dark purple greywacke.	weak	very broken
70'	concretions	f.g., light purple, greywacke	m. strong.	blocky 040/40 SE : 1'+ 122/85 S : 6"-18"
27½°	1" phyllite band	f.g.	weak	broken.
100'	bedding 034/58NW 6"-18"	m.g. phyllite greywacke	m. strong to strong.	blocky 139/68 SW : 2"-8" 047/20 SE : 1'-2' cleaved blocky

Bottom of Costean

Scale: 1" : 10' slope distance

Logged by: J. Braybrooke

Project Adelaide River Gorge Dam Site No 1.

Costean C'-C' on right bank

Sheet 1 of 1

South East.

Slope angle	Structure	L.H. Wall	Costean floor plan	R.H. Wall	Lithology	Strength	Fractures.
0'		equivalent bed in bottom of costean b-b'			moderately to heavily weathered f.g. dark-purple Greywacke.	m. strong	irregularly broken
25½'	bedding: 040/49NW : 1'-2'				lightly weathered, f.g., light-purple greywacke phyllite.	m. strong.	blocky 058/25SE: 2"-2' 138/83NE : 8"-2'
	minor crenulations bedding: 047/52NW.				m.g. purple phyllite	weak	tabular cleaved.
	minor crenulations				grit. m.g. phyllite.	m. strong.	blocky.
	bedding: 030/60 NW.				f.g.		blocky 092/49S : 1' 115/75N
48'					heavily weathered f.g. greywacke.	weak.	broken.
		Bottom		of	equivalent to f.g. greywacke, top of costean d-d'	Costean	

Scale : 1" = 10' slope distance

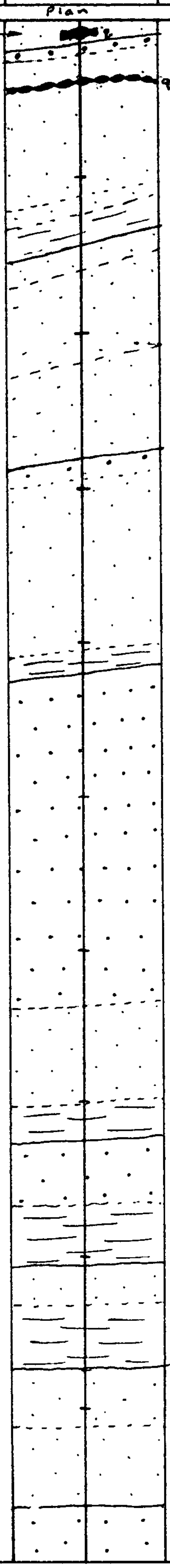
Logged by: J. Graybrooke

Project Adelaide River Gorge Dam Site No 1

Costean d - d' on right bank.

sheet 1 of 2.

South-east



Slope angle	Structure	L.H. Wall	Costean floor	R.H. Wall	Lithology	Strength	Fractures.
0'	quartz-hematite vein 2"-6" quartz-hematite vein. 018/52E.	equivalent bed in bottom of costean C-C'			f.g. greywacke grit f.g. greywacke	m. strong with weak bands.	065/31 NW blocky with occasional broken zones broken
					v. weathered weathered, broken zone.	weak	broken.
					c.g. greywacke. phyllite.		
23°					grey, m.g. greywacke.	m. strong	blocky 024/33E.: 4"-1' spacing
					v. f.g., purple greywacke	weak	closely fractured.
	¼"-½" slickensided quartz vein // bedding: 035/50NW				phyllite	weak.	cleaved & broken
	bedding: 034/33 NW				m.g.	m. strong.	blocky.
					brown phyllite.	weak.	cleaved. - ½"-4", tabular
85'	bedding: 045/46 NW				f.g. red-brown phyllite.	weak.	cleaved, : ¼"-2", tabular
12½°					f.g.	m. strong	broken.
					v. f.g. greywacke	weak.	platey & broken
100'					m.g. greywacke	m. strong.	blocky.

Scale : 1" : 10' slope distance

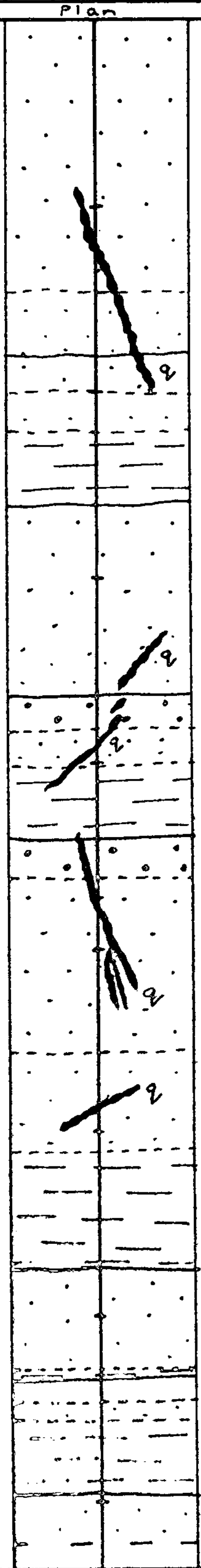
Logged by : J. Braybrooke.

Project Adelaide River Gorge Dam Site No 1.

Costean d - d' on right bank.

Sheet 2 of 2.

Slope angle	Structure	L. H. Wall	Costean floor Plan	R. H. Wall	Lithology	Strength	Fractures
100'					m.g. greywacke m.g.	friable to medium strong.	blocky
	1/4" quartz vein: 112/73 S bedding: 045/52 NW				f.g. greywacke	friable, weak	broken
24½°	bedding: 040/34 NW				m.g. mg to f.g. phyllite	medium strong. weak weak	blocky. broken broken
					m.g. greywacke f.g.	medium strong.	blocky 037/21 SE : 18-24" 107/35 S : 4"-8" spacing.
140'	1"-2" qtz-hematite vein: 152/60 NE bedding: 048/45 NW				grit m.g. f.g. phyllite	medium strong weak	blocky cleaved.
	1" qtz-hematite vein 116/90				grit m.g.	medium strong.	blocky 088/69 S : 1' 024/80 E : 1'-2'
23°	1" qtz-hematite vein: 160/48 E bedding: 045/40 NW				f.g. greywacke; laterite along some zones phyllite with partial lateritic cover	m. strong to weak weak	blocky
					m.g. greywacke f.g. phyllite.	m. strong to weak	blocky.
	bedding 052/40 NW.				grit f.g. greywacke phyllite.	weak	
					f.g. greywacke with laterite		
184'		Bottom		of		Costean	



Scale : 1":10' slope distance

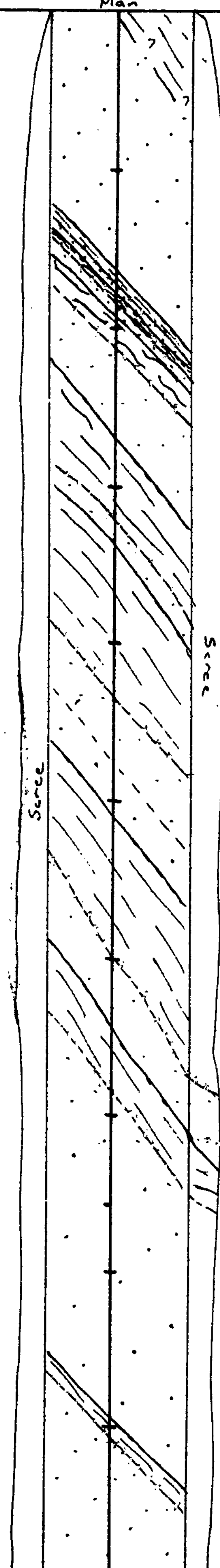
Logged by : J. Braybrooke

Project. Adelaide River Gorge Dam Site No 1.

