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DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1960/23

GEOLOGICAL INVESTIGATION OF WODEN WEIR SITE.

by

D.E. Gardner.

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Contents

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SUMMARY

The bedrock at the Woden Weir Site will provide good foundations for a weir except within a closely fractured zone about 30 feet wide beneath the western channel of the river where some bands of crushed rock approximately 3 feet wide will need special treatment.

Superficial deposits are thin beneath the right abutment and the floor of the river valley. Beneath the left abutment these deposits range in thickness from 30 to 40 feet over a width of 280 feet, and they may be unstable when saturated with water.

INTRODUCTION

A preliminary investigation of the Woden Weir Site, then termed the "Alternative Yarralumla Site" (Gardner, 1958) was made during August and September, 1958, when diamond drilling and some costeaning was done along the axis of the proposed site. Costeaning exposed sound bedrock at a shallow depth below the right abutment. Diamond drilling showed that a zone of fracturing occurs beneath the western channel of the river and that the bedrock below the left abutment is covered by thick superficial deposits for about 400 feet back from the river.

Supplementary drilling, costeaning and soil sampling during November and December, 1959, were intended to investigate the fracture zone beneath the western channel, to explore the bedrock beneath the left abutment for possible fracturing, and to ascertain the nature and distribution of the unconsolidated sediments or soils that constitute the superficial deposits. The density of drill holes was increased to investigate the feasibility of the pre-stressing the structure with anchored cables some four feet apart.
Eight diamond drill holes were to be put down along the axis from the bottoms of costeans 15 feet deep giving a total of 615 feet of drilling. In practice the amount of costeaning was reduced and the drilling in the eight holes was increased to 789 feet. An additional hole 150 feet long was drilled into the fractured zone a short distance downstream. Additional holes put down by the National Capital Development Commission without geological advice, totalled 326 feet of drilling. Soil sampling was carried out for the Commission by private contractors without geological supervision. The contractors had insufficient knowledge of the materials that would be penetrated during augering and the sampling was ineffective. The logs compiled by the operator may be of some use when interpreted in conjunction with the results of diamond drilling and costeaning.

GEOLOGY (Plates 1, 2)

GENERAL:

The bedrock is an intrusive quartz porphyry, the Mount Painter Porphyry (Opik, 1953, 1954). It forms hard little weathered outcrops at the foot of the left bank of the river, and at several localities on the opposite side of the valley up to R.L. 1840 feet. Weathered outcrops appear in the left hand side of the valley up to R.L. 1795 feet. Elsewhere the bedrock is covered by superficial deposits consisting of river alluvium in the valley floor and in the adjacent narrow flat on the west, and lacustrine (?) and aeolian deposits in the flat-lying country on the eastern side of the river valley. Remnants of lacustrine (?) deposits occur up to at least R.L. 1845 feet on the right hand side of the valley. The geology of the site is shown in Plates 1 and 2.

BEDROCK:

Lithology

The Mount Painter Porphyry is hard and tough when fresh. A thin section description of porphyry from the Yarralumla Weir site, about 1200 feet upstream from the Woden site, is given in Appendix 1. Near the surface the porphyry weathers to a friable, commonly granular earth, and in fracture and shear zones the weathering may proceed to considerable depths, as described below under "Weathering".

Profile along Axis.

In profile along the axis of the weir (Plate 2), the surface of bedrock is substantially horizontal in the valley floor over a width of 220 feet at about R.L. 1760 feet. At the right abutment it rises fairly steeply from the valley floor up to R.L. 1835 feet and then more gently to at least R.L. 1842 feet. At the left abutment the bedrock, covered by thick superficial deposits rises to a low crest at R.L. 1795 feet, distant 90 feet along the axis from the river bank, and thence it slopes gradually downwards to about R.L. 1785 feet at a distance of 200 feet from the river bank. It rises to a low rounded crest at R.L. 1795 feet, 220 feet from the bank. From this point the bedrock rises gradually and at 480 feet from the bank it rises sharply to R.L. 1827 feet. It is thought that the bedrock profile continues to rise gently towards Government House, where the ground-surface, which is underlain by alluvium, is approximately at R.L. 1855 feet, but this needs to be checked by pitting or augering.

Profile at Site of Spillway.

The level of the bedrock surface was determined 50 feet downstream from the axis in drill hole No.21, and 100 feet downstream in holes 22, 23 and 24. Results are illustrated in Plate 2. Along the eastern side of the valley and in the valley-floor the profile 100 feet downstream is essentially the same as that along the axis and is at the same elevation. On the left hand side of the valley the bedrock is at a greater elevation, being five feet higher at the locality of hole 22 and apparently three feet higher at the projected position of hole 21.

Weathering.

In the valley floor the thickness of weathered bedrock is generally less than 5 feet, except beneath the western channel, where weathering in narrow crushed bands goes down to at least 90 feet below the surface of the bedrock. These crushed bands are described below under "Fracturing". Beneath the right hand slope of the valley the thickness of weathered

bedrock is fairly uniform and close to 15 feet; beneath the left hand slope it ranges from one foot to 22 feet. However, the degree of weathering decreases from the surface downwards. The partly weathered rock probably has adequate strength as a weir foundation at a depth of about 10 feet below its surface in the right hand abutment and generally less than 10 feet on the left abutment, although in the vicinity of drill holes 15 and 16 it ranges from 12 to 15 feet in depth.

Fracturing

Western Channel Crushed Bands: At the Woden Site little fracturing is revealed in the drill cores excepting those from beneath the western channel, and some minor fracturing in holes No.2, 7, 15 and 16.

Beneath the western channel much jointing occurs over of 60 feet and a zone 20 feet wide contains three bands, up to 3 feet wide, of crushed rock. The core recovered from the severely crushed porphyry consists of particles that range in size from an inch or so down to a quarter of an inch and smaller.

Bands of crushed rock were encountered during the preliminary investigation in drill holes 3 and 6, and were further examined along the weir-axis by holes 10 and 11.

Position and Attitude of Bands of Crushing: Intersections in drill holes 3, 10 and 11 indicate that the broad zone of jointing and fracturing dips steeply west. Exposures of sound bedrock in the eastern on the right hand side of the river and in the river bank almost on the left hand side, show that the broad fracture zone must be parallel to the river channel. Hole 24 drilled to explore the fracture zone 100 feet downstream, where it underlies the proposed spillway, encountered minor crushing and fracturing, but did not reveal the succession of crushed bands found beneath the axis. This suggests that the crushing occurs in lenticular bands within the broad fracture zone. Individual crushed bands probably persist for only a short distance along the strike, approximately parallel to the main band of fracturing, and dip steeply either to west or to east. They probably give place to other lenticular crushed bands, within the broad fracture zone, offset a short distance either to the west or to the east. The exact positions of the crushed bands will be revealed when the overburden is stripped from the area.

Minor Fracturing: Drill holes 2, 7, 15 and 16, intersected bands of closely jointed porphyry up to a few feet in length, containing a few inches of crushed rock.

Foundation for Weir.

Except in the fractured zone beneath the right hand channel of the river the bedrock will provide a suitable foundation for a weir at a depth of about 10 feet below its surface. No difficulty is anticipated in anchoring cables at 4-foot centres for pre-stressing.

In the zone of fracturing, which includes narrow lenticular bands of crushed rock, special treatment will be needed. For a concrete gravity weir some excavation of weathered rock and filling with concrete, followed by washing and grouting will probably be adequate. This fractured zone will present difficulties in pre-stressing, but it may be possible to site at least some of the cable holes in relatively competent zones between the crushed bands. Additional design drilling would seem necessary in this zone.

Superficial Deposits: (Plates 1, and 2).

General.

In the river channels the bedrock is covered by sand and gravel ranging in thickness from a few inches to a foot or two. The island in the river consists mainly of sand and gravel 5 feet in thickness. On the right bank of the river, the costean along the probable axis of the weir exposed 15 feet of river alluvium. This thins rapidly up-slope to 5 feet at a distance of 80 feet from the river bank.

Beneath the left bank the alluvium is 12 feet in thickness. This decreases virtually to zero at a distance of 60 feet from the bank but increases to 40 feet thick at a distance of 270 feet up-slope from the bank. The thickness of the alluvium decreases very gradually to 30 feet at a distance of 470 feet from the river, and thence decreases sharply to 5 feet in an additional 40 feet from the river.

The alluvium comprises an upper layer of aeolian material consisting of very fine sand and silt, with a varying proportion of clay. This rests on lenticular beds of gravel, coarse sand, and clay which may represent lacustrine sediments.

Aeolian Deposits

The aeolian deposits, formed from fine sediments that have been blown by the wind from the river channel , occurs at numerous localities along the Molonglo River, generally on slopes that are exposed to westerly winds. They are deposits of some antiquity, probably dating back to the late Pleistocene, and have been partly modified by soil-forming processes. A typical section exposed in the costean is:-

Depth from Surface	
0 - 1'0	Pale, red-brown, very fine sand
1'0 - 1'9	Deeper red, very fine sand, with a little clay.
1'9 - 4'1	Soft, very fine moist sand, with more clay.
4'1 - 5'0	Very fine sand with much clay and some soft ferruginous nodules.
5'0 - 6'6	Reddish yellow, fine sand, very clayey with grey brown nodules.
6'6 - 8'0	Ditto, with increase in clay content
Below 8'0	(?)Lacustrine sediment.

At the weir site the aeolian material has a maximum thickness of 10 feet a short distance down the slope of the river valley from the edge of the flat country above. From this point it decreases in thickness both towards the river and away from it. At the locality of drill hole No.9 on the flat, 500 feet from the river, it is 3 feet thick; at 160 feet from the river bank it is less than 5 feet thick. The thickness of the aeolian deposit upstream and downstream from the axis is not well known. Auger-hole logs compiled by the operator of a power auger which had been intended for soil sampling and probing to bedrock, show "gravel" at approximately the depth of the (?) lacustrine sediments in the costean along the axis, but these logs are not reliable, and the work was done without geological supervision. The position of auger holes and the logged depths are shown in Plate 1.

The aeolian material can support a considerabe load when dry, but it breaks down rapidly when immersed in water and presumably could be subject to slumping in saturated banks around the lake. Loading tests are now being carried out by Department of Works.

(?)Lacustrine Sediment.

The (?) lacustrine sediment beneath the aeolian material consists of gravel, sand, and clay with a varying proportion of silt, loosely cemented by iron oxide and by clay. It is probably much more stable under load when saturated than the aeolian material, but this has not been demonstrated. A section of lacustrine beds exposed in the costean below the aeolian deposits, in descending order, is as follows:-

8' - 9'7 Coarse sand and small pebbles, with some silt.
9'7 - 10' Large, well rounded pebbles with coarse sand and silt.
10' - 10'7 Small pebbles and coarse sand.
10'7- 11' Dull yellow clay with disseminated coarse sand. Dark ferruginous staining of cracks.
11' Bottom of costean.

Following is the log of hole 16, in alluvium, below 11 feet, vertical depth.

11' - 12'5 Buff, red-buff and mottled red-buff sandy and silty clay.
12'5- 13'1 Mottled red-buff and pale buff coarse sandy silty clay.
13'1- 17'10 Buff and red buff, sandy, silty clay. Some coarse sand grains from 16' to 17.
17'10- 18'5 Buff sandy, silty clay; a high proportion of sand.
18'5 - 20'6 Buff and brown buff sandy and silty clay.
20'6 - 23'6 Brown sandy silt and silty sand.
23'6 - 25'6 Brown sandy silt and reddish-buff coarse sand with small pebbles.
25'6 - 29'4 Red-brown clayey sand, fine sandy clay and brown sandy silt.
29'4 - 32'3 Red-brown clayey silt packed with small pebbles and coarse sand. Towards base quartz pebbles up to 1½" across.
32'3 - 38'6 Casing washed down. Washings of brown silty sand. Quartz pebbles at base.
38'6 - 42'4 Drilled with barrel. No core recovered.
42'4 - 42'5 Quartz pebbles.
Below 42'5 Moderately fresh porphyry.