Costean e - e' behind right bank.

Sheet 1 of 7

South-west.



Slope angle	Structure.	L.H. wall. Section	Costean floor Plan	R.H. Wall. Section	Lithology	Strength	Fractures
0'					phyllite	weak.	
					poor % of m.g. gwke.	m. strong.	
5°							
					f.g. gwke / phyllite / phyllite. / f.g. gwke / phyllite.		
	crenulated. bedding 022/42 NW				f.g. purple greywacke.	weak	broken.
30'					phyllite. f.g. gwke.	weak.	closely cleaved & broken
					phyllite.		
20°					f.g. gwke	weak	
	bedding 044/40NW				m.g. gwke.	m. strong.	blocky
					phyllite	weak	closely cleaved.
					f.g. gwke.	m. strong.	blocky
65' 25°					phyllite.	weak.	
					f.g gwke, m.g. gwke, c.g. gwke } poor %		
							blocky.
					c.g. gwke with much weathered feldspar		
					phyllite		
					f.g. gwke		
					m.g. gwke.	m. strong.	blocky
100'							

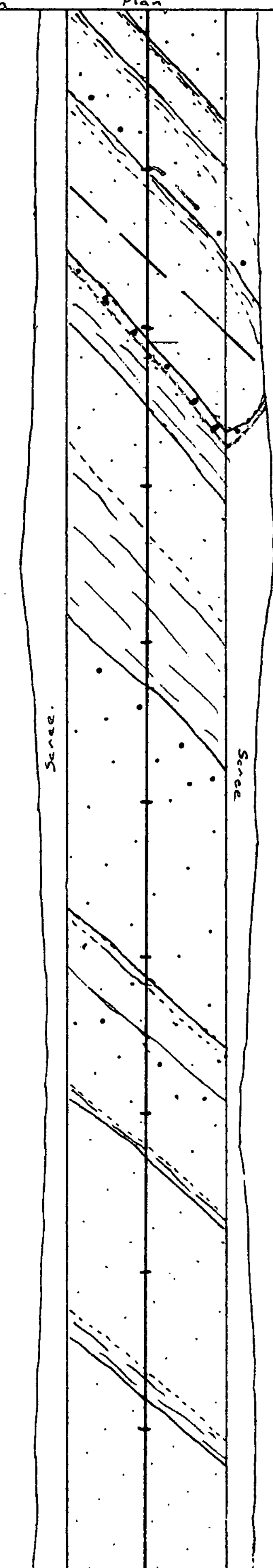
Scale : 1":10' slope distance

Logged by : J. Braybrooke.

Project: Adelaide River Gorge Dam Site No1.

Costean: e - e' behind right bank

Sheet 2 of 7



Slope angle	Structure	L.H. Wall Section	Costean Floor Plan	R.H. Wall Section	Lithology	Strength	Fractures
100'					m.g. gwke.		
					phyllite		
	bedding 042/43NW				f.g. gwke.		
					phyllite f.g. gwke. c.g. gwke grit.	m strong.	blocky 063/50SE : 8'-1'
	anticlinal fold axis				phyllite. f.g. gwke.	m strong.	blocky to tabular
	bedding 007/56 NE				grit		
					phyllite.		
					f.g. gwke.	m. strong to weak.	007/49 E broken.
25°	crenulations bedding 012/84NE				purple phyllite.	weak.	cleaved & broken
					grit. m.g. gwke.	m. strong.	blocky to broken.
	bedding 162/55 NE				c.g. gwke.		
					f.g. gwke.		
					c.g. gwke (poor %) phyllite.		
					f.g. gwke. phyllite		broken. blocky 032/43NW : 1' 165/43NE : 2'
					m.g. gwke. (v. weathered)	friable	
					f.g. gwke	m st[illegible]	[illegible]
200'							

Scale: 1" : 10' slope distance.

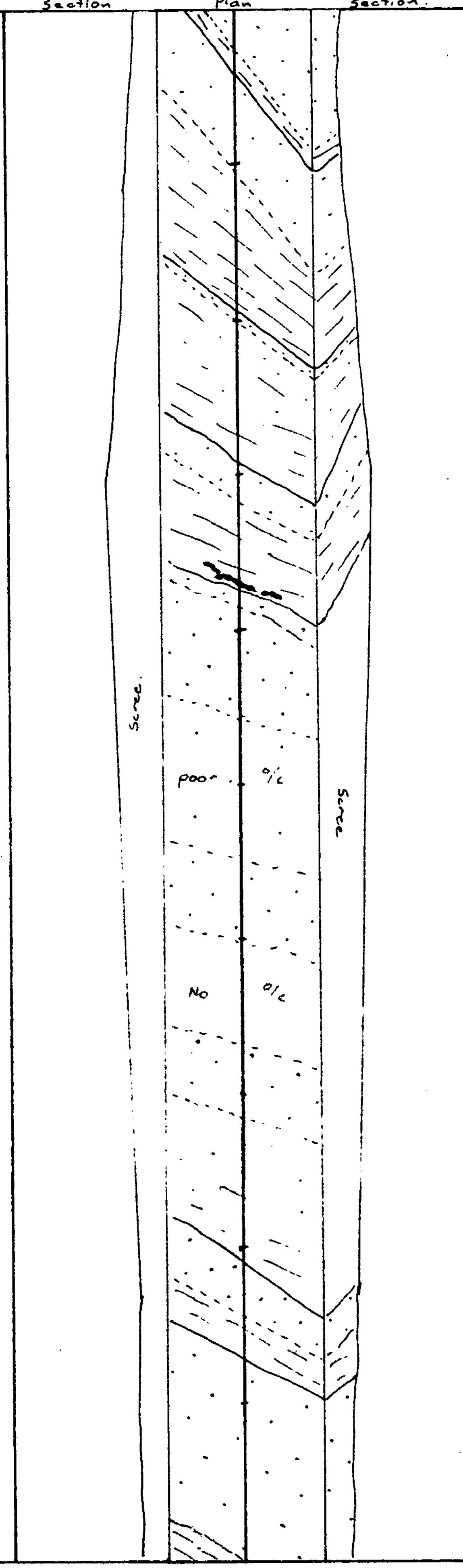
Logged by: J. Braybrooke.

Project: Adelaide River Gorge Dam Site No 1

Costean: e - e' behind right bank.