WATER PRESSURE TESTING

Little water was lost in pressure testing in either bedrock or alluvium. During preliminary investigations in 1958, testing was done over 10-foot and 20-foot intervals of the drill holes, with pressures of up to 50 lb. per square inch. Results are illustrated in Plate 3. The maximum loss in bedrock, in hole No.3, was 0.35 gallon per minute per foot. In alluvium the maximum loss was 0.006 per gallon per minute per foot at 15 lb. per square inch in the shallow hole No.9. Deeper alluvium in hole No.8 gave a loss of .001 gallon per minute per foot at 30 lb. per square inch.

Each of the holes drilled along the axis in 1959 was subjected to a single test from the bottom of the hole up to about the level of unweathered or slightly weathered porphyry. The water was taken direct from the main and maximum pressures ranged from 45 to 100 lb.per square inch. Leakage, all in bedrock, ranged from 0.06 to 0.22 gallon per minute per foot, and is shown diagrammatically in Plate 3.

REFERENCES.

GARDNER, D.E., 1950 - Geological investigation of weir sites at Acton and Yarralumla, Canberra. A.C.T. Bur.Min.Resour.Aust. Records 1958/91.

" OPIK, A.A., 1953 - Geological map of Canberra. Bur.Min. Resour.Aust. Drawing A.C.T. G2-12. G2-13.

" OPIK, A.A., 1954 - In "Canberra, a Nation's Capital". Aust.Ass.Ad.Sci., Canberra, 1954.

APPENDIX I.

THIN SECTION DESCRIPTIONS

by

W.R. Morgan.

Yarralumla Weir Site..

DD2, 58'2" Proposed site for the Molonglo River Weir, Yarralumla.

Hand Specimen: The rock has a light grey, fine-grained groundmass which encloses numerous coarse phenocrysts. The latter are composed of rounded quartz, tabular felspar, and a dark ferro-magnesian mineral. The specimen is cut by veins of calcite.

Thin Section. The specimen consists of very numerous phenocrysts enclosed by an exceedingly fine-grained, holocrystalline groundmass. The latter appears to consist of sericite and chlorite, with some quartz, and opaque dust. The phenocrysts range between 0.06 mm. and 6.0 mm. in size. Quartz forms anhedral, rounded and partly resorbed crystals, showing some cracking, and undulose extinction. It encloses minute, opaque particles, either as "clouds", or as sub-parallel lines. Albite phenocrysts form subhedral, rather tabular crystals, now almost completely sericitized. Some indistinct traces of carlsbad and albite twinning may be seen, while its refractive index is less than that of Canada balsam. A biaxially positive figure, with $2V = 85^{\circ}$ was obtained. An extinction angle measured on a section normal to the X-bisectrix showed a composition of An5. Green chlorite forms flaky, prismatic crystals, which appear to pseudo-morph biotite, and it occurs as irregular veins cutting the rock, or sometimes surrounding sericitized albite as a fringe. It is pleochroic: X = very light fawn-green; Y = very light green; Z = green: absorption: $Z > Y > X$. It gives a negative interference figure, with $2V = 0$. The birefringence = 0.0025. Very often ilmenite, decomposed to leucoxene, is present in irregular masses lying along the cleavage traces. Some nontronite is associated with chlorite.

Ilmenite and leucoxene occur as small, irregular masses throughout the rock. A few coarse, prismatic crystals of apatite are present. A little zircon, occurring as small prismatic crystals with pyramidal terminations, may be seen. Calcite cuts the rock in a few thin and irregular veins.

An estimation of the percentage mineralogical composition of phenocrysts is: Sericitized albite 50; quartz 25; chlorite 20; the remainder 5.

The rock is a dacite or granodiorite porphyry, depending on whether it is extrusive or intrusive.

DD2, 40'0" Proposed site for the Molonglo River Weir, Yarralumla.

Hand Specimen: The groundmass of this specimen has a grey-green colour, while the ferro-magnesian phenocrysts are stained with hydrated iron oxide: otherwise the rock is similar to that at 58'2".

Thin Section. In texture this rock is similar to the previously described specimen. The mineralogy is also closely similar. The main difference is that nontronite predominates over chlorite as an alteration product of biotite, and in the veins cutting the rock. Some apparent xenoliths of a possible quartz-siltstone are present, surrounded by a rim of nontronite. The rock is again a dacite or granodiorite porphyry.

APPENDIX 2.

GEOLOGICAL LOGS

OF

DIAMOND DRILL HOLES.

ALTERNATIVE ~~SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY~~

YARRALUMLA

GEOLOGICAL LOG OF DRILL HOLE

PROJECT (WODEN) WEIR SITE FEATURE SOUTH BANK

HOLE No. D.D.H. 1 CO-ORDINATES: E ..... M ..... N ..... M ..... R.L. GROUND 1821'

LOCATION 170' south of Molonglo River ANGLE FROM HORIZONTAL Vertical DIRECTION .....

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (Ft) FROM	TO	LOSS IN GPM	PRESSURE P.S.I.	LENGTH OF TEST (min)
Red soil and clay	Red soil and clay does not cave-in		10'									
Clayey sand	Buff-coloured sand and clay — sand fine to very fine caving-in occurs		22'									
Clayey sand and gravel	Buff coloured sand gravel and clay — gravel from small pebbles to 2" diam. — sand fine and very fine		28'6"									
	core commences 30' 1"		30'1"									
Weathered grey-green porphyry	Grey green porphyry with cream feldspars and open limonite stained fractures; some calcareous shears between 35' and 39'		35'0"			6" shattered and weathered						
			39'0"			1' strongly fractured						
Unweathered grey green porphyry	Grey green porphyry with calcareous cement in shears and fractures. Some open fractures with euhedral quartz and limonite formed by removal of calcareous cement. Phenocrysts of quartz, white feldspars and femic minerals in a grey green groundmass		53'8"		100	calcareous shears steeply dipping between 65° and vertical fractures dip mainly 25° — some fractures steeper up to 60° slickensides common along fractures	27'7"					
	End of hole						Subsequent water levels 8-8-58 33'7" 9-8-58 33'8" 11-8-58 34'7" 13-8-58 34'9" 18-8-58 36'0" 29-8-58 37'6" 2-9-58 38'0" 9-9-58 38'5" 16-9-58 38'11"				

DRILL No. 11A 1009
TYPE MINDRILL

DRILLER V. HILTUNEN
COMMENCED 28-7-58
COMPLETED 7-8-58

ENGINEERING GEOLOGY BRANCH

LOGGED E.G. WILSON
SHEET No. 1
DRAWN E.G. WILSON
CHECKED
SUBMITTED

VERT. SCALE 1" = 10'
SHEET 1 OF 1
DRAWING No.

ALTERNATIVE YARRALUMLA

~~SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY~~

GEOLOGICAL LOG OF DRILL HOLE

PROJECT (WODEN) WEIR SITE FEATURE SOUTH BANK 1793'

HOLE No. D.D.H. 2 CO-ORDINATES: E ..... M ....., N ..... M ..... R.L. GROUND .....

LOCATION 100' south of Molonglo R. ANGLE FROM HORIZONTAL Vertical DIRECTION .....

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (FT) FROM	TO	LOSS IN GPM	PRESSURE IN P.S.I.	LENGTH OF TEST (mins)
Red soil and sand			2'0"									
Deeply weathered porphyry			3'7"									
	Core commenced 5'1"		5'1"									
Weathered grey-green porphyry	Grey-green porphyry with cream feldspars and open limonite stained shears and fractures					Strongly shattered rock fractures 25° and 45° dip. shears dip steeply 60° and above slickensides common						
			18'8½"		100	well fractured						
			23'7"			well fractured and weathered - some clay present						
						Solid rock - few fractures mainly dipping 15° with limonite stains Slickensides common						
			35'3"									
Unweathered grey-green porphyry	Grey green porphyry with calcareous cement in shears and fractures. Some open fractures with euhedral quartz and limonite stains formed by removal of calcareous cement. Phenocrysts of quartz, white feldspars and femic minerals in a grey-green groundmass		38'6"			End of hole	Standing water levels 13-8-58 23'0" 18-8-58 19'10" 29-8-58 20'5" 3-9-58 22'7" 9-9-58 22'10" 16-9-58 22'10"					

(after rain)

DRILL No. 1A .009
TYPE MINDRILL

DRILLER V. HILTUNEN
COMMENCED 8-8-58
COMPLETED 11-8-58

ENGINEERING GEOLOGY BRANCH

LOGGED E.G. WILSON
SHEET No. 1
DRAWN E.G. WILSON
CHECKED
SUBMITTED

VERT. SCALE 1" = 10'

SHEET 1 OF 1

DRAWING No. .....

ALTERNATIVE YARRALUMLA

~~SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY~~

1.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT (WODEN) WEIR SITE FEATURE North bank

HOLE No. D.D.H. 3 CO-ORDINATES: E. ... M ... N ... M ... R.L. GROUND 1781'

LOCATION North bank 20' from river ANGLE FROM HORIZONTAL Vertical DIRECTION ...

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RE-COVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (FT) FROM	TO	LOSS IN G.P.M.	PRESSURE P.S.I.	LENGTH OF TEST (min)
Soil	Brown soil		2'6"									
Sand and Clay	Fine buff-coloured sand and clay		11'4"									
Sand and Gravel	Sand and gravel with some 2" cobbles		13'10"				Casing to 14'5"					
Weathered Porphyry	Fractured and very weathered rock in part to a clay limonite in fractures		20'6"		90							
			24'6"	No core	60	Loss of core due washing out of clay						
			27'0"			Broken core						
Partially weathered porphyry	Grey green porphyry with open limonite stained fractures and shears		30'		100	Shears inclined 60° and 25° present. Some shears 15° and vertical fractures present also slickensides common; shears and fractures limonite stained and open.						
						fractured and badly weathered core						
			40'			broken core						
			50'			broken and badly weathered						
			52'8"									
Unweathered porphyry	Yellowish green porphyry with epidote and calcite cement in shears and fractures					No open fractures present / Shears and fractures have been recemented with calcite / No limonite present.						
	Green porphyry with calcite deposited in shears and fractures		61'6"			End of hole	Standing water levels 21-8-58 10'4½" 26-8-58 10'10" 29-8-58 10'10" 3-9-58 11'2" 9-9-58 11'1½" 16-9-58 11'3"					

DRILL No. 1/R 009
TYPE MINDRILL
DRILLER V. HILTUNEN
COMMENCED 15-8-58
COMPLETED 26-8-58

ENGINEERING GEOLOGY BRANCH
LOGGED E.G. WILSON
SHEET No. 1
DRAWN E.G. WILSON
CHECKED
SUBMITTED

VERT. SCALE 1" = 10'
SHEET 1 OF 1
DRAWING No.

ALTERNATIVE YARRALUMLA ~~SNOWY MOUNTAINS HYDRO ELECTRIC AUTHORITY~~

GEOLOGICAL LOG OF DRILL HOLE

PROJECT (WODEN) WEIR SITE FEATURE Molonglo R.

HOLE No. D.D.H. 4 CO-ORDINATES: E ..... M ....., N ..... M ..... R.L. GROUND 1824'

LOCATION North bank in forest above road ANGLE FROM HORIZONTAL Vertical DIRECTION .....