Slope angle	Structure	Lithology	Strength	Fractures
200		f.g. greywacke. phyllite.	m. strong.	
	bedding 179/61E	f.g. greywacke	m. strong	blocky
		phyllite.	weak.	cleaved.
	bedding 001/51 E.	f.g. greywacke		105/58 N: 1'
		f.g. greywacke to phyllite.	weak.	cleaved.
		f.g. greywacke	m. strong.	broken 006/[illegible]W : 2"-4"
	bedding 171/59 E.	heavily weathered phyllite.	weak	cleaved.
	quartz veining	f.g. greywacke		
25°		m.g. greywacke	m. strong to weak	blocky to broken 026/39 NW
		poor % of greywacke	weak	highly broken
		m.g. greywacke	m. strong.	
		No %		
		weathered m.g. - c.g. greywacke	weak	
		f.g. greywacke to phyllite.	weak	cleaved
	bedding 174/60E	m.g. greywacke	m. hard	
		phyllite	soft - weak	
		m.g. greywacke	m. hard.	blocky
300'				

L.H. Wall Section | Costean Floor Plan | R.H. Wall Section



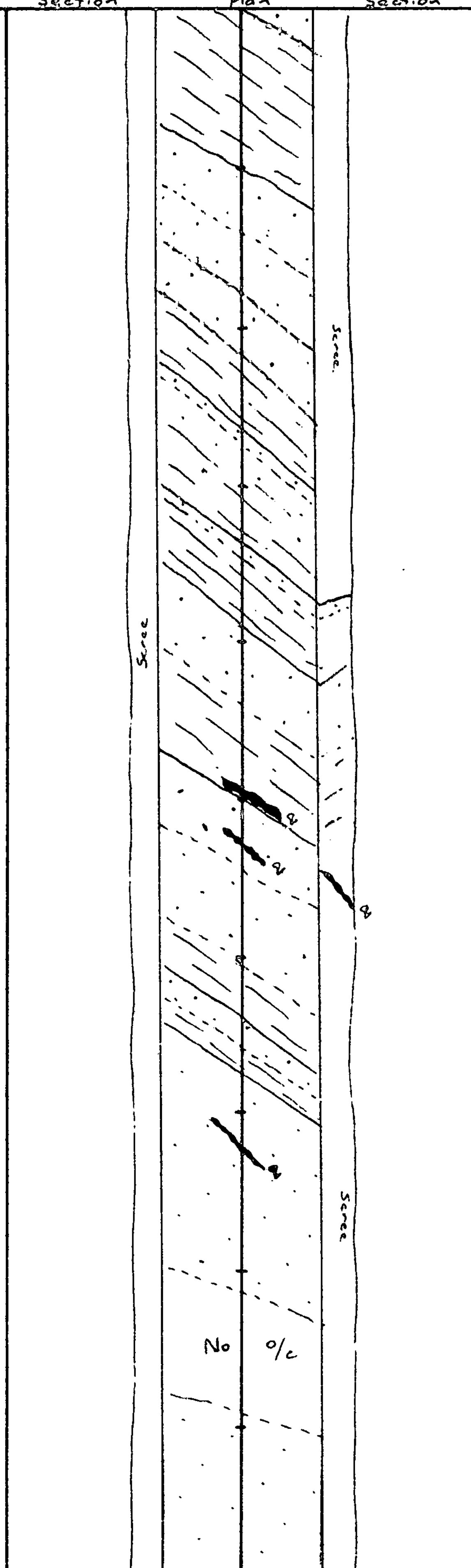
Scale : 1" : 10' slope distance

Logged by : J. Braybrooke.

Project: Adelaide River Gorge Dam Site No1

Costean: e - e' behind right bank.

Slope angle	Structure	L.H. Wall Section	Costean Floor Plan	R.H. Wall Section	Lithology	Strength	Fractures
300					m.g. greywacke		
					phyllite	weak	cleaved & broken
	bedding 006/61 E				mg - f.g. greywacke.	m. strong.	blocky.
					f.g greywacke	weak.	highly broken
	bedding 004/75 E				f.g. micaceous greywacke	weak.	broken
					phyllite.	weak.	cleaved.
	bedding 178/60E				f.g. greywacke	weak	
					f.g. greywacke & phyllite..	weak.	cleaved & broken
26°					f.g. greywacke	m. strong.	090/81 N broken
					phyllite.	weak	cleaved
					f.g. greywacke	m. strong.	blocky to tabular. 096/70N. 1"-6"
					spotted phyllite	weak	cleaved
	quartz veining				m.g. gwke.	weak.	broken
							023/52W : 6"-10" some with qtz.
					f.g. gwke.	weak.	
					phyllite	weak	cleaved.
	bedding 180/60E				m.g. gwke f.g. phyllite	m. strong weak.	blocky 016/61E
370'	thin quartz vein 019/46 W				f g gwke	m. strong	blocky to tabular
16°					No o/c		
					f.g. gwke.	weak to m. strong.	broken.
400'							



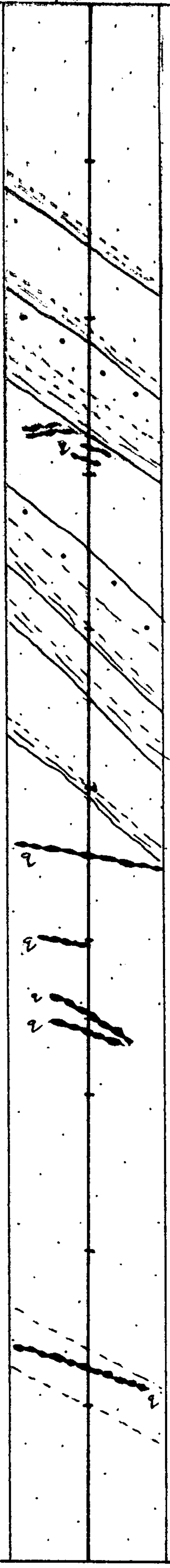
Scale : 1":10' slope distance

Logged by: J. Braybrooke.

Project Adelaide River Gorge Dam Site No1.

Costean e - e' behind right bank.

Sheet 5 of 7

Slope angle	Structure	L.H. Wall Section	Costean Floor Plan	R.H. Wall Section	Lithology	Strength	Fractures
400'					f.g. gwke. phyllite	m. hard.	blocky
	bedding [illegible]/71 E				f.g. gwke phyllite.	m. hard.	blocky 097/69 N : 3"-6"
	much fine quartz veining				grit m.g. gwke f.g. gwke phyllite	friable & weak friable.	cleaved ¼"-1"
	bedding 172/56 E				f.g. gwke.	m. hard.	blocky
16°	bedding 019/74 E				grit f.g. gwke phyllite.	friable & weak m. hard.	
					f.g. gwke. phyllite.		
					f.g. gwke phyllite.	weak	broken
	½" quartz vein 1" quartz vein 170/46 W bedding 008/40E				heavily weathered. f.g. greywacke.	weak & soft	
						Soft.	
	2" quartz vein				f.g. gwke.	m. hard.	
500'					heavily weathered f.g. gwke.	soft & weak.	

Scale : 1" = 10' slope distance

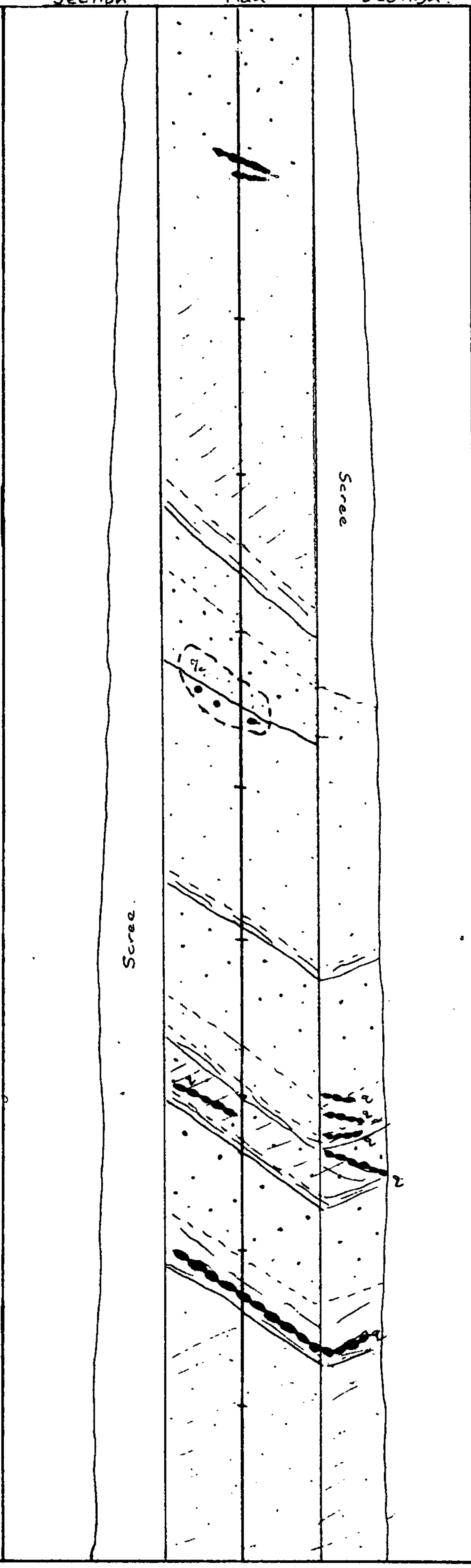
Logged by: J. Braybrooke.

Project: Adelaide River Gorge Dam Site No1.

Costean: e - e' behind right bank.

sheet 6 of 7

Slope angle	Structure	L.H. Wall Section	Costean floor Plan	R.H. Wall Section	Lithology	Strength	Fractures
500'	bedding 178/58E				highly weathered. c.g. gwke. m.g. (poor %)	soft	
					highly weathered lateritised. f.g gwke. lateritised phyllite.		
16°					f.g. gwke. m.g gwke: grit.	m. hard. weak.	
					f.g. gwke phyllite	Soft	
	bedding 020/68E				m.g. gwke. f.g. gwke. phyllite.	Soft. soft - weak.	
	3" quartz vein 075/45 SW				lateritised m.g. gwke. phyllite	soft	
					c.g. gwke. phyllite.	m. hard. m. strong	blocky 094/61 S : 1"-10"
600'	1-2' quartz vein 179/57 E (along bedding)				grit. lateritised. f.g. gwke. lateritised.. f.g. to m.g. greywacke.	weak - soft	



Scale : 1":10' slope distance

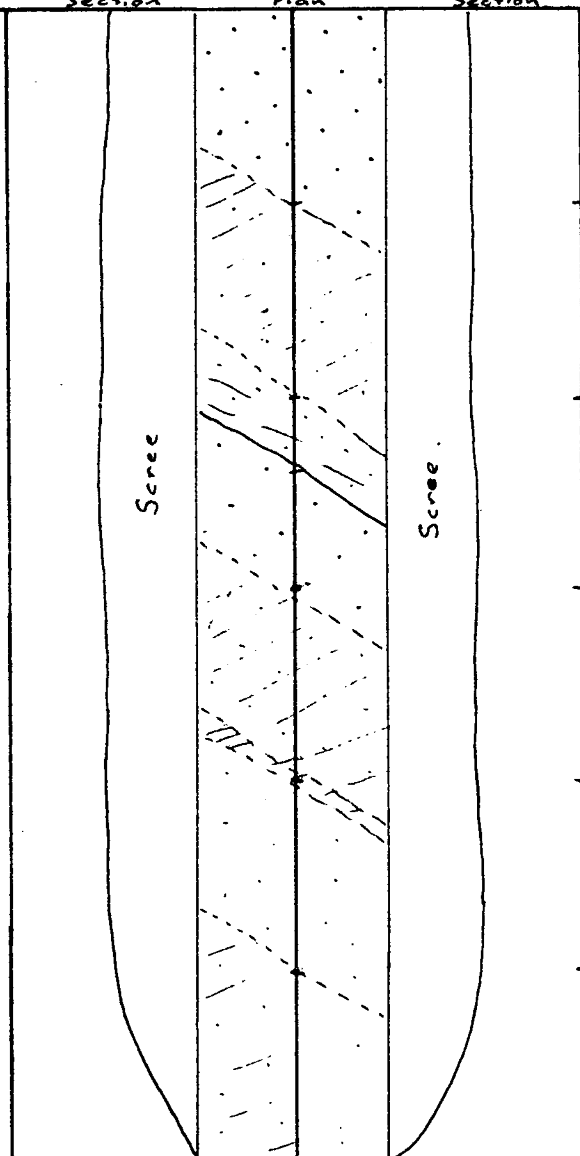
Logged by : J. Braybrooke.

Project. Adelaide River Gorge Dam Site No1.

Costean e - e' behind right bank.

sheet 7 of 7

slope angle	Structure	L. H. Wall. Section	Costean floor Plan	R. H. Wall. Section	Lithology	Strength	Fractures.
600'					highly weathered m.g. greywacke	Soft Weak.	
					laterised greywacke.		
16°	bedding. 151/41E				f.g. greywacke + phyllite		
					weathered m.g. to f.g. greywacke	Soft Weak	
660'					highly weathered laterised greywacke.		



Bottom of Costean.

Scale : 1" : 10' slope distance.

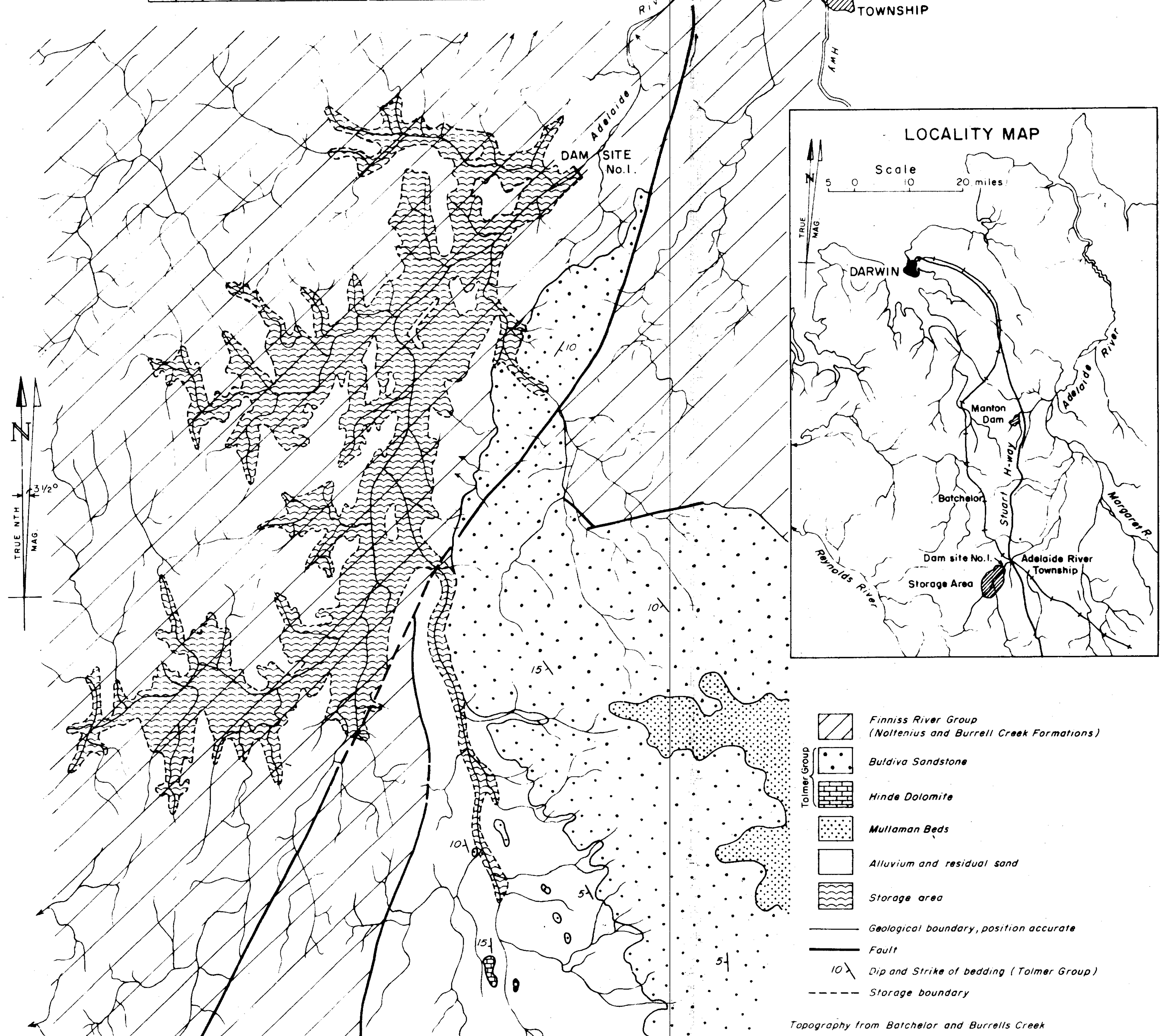
Logged by : J. Braybrooke.