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (FT) FROM	TO	LOSS IN GP.M.	PRESSURE IN S.I.	LENGTH OF TEST (min)
Soil and clay	Red soil and clay		1'3"									
			4'9"				Coring commences 5' 1"					
Slightly weathered porphyry	Slightly weathered but solid yellowish green porphyry with calcite in shears and fractures. Epidote is present throughout giving characteristic colour to core. Sections of core creamy-brown in colour are limonite stained calcite has been leached from shears and fractures in those sections. Solid massive core throughout except where limonitised		10'			Creamy brown limonitised, leached of calcite						
			20'			limonitised						
					100	limonitised						
			30'			Shears dominantly 60° recemented by calcite-calcite also in vertical and low angle fractures both of which displace high angle shears. Slickensides common.						
			40'			broken core limonitised						
						limonitised						
			50'			limonite staining is common in open fractures especially at shallow levels.						
						limonitised						
			60'									
			65'8"									
	End of hole						Standing water levels 3-9-58 45' 11½" 9-9-58 44' 10½" 10-9-58 45' 2"					

DRILL No. 1/A 1009
TYPE MINDRILL
DRILLER V. HILTUNEN
COMMENCED 27-8-58
COMPLETED 30-8-58

ENGINEERING GEOLOGY BRANCH
LOGGED E.G. WILSON
SHEET No. 1
DRAWN E.G. WILSON
CHECKED
SUBMITTED

VERT. SCALE 1" = 10'
SHEET 1 OF 1
DRAWING No.

ALTERNATIVE YARRALUMLA ~~SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY~~

GEOLOGICAL LOG OF DRILL HOLE

PROJECT (WODEN) WEIR SITE FEATURE Middle of Molonglo R.

HOLE No. D.D.H. 5 CO-ORDINATES: E ..... M ....., N ..... M ..... R.L. GROUND 1774'

LOCATION On gravel bank - middle of Molonglo R. ANGLE FROM HORIZONTAL Vertical DIRECTION .....

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (Ft) FROM	TO	LOSS IN (GPM)	PRESSURE (PSI)	LENGTH OF TEST (mins)
Clayey sand	Brown sand and clay		6'7"									
Sandy clay	Grey black clay with coarse sand		8'4"									
Grey-green unweathered porphyry	Solid, green to yellowish green core with phenocrysts of quartz, white feldspar, and femic minerals in a green groundmass. Epidote occurs as an alteration of feldspars. Calcite recements shears and fractures		10' 20' 23'8"	100		Main shears dip 60° others dip 25° Slickensides common calcite cemented 60° shears; limonite coated fractures 20' & 22'; 1" calcite cemented shear dips 60°	Standing water levels 5'0" Creek level					

DRILL TYPE 1A-009 MINDRILL

DRILLER V. HILTUNEN

COMMENCED 2-9-58

COMPLETED 3-9-58

ENGINEERING GEOLOGY BRANCH

LOGGED E.G. WILSON

SHEET No. 1

DRAWN E.G. WILSON

CHECKED .....

SUBMITTED .....

VERT. SCALE 1" = 10'

SHEET 1 OF 1

DRAWING No. .....

ALTERNATIVE YARRALUMLA

~~SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY~~

GEOLOGICAL LOG OF DRILL HOLE

PROJECT (WODEN) WEIR SITE FEATURE Middle of Molonglo R.

HOLE No. D.D.H.6 CO-ORDINATES E. ... M ... N ... M ... R.L. GROUND 1774

LOCATION On gravel bank — middle of Molonglo R. ANGLE FROM HORIZONTAL 50° DIRECTION 302°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (FT) FROM	TO	LOSS IN G.P.M.	PRESSURE P.S.I.	LENGTH OF TEST (min)
Clayey sand	Brown sand with some clay		6'									
Sandy clay	Black clay with coarse sand		11'5"									
	core commences		12'8"			bottom of casing						
Green porphyry slightly weathered in places with deep weathering in localised zones only	Solid green core with phenocrysts of quartz, mainly white feldspar and green femic minerals in a dark green groundmass. Shears have been recemented with calcite — garnet is also present, subsequent leaching of calcite by groundwater leaves open fractures coated with limonite and exhibiting slickensides and in some cases euhedral quartz.		20' 30' 40' 50' 60' 70' 80' 90' 100'		100 85 100	limonite stains in open fractures Slickensides common throughout the core — occasional xenoliths present. Core weathered only where drill intersects zones of deeper weathering associated with vertical fractures limonite 10" lost—clay washed out by water stains in open fractures limonite stains in fractures						

DRILL No. 1/B 1008
TYPE MINDRILL

DRILLER V. HILTUNEN
COMMENCED 4.9.58
COMPLETED 13.9.58

ENGINEERING GEOLOGY BRANCH
LOGGED E.G. WILSON
SHEET No.
DRAWN E.G. WILSON
CHECKED
SUBMITTED

VERT. SCALE 1" = 10'
SHEET 1 OF 2
DRAWING No.

ALTERNATIVE YARRALUMLA

~~SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY~~

GEOLOGICAL LOG OF DRILL HOLE

PROJECT (WODEN) WEIR SITE FEATURE Middle of Molonglo R.

HOLE No D.D.H. 6 CO-ORDINATES: E M N M R.L. GROUND 1774'

LOCATION On gravel bank — middle of Molonglo R. ANGLE FROM HORIZONTAL 50° DIRECTION 302°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (FT) FROM	TO	LOSS IN GAL/MIN	PRESSURE IN P.S.I.	LENGTH OF TEST (mins)
Green porphyry slightly weathered in places with deep weathering in localised zones only	See page 1 for general description		110'			limonite stains in open fractures						
			120'		100	weathered limonite in fractures						
						weathered with limonite						
			180'			limonite stains in open fractures						
			140'									
	End of hole		145'6"				No water levels or water pressure testing in this hole					

DRILL No 1/A .009
TYPE MINDRILL
DRILLER V. HILTUNEN
COMMENCED
COMPLETED

ENGINEERING GEOLOGY BRANCH
LOGGED E.G. WILSON
SHEET No 2
DRAWN E.G. WILSON
CHECKED
SUBMITTED

VERT. SCALE 1" = 10'
SHEET 2 OF 2
DRAWING No.