ADELAIDE RIVER GORGE DAM SITE No.1.
Geological Sketch Map of Storage and Catchment Area

PLATE I.

Scale

1 ½ 0 1 2 3 MILES



Topography from Batchelor and Burrells Creek 1:50,000 Topographic Maps 5171-III and IV, Geology from B.M.R. 1 inch to 1 mile geological maps; modified by E.J. Best and J.C Braybrooke, 1966

Bureau of Mineral Resources, Geology and Geophysics   September 1967.   To accompany Record 1967/120.

D 52/A8/232   EJ

PLATE 2.

ADELAIDE RIVER GORGE

Combined Geological and Topographical Map

Sheet 1.

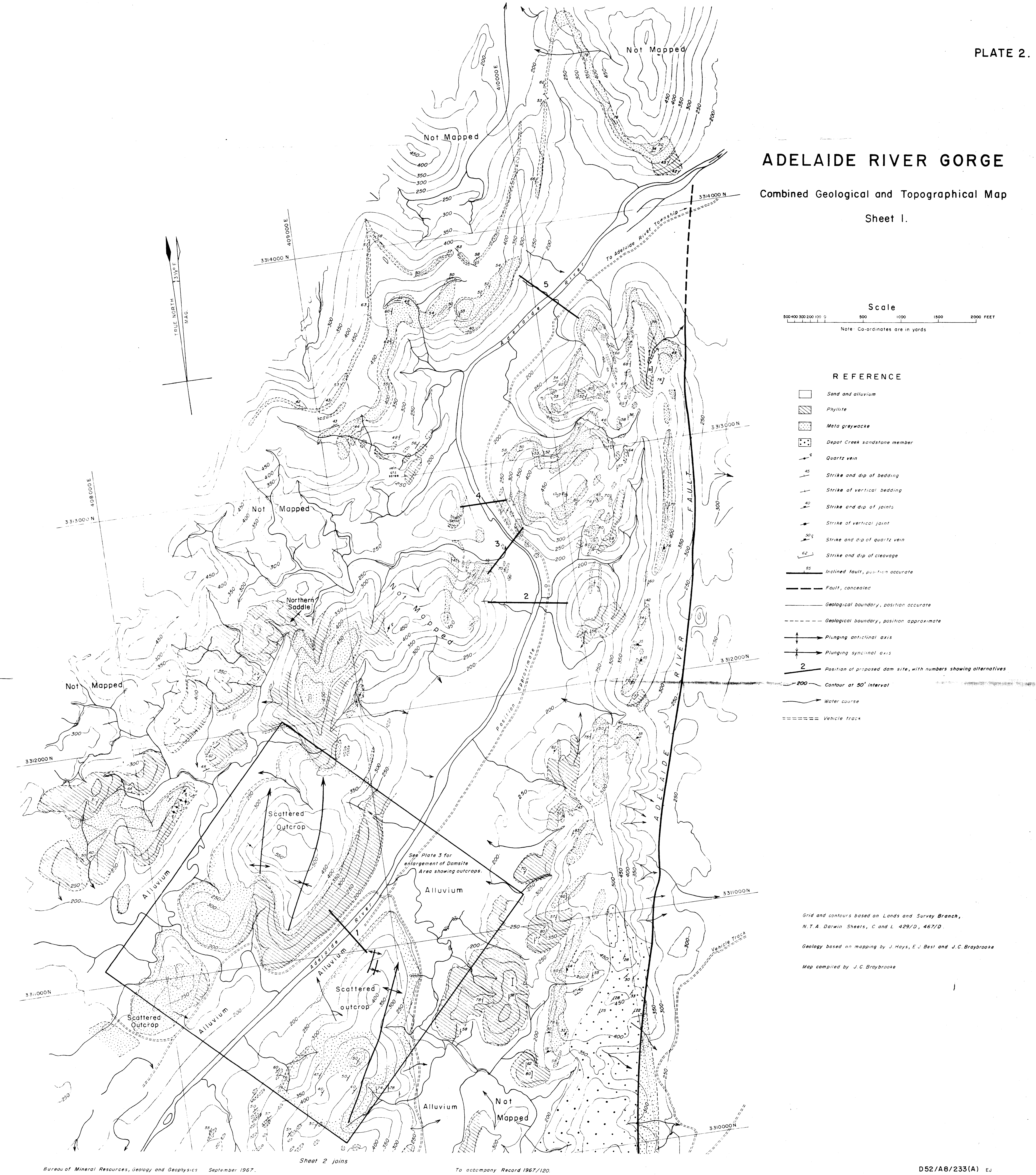


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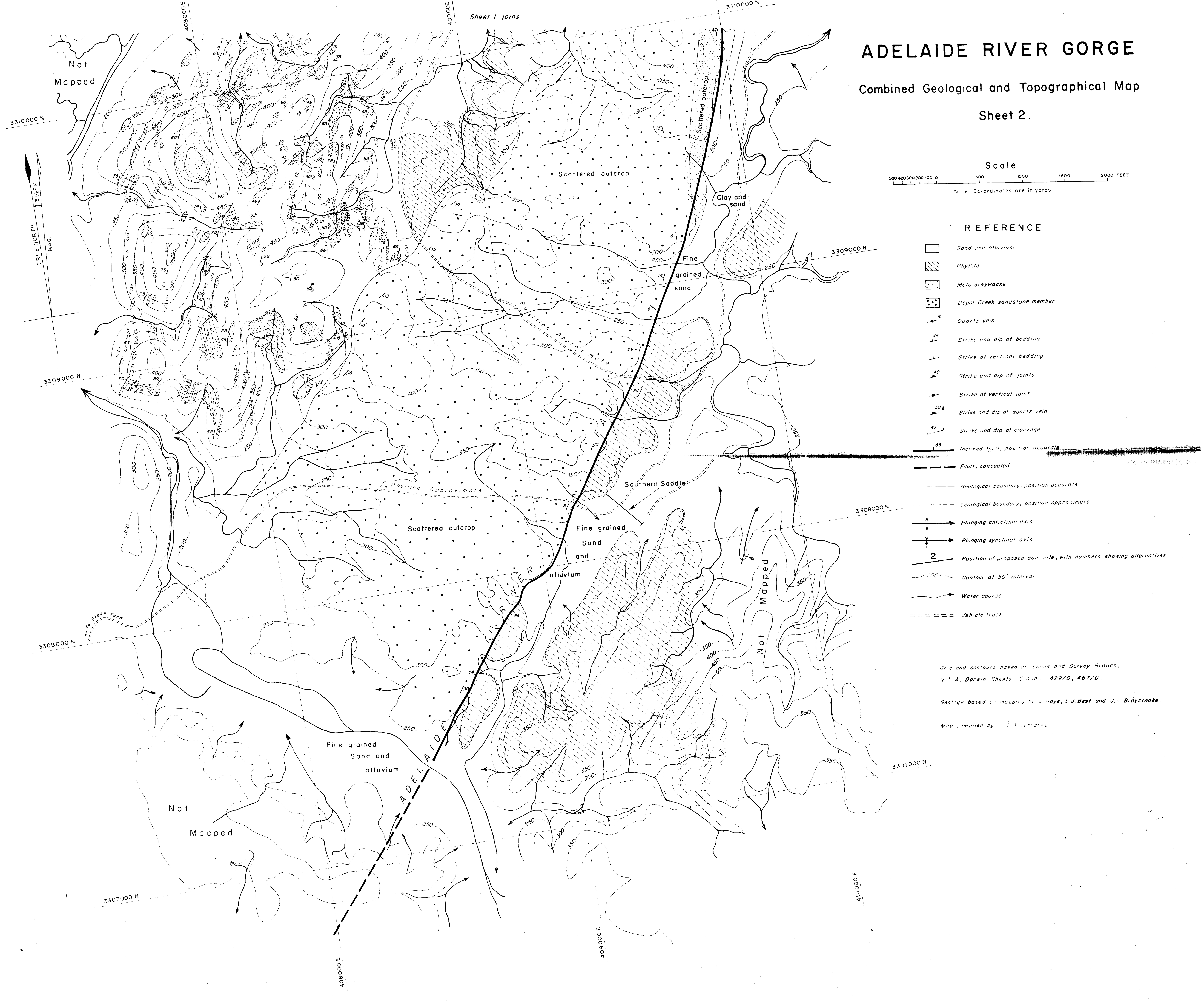
PLATE 2.



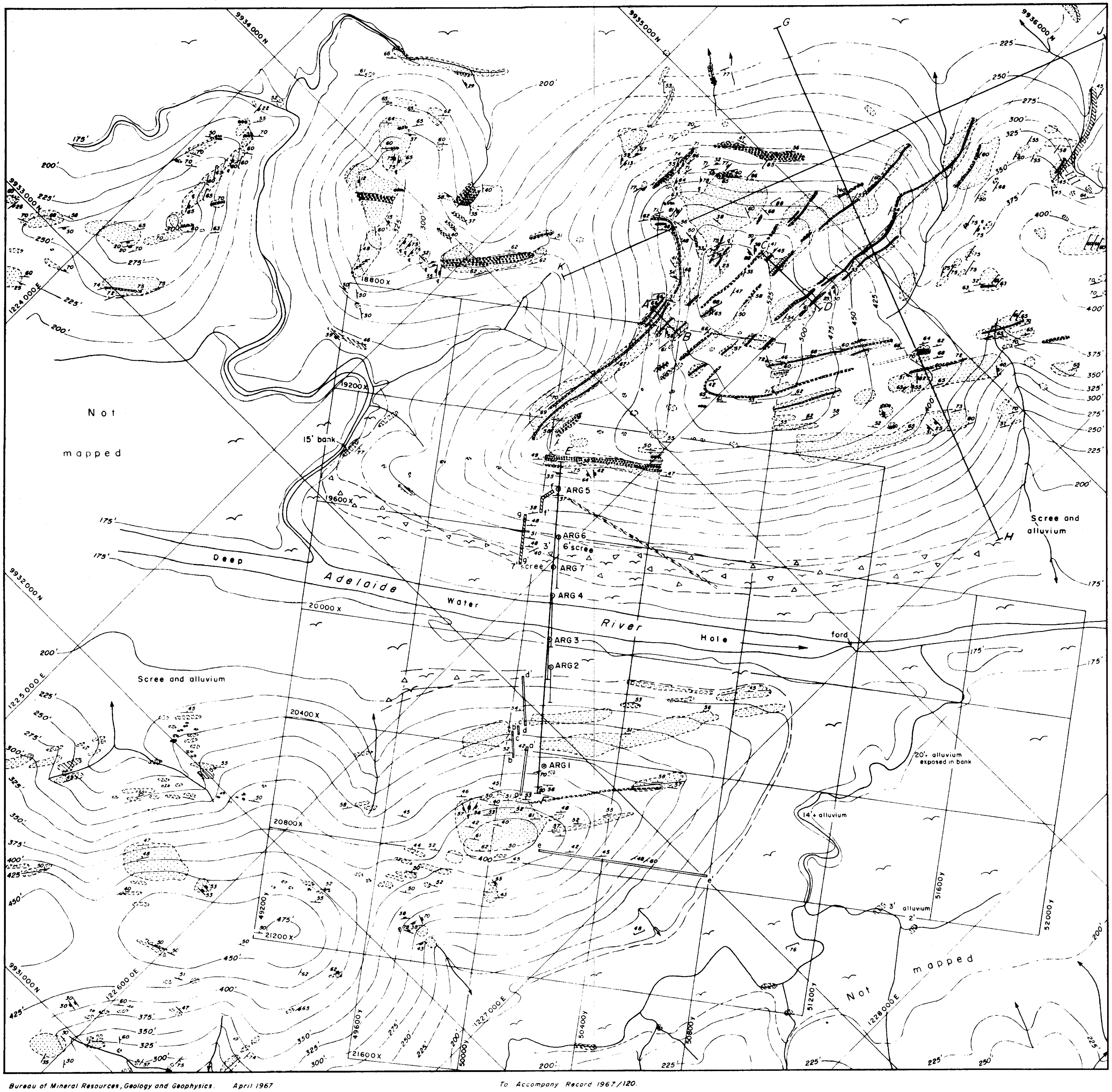
Bureau of Mineral Resources, Geology and Geophysics September 1967

To accompany Record 1967/120

D52/A8/233(B) EJ

PLATE 3.

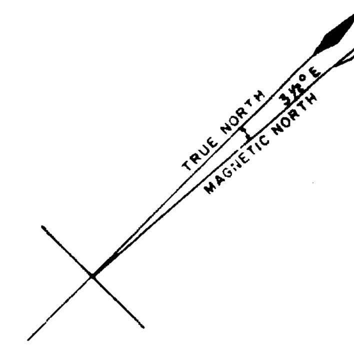
DAM SITE No.1.
ADELAIDE RIVER GORGE
Combined Outcrop and Topographical Map



Scale

100 0 100 200 300 400 500 feet

Note Co-ordinates are in yards.



REFERENCE

- Thin soil and scree cover, scattered outcrops
- Scree and slope wash
- Alluvium
- Phyllite
- Graded meta-greywacke
- Pebble conglomerate
- 30 Strike and dip of bedding
- Strike of vertical bedding
- 40 Strike and dip of joints
- Strike of vertical joints
- 50 Strike and dip of quartz-filled joints
- 80 Strike and dip of cleavage
- Strike of vertical cleavage
- Geological boundary, position accurate
- Geological boundary, position approximate
- Shear-zone
- ARG1 Drill hole position with number
- a a' Costean (see Appendix for detailed logs)
- Cross Section line
- Water course
- 300 Contours at 25' intervals

For Geological sections AB and CD see Plate 6
" " section EF — see Figure 3
" " section GH — see Plate 5
" " section KJ — see Plate 4

Grid and Contours based on Lands and Survey Branch, N.T.A. Sheet C and L 430/D.
400' Damsite Grid laid out by W.R.B Surveyors.
Geology based on mapping by E. J. Best and J. C. Braybrooke.
Compiled by J. C. Braybrooke.