ALTERNATIVE YARRALUMLA ~~SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY~~

GEOLOGICAL LOG OF DRILL HOLE

1.

PROJECT (WODEN) WEIR SITE FEATURE Middle of Molonglo R.

HOLE No D.D.H. 7 CO-ORDINATES: E M N M R.L. GROUND 1774'

LOCATION On gravel bank—middle of Molonglo R. ANGLE FROM HORIZONTAL 50° DIRECTION 122°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (FT) FROM	TO	LOSS IN GPM	PRESSURE PSI	LENGTH OF TEST (min)
Clayey sand	Brown sand with some clay											
Sandy clay	Dark brown clay with some sand		10'									
	Black clay with coarse sand											
Green porphyry slightly weathered in places with deep weathering in localised zones only.	Solid green core with phenocrysts of quartz, mainly white feldspar, and green femic minerals in a dark green groundmass. Shears have been recemented with calcite — subsequent leaching of calcite by groundwater leaves open fractures coated with limonite and exhibiting slickensides, also euhedral quartz in some places. In part core is epidote green from alteration of feldspars. Garnet is also present.		20' 30' 40' 50' 60' 70' 80' 90' 100'		100	limonite in open fractures; limonite in open fractures; Slickensides common throughout the core — occasional xenoliths present. Core shows epidote present in places. No evidence of direct epidote mineralisation; epidote green						

DRILL No 1/A :009
TYPE MINDRILL

DRILLER V. HILTUNEN
COMMENCED 15-9-58
COMPLETED 19-9-58

ENGINEERING GEOLOGY BRANCH

LOGGED E.G. WILSON
SHEET No. 1
DRAWN E.G. WILSON
CHECKED
SUBMITTED

VERT. SCALE 1" = 10'

SHEET 1 OF 2

DRAWING No.

ALTERNATIVE YARRALUMLA ~~SNOWY MOUNTAINS HYDRO ELECTRIC AUTHORITY~~

GEOLOGICAL LOG OF DRILL HOLE

PROJECT (WODEN) WEIR SITE FEATURE Middle of Molonglo R.

HOLE No D.D.H.7 CO-ORDINATES: E ..... M ..... N ..... M ..... R.L. GROUND 1774

LOCATION On gravel bank — middle of Molonglo R. ANGLE FROM HORIZONTAL 50° DIRECTION 122°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (FT) FROM	TO	LOSS IN DRILL	PRESSURE (P.S.I.)	LENGTH OF TEST (MIN.)
Green porphyry slightly weathered in places with deeper weathering in localised zones only	See page 1 for general description		110' 120' 130'		100	epidote green – zenolith epidote green in colour						
	End of hole						No water levels or water pressure testing in this hole					

DRILL No. 11A '009 TYPE MINDRILL

DRILLER V. HILTHUYEN

COMMENCED 15-9-58

COMPLETED 19-9-58

ENGINEERING GEOLOGY BRANCH

LOGGED E.G. WILSON

SHEET No. 2

DRAWN E.G. WILSON

CHECKED

SUBMITTED

VERT. SCALE 1" = 10'

SHEET 2 OF 2

DRAWING No.

SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY

GEOLOGICAL LOG OF DRILL HOLE

ALTERNATIVE YARRALUMLA

PROJECT (WODEN) WEIR SITE FEATURE

HOLE No. 8 CO-ORDINATES: E M, N M A.L. GROUND 1839'

LOCATION 165' from river channel ANGLE FROM HORIZONTAL DIRECTION

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (FT) FROM	TO	LOSS IN GPM	PRESSURE P.S.I.	LENGTH OF TEST (MINS)
Aeolian	Red fine sand and a little clay		2'									
	Clay and sandy clay											
Lacustrine(?)	Clay, sand and gravel in clay matrix and thin lenses of loose sand (Loose Sand) (Loose Sand)		22'7									
Quartz-porphyry	Decomposed porphyry Firm weathered porphyry		40' 41'3									
			46'3			End of hole						

DRILL No. 4 · 009
TYPE MINDRILL

DRILLER V. HILTUNEN
COMMENCED 23-9-56
COMPLETED 27-9-56

ENGINEERING GEOLOGY BRANCH

LOGGED D. E. Gardner
SHEET No.
DRAWN
CHECKED
SUBMITTED

VERT. SCALE

SHEET OF

DRAWING No.

SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY

GEOLOGICAL LOG OF DRILL HOLE

ALTERNATIVE YARRALUMLA

PROJECT (WODEN) WEIR SITE FEATURE

HOLE No. 9 CO-ORDINATES: E M, N M R.L. GROUND 1832'

LOCATION 265' South-east from river channel ANGLE FROM HORIZONTAL 90° DIRECTION

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION	R.L.	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY (%)	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	NOTES WATER LEVEL (DATE) DRILLING WATER RETURN CHARACTER OF DRILL CUTTINGS	PERCOLATION TEST DEPTH (FT) FROM	TO	LOSS IN GPM	PRESSURE @ 5 ft	MINUTES OF TEST (min)
Aeolian	Sand and sandy clay		3'									
Lacustrine (?)	Silty clay		5'6									
Quartz-porphyry, weathered.	Grey and brown soft weathered porphyry		11'5			End of hole						

DRILL No. 4 "DCP"
TYPE MINDRILL

DRILLER V. HILTUNEN
COMMENCED 29-9-58
COMPLETED 29-9-58

ENGINEERING GEOLOGY BRANCH

LOGGED D.E. Gardner
SHEET No.
DRAWN
CHECKED
SUBMITTED

VERT. SCALE

SHEET OF

DRAWING No.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site — HOLE NO. 10 — R.L. 1778'