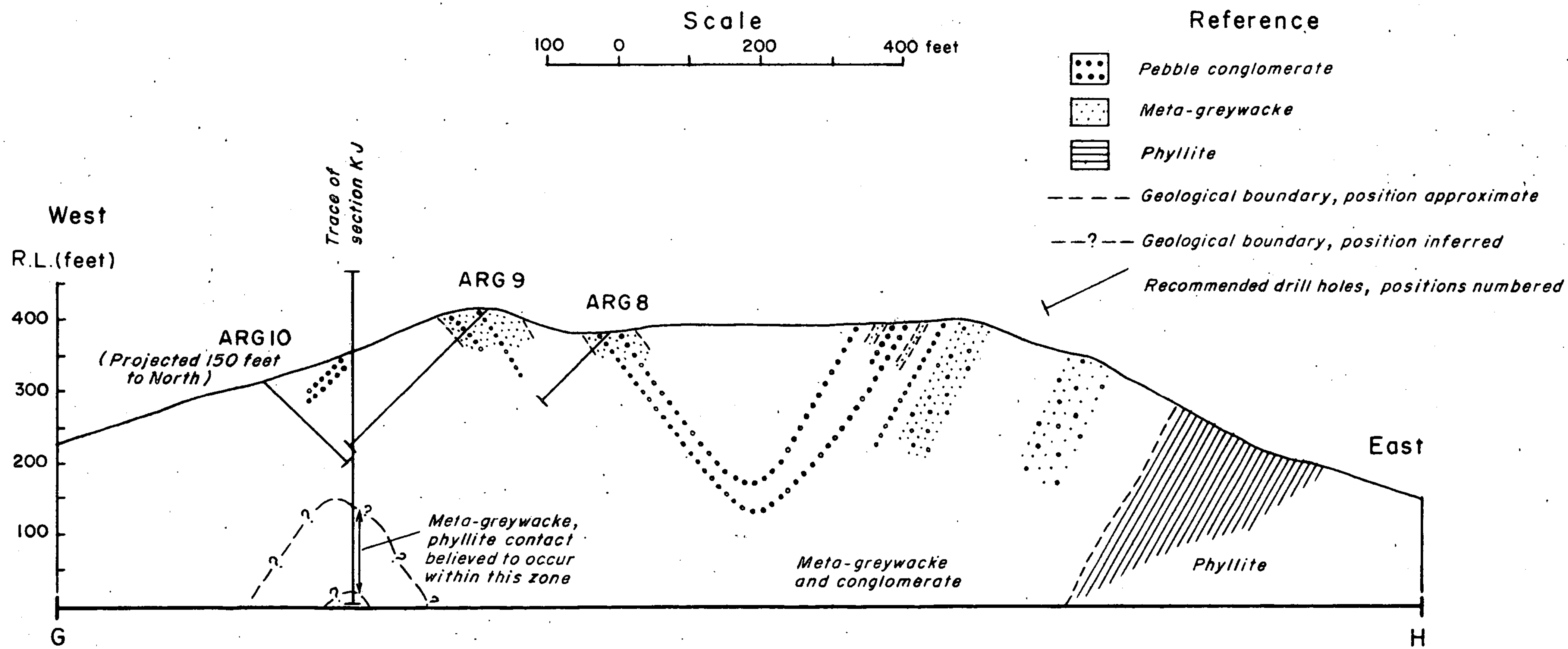
Bureau of Mineral Resources, Geology and Geophysics. April 1967.
To Accompany Record 1967/120.
D52/A8/234 EJ

PLATE 4.

Adelaide River Gorge Damsite No.1.

PROPOSED QUARRY SITE

Interpretive Geological Section GH normal to fold axes



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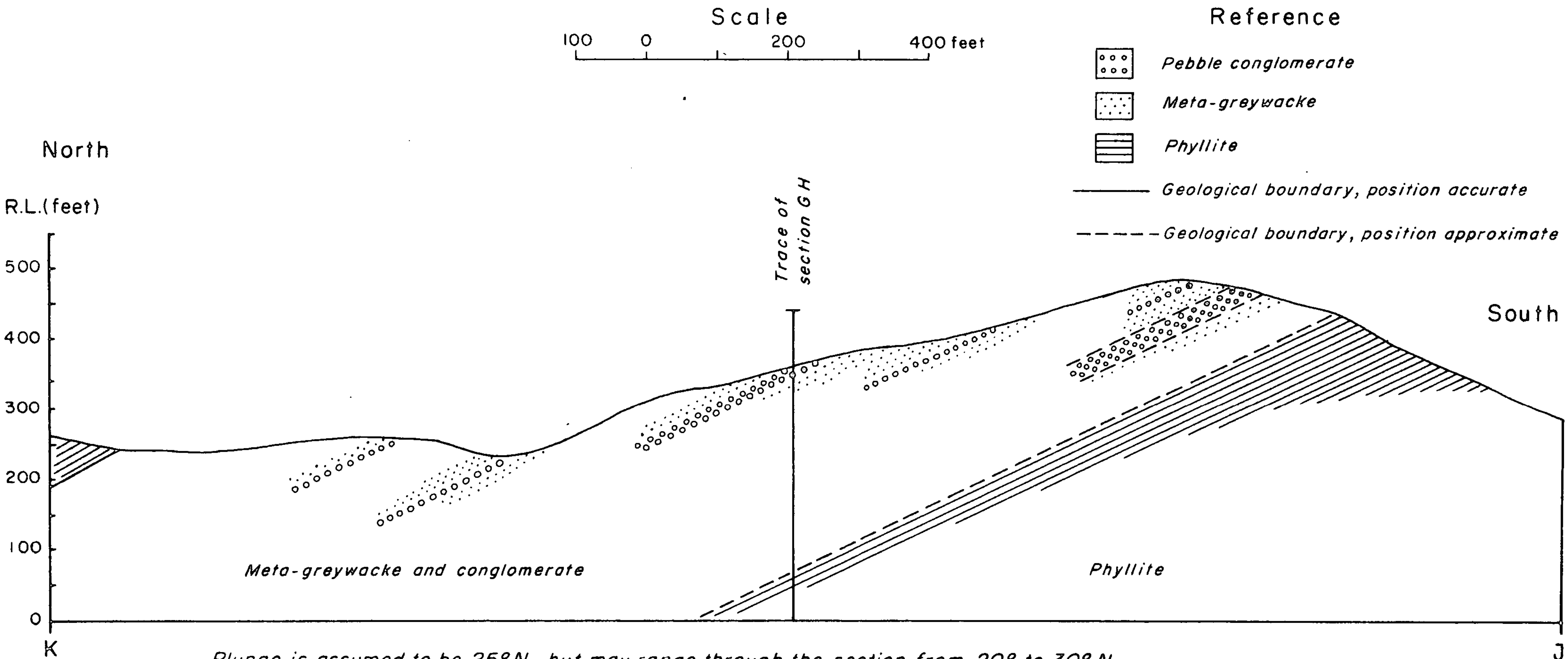
D52/A8/235 EJ

PLATE 5.

Adelaide River Gorge Damsite No.1.
PROPOSED QUARRY SITE

Interpretive Geological Section KJ along Anticlinal Axis

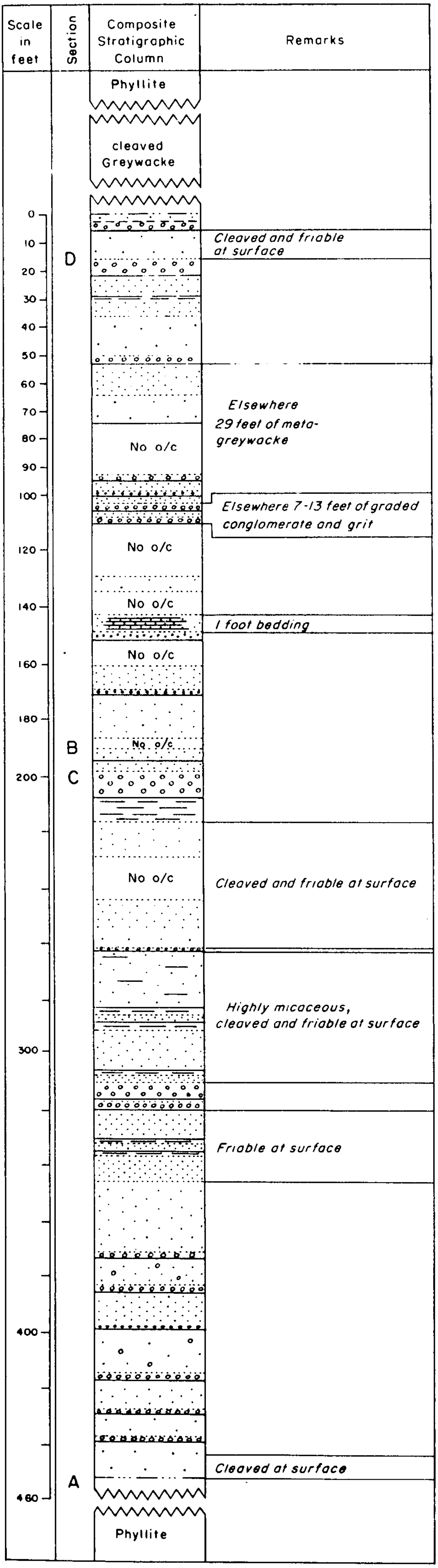


Plunge is assumed to be 25° N, but may range through the section from 20° to 30° N.
See Section GH (Plate 4) for locations of proposed drill holes ARG8, ARG9 & ARG10.

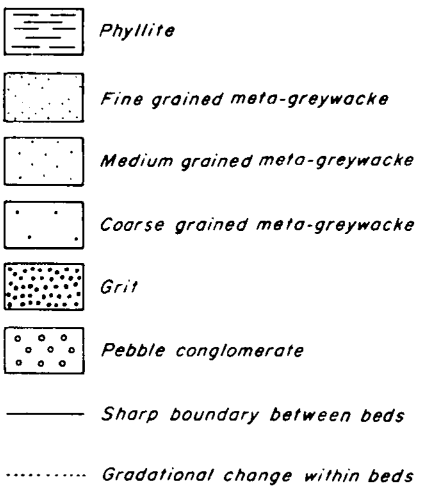
PLATE 6.

ADELAIDE RIVER GORGE DAM SITE No.1.

Composite Stratigraphic Column of Quarry Site



Column of Quarry Site built up from outcrops near Section Lines A-B and C-D (see Plate 3) Many correlations between outcrops are interpretative. Quarry Site is entirely within the Noltenius Formation.



D52/A8/237

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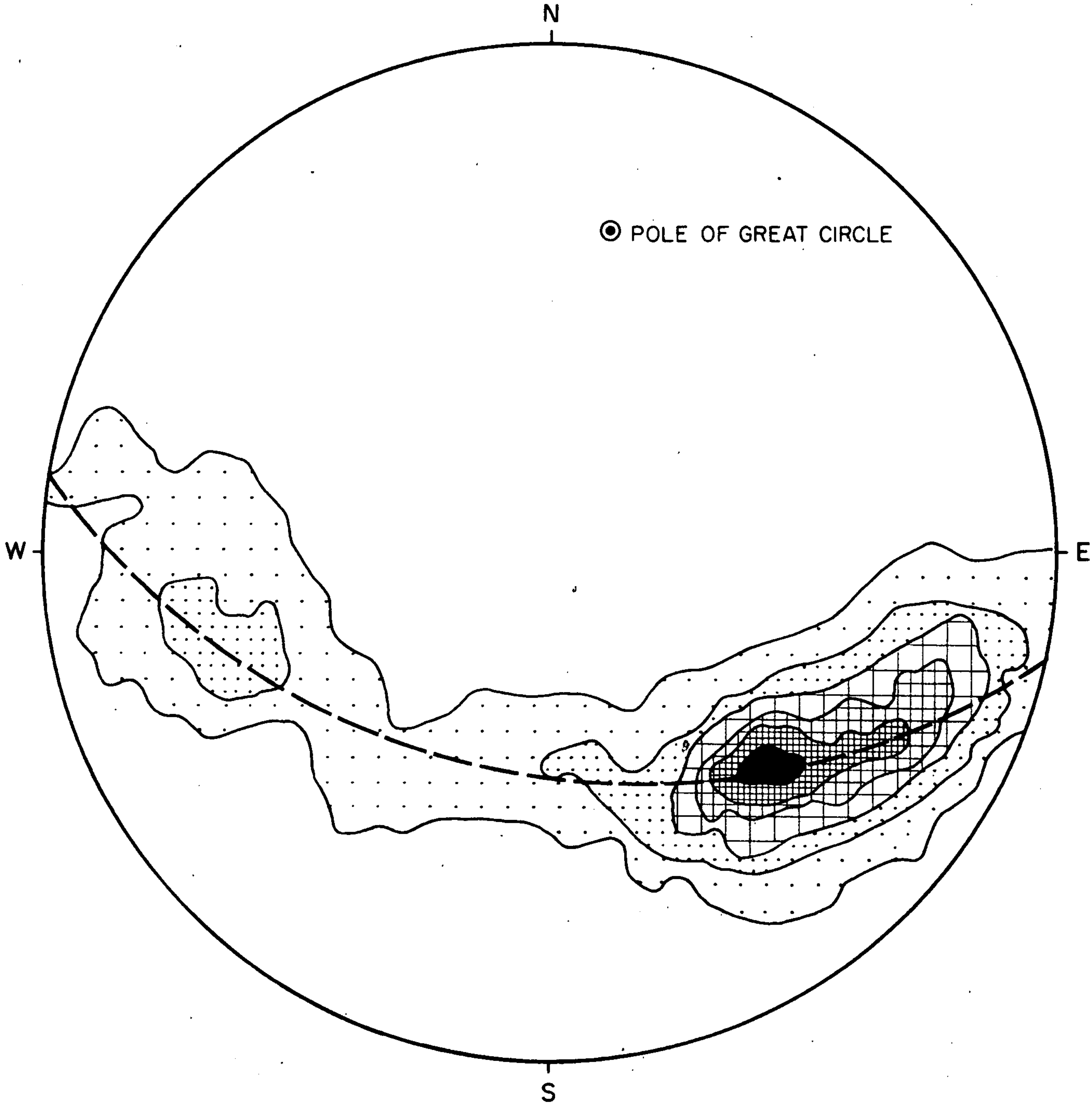
ADELAIDE RIVER GORGE

PATTERN OF FOLDING IN ENVIRONS OF SCHEME



CONTOURED POLAR DIAGRAM OF 610 BEDDING PLANE MEASUREMENTS SHOWING THE GREAT CIRCLE AND POLE
(plunge of fold axis : 34° on magnetic bearing 010°)

CONTOURS PER 1% AREA

12% 10% 8% 5% 3% 1%

To accompany Record 1967/120

D52/A8/238