LOCATION 28'N of river on axis — ANGLE FROM HORIZONTAL 50° — DIRECTION 110° M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES, JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	
Soil and Sand		10' 15'	Washed to 15'	0% ← NX casing to 20' →	Coring commenced at 15'0"	
Very Weathered Porphyry	Very weathered and granular grey qtz porph with a large amt of clay.	NX casing 20'	lost		Very broken core Limonite + clay.	
Weathered Porphyry	Yellow-brown weathered porphyry with felspars altering to clay. There are zones of intensive weathering where core is fragmental and where clay is abundant. Some slickensiding occurs on the joints 10°-15° to the core axis is a dominant joint direction.	NX 30' 40' 50' 60'	lost lost lost	65% 100% 80%	crushed(?) porphyry with limonite & clay ← Very broken zone. Fairly closely jointed zone, with quartz veins, limonite and slickensiding. Long fractures at 10° to axis. Closely jointed and fractured zone, with limonite and clay Yellow-brown crushed and weathed zone ← Slickensides	
		70'		100%	Clayey material and limonite on joints } SHEAR ZONE with crushed porphyry and clay and calcite	
Fresh Porphyry.	Unweathered greenish grey quartz-porphyry not very closely jointed.	80' 90' 99'6"		100%	A little limonite on the more open joints	

END OF HOLE

DRILL NO 6-A-18
TYPE BOYLES
DRILLER J MORGAN
COMMENCED 26-12-59
COMPLETED 28-12-59

LOGGED P. WHITMEE

VERTICAL SCALE 10' — 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Wooden Weir Site — HOLE NO 11 — R.L 1778'

LOCATION 17'N of river on axis — ANGLE FROM HORIZONTAL 50° — DIRECTION 110° M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY %	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
Soil and Sand.		10' 20'	Washed to 20'	25%	
Slightly weathered Porphyry	Slightly weathered yellow-green quartz-porphyry, very closely jointed.	30'		99%	Closely, but tightly jointed core, with limonite and slickensides on most joints
Fresh Porphyry	Fresh grey-green quartz-porphyry, not very closely jointed, with quartz and calcite veins. The joints show thin films of limonite and some slickensides	40' 50' 60' 70' 80' 87½'		100%	Quartz vein; closely jointed (?crushed) zone; slickensides; small quartz veins; Limonite on all joints; Scattered quartz veins
	END of HOLE.				

DRILL NO 6-A-18

TYPE BOYLES

DRILLER J. MORGAN

COMMENCED 23-12-59

COMPLETED 24-12-59

LOGGED P. WHITMEE

VERTICAL SCALE 10'—1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Sheet 1.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site — HOLE NO 12 — R.L. 1777·6'

LOCATION On South bank of Molonglo R — ANGLE FROM HORIZONTAL 50° — DIRECTION 290°M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES, JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
Fragmental qtz-porphyry	Fragments of slightly weathered quartz-porphyry	5'			limonite on joints Coring commences at 5'6"
Partly weathered qtz-porphy.	Partly weathered grey-brown quartz porphy. Tight joints	NX ↓ 10'		100%	closely jointed, with limonite, clay and slickensiding on jts
Fresh Quartz Porphyry	A fresh grey-green quartz porphyry with phenocrysts of quartz, white felspar and green ferric minerals in a green ground mass (probably epidot-ised). Shears have been recemented with calcite and subsequent leaching by ground water leaves open fractures which are now coated with limonite, clay, and which exhibit slickensides. Some euhedral quartz crystals are also visible on the shears	20'		100%	Most joints tight with a little limonite and/or calcite. Also slight slickensiding. A few open fissures up to 1/16" with limonite, clay, and qtz. crystals
		30'			Thin crush zone cemented by carbonate.
		40'			Matrix almost entirely (?) epidotised
		50'			Thick carbonate veins up to ½" thick occur irregularly
		60'			A number of long tight, clay-filled joints // to core axis.
		70'			Band of strong epidotiz^{n} of ground mass and felspar phenocrysts.
		80'		100%	Xenolith Slickensides with clay and chlorite
		90'			Long calcite vein down joint. ¼" thick Cross joints have rough surfaces
		100'			Carbonate vein Xenolith with reaction rim

DRILL NO 6-A-18

TYPE Boyles

DRILLER J. Morgan

COMMENCED 24-11-59

COMPLETED 26-11-59

LOGGED P. Whitmee

VERTICAL SCALE 10' - 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS Sheet 2.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT WODEN WEIR SITE HOLE NO 12 R.L 1777·6

LOCATION ON SOUTH BANK OF MOLONGLO R. ANGLE FROM HORIZONTAL 50° DIRECTION 290°M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES	
Fresh Quartz Porphyry	See Sheet 1	100 NX 110' 118'		100%	Below 100', rock is highly epidotised Clay and calcite common on joints Zone of recemented protoclastic crushing ←	
	END OF HOLE.					

DRILL NO 6-A-18
TYPE BOYLES
DRILLER J. MORGAN
COMMENCED 24·11·59
COMPLETED 26·11·59

LOGGED P. WHITMEE

VERTICAL SCALE 10'—1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Wooden Weir Site HOLE NO. 13 R.L. 1804'

LOCATION 160'S of river on axis ANGLE FROM HORIZONTAL 50° DIRECTION 110°M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES
Sand		10'			Coring commenced 10'10"
Slightly Weathered Porphyry	Slightly weathered green-grey quartz porphyry, fairly closely jointed with limonite on joints. Some scattered calcite veins	NX ↓ 20' 30' 40'		100%	← ½" calcite and ochrous limonite vein Variable texture Some calcite veins Joints, usually tight, fairly common, often with coatings of dark dendritic limonite or ochrous limonite
Fresh Porphyry	Fresh green-grey quartz-porphyry with scattered calcite veins and tight joints with a thin film of hard brown limonite	50' 60' 70' 80'		100%	Faint slickensides on most joints ← xenoliths Joints mainly tight, but some with grey clay and ochrous limonite ½" calcite vein ½" calcite vein ← closely jointed and broken zone
	End of Hole.				

DRILL NO 6-A-18

TYPE Boyles

DRILLER J. MORGAN

COMMENCED 28-11-59

COMPLETED 1-12-59

LOGGED D.S. WHITMEE.

VERTICAL SCALE 10'—1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site — HOLE NO. 14 — R.L. 1817'

LOCATION 250' S of river on axis — ANGLE FROM HORIZONTAL 50° — DIRECTION 110° M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES,	
Sand		10'				
Gravel	River gravel and reddish sand	20'				Casing to 20'
Weathered Porphyry	Brown weathered qtz porphyry with limonite & clay	NX 25'			closely jointed with slickensides at 60°-70° to axis	
Partly Weathered Porphyry	Partially weathered green-brown quartz porphyry, with fairly common joints. Slickensides are also fairly common. Brown limonite is present on almost all joints and fractures	30' 40' 46'		100%	Numerous close and irregular joints, with limonite	
Fresh Porphyry	Fresh grey quartz porphyry. Grey clay is common on joints below 50'. Carbonate and limonitic material present on joints throughout.	50' 60' 70' 80' 89'		100%	Fairly closely jointed. Joints filled with limonite, ochreous in part, calcite, a little chlorite and some carbonate material. v. closely jointed zone	

DRILL NO 6-A-18

TYPE Boyles

DRILLER J. Morgan

COMMENCED 4-12-59

COMPLETED 7-12-59

LOGGED P. S. Whitmee

VERTICAL SCALE 10' — 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site HOLE NO 15 R.L. 1028'

LOCATION 330' S. of river, on axis ANGLE FROM HORIZONTAL 50° DIRECTION 110°M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES JOINTS VEINS, SEAMS FAULTS CRUSHED ZONES
Clay, Sand, and Silt		10' 20' 30' 40'	Washed to 40'.		Core commences at 40'
Weathered Porphyry	Brown weathered qtz-porphyry; very closely jointed; zones of very broken, granulated and powdery rock. All joints and fractures have ochrous limonite and clay; a few calcite veins also present	NY ↓ 50' 60' 70'	4'0" core lost	76% 100%	Very broken and granulated, powdery in parts; very closely jointed. Some open fissures 1/16"-1/8", partly filled with calcite and ochrous limonite. Small amounts of dark brown clay in granulated zones. Plastic clay seams form about 20% of rock. Less weathered, limonite on joints Scattered calcite veins Hornblende phenocrysts common. Faint slickensides on some joints
Fresh Porphyry	Fresh grey-green qtz-porphyry with xenoliths. Fissures, joints and slickensides fairly common	80' 84'3"		100%	Calcite veins common, limonite and grey clay on joints. Hornblende phenocrysts common
	End of Hole				

DRILL NO 6-A-1B

TYPE Boyles

DRILLER J. MORGAN

COMMENCED 8-12-59

COMPLETED 10-12-59

LOGGED P. S. Whitmee

VERTICAL SCALE 10'—1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Sheet 1

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site HOLE NO 16 R.L. 1829'

LOCATION 380' S of river on axis ANGLE FROM HORIZONTAL 50° DIRECTION 290°M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
Soil	Buff-grey fine silty soil cover	NX ↓ 4'			
Sand	A fine red-brown fine grained aeolianite, becoming more nodular with depth. Leaching and clay content incr. with depth also.	10' 20' 25'		100% dry to 42'3"	
Silty Sand	Buff silty sand and sandy silt. Numerous small pebbles increasing in size with depth.	30' 40' NX Casing ↓ 50' 55'5"		Drilled 100% ← Drilled with NX Casing	
Gravel	River gravel (cobbles).	59'		84%	
Fairly Fresh Quartz Porphyry	A fairly fresh, fairly closely jointed quartz-porphyry with limonite, clay and slickensides on the joints. There are some crushed(?) zones up to 8" wide in which weathering has occured	60' NX ↓ 70' 80' 90' 100'		100%	Open joints with limonite. Fine tight joints. inclusion. Crushed zone. well jointed zone possibly shattered. Decomposed clayey grey-yellow-brown material with coarser quartz grains. Joints at 45° to axis. A great deal of carbonate and quartz veins

DRILL NO 6-A-18

TYPE BOYLES

DRILLER J MORGAN

COMMENCED 18-11-59

COMPLETED 23-11-59

LOGGED P. Whitmee

VERTICAL SCALE 10' — 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS Sheet 2.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site HOLE NO. 16 R.L. 1829'

LOCATION 380' S of river on axis ANGLE FROM HORIZONTAL 50° DIRECTION 290°M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	
Fresh Quartz Porphyry	See Sheet 1	NX ↓ 110' 120'		100%	Most joints have rough surfaces; some have a clay film and others have small pyrite aggregate. Joints very irregular, with clay, quartz, calcite, limonite and	chlorite
	END OF HOLE.					

DRILL NO 6-A-18

TYPE Boyles

DRILLER J. MORGAN

COMMENCED 18-11-59

COMPLETED 23-11-59

LOGGED

VERTICAL SCALE 10' — 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site HOLE NO 17 R.L. 1821'

LOCATION 270' S of river on axis ANGLE FROM HORIZONTAL 50° DIRECTION 290°M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LOSS & CORE RECOVERY	STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES
Clay, Silt, and Sand			Washed to 40'		
		30'0"			Coring commenced at 30'0"
Very weathered porphyry	Very weathered yellow-brown quartz-porphyry, fairly closely jointed	NX ↓ 35'1"		100%	Black limonite on joints; closely jointed and broken zone
Partly Weathered porphyry	Green grey quartz porphyry, with limonite and calcite	40'			Limonite, calcite and clay on joints; deeply weathered zone; Some slickensides
Unweathered porphyry	A light grey-green qtz-porphyry with fairly fine ground mass. Fairly closely jointed, open joints coated by limonite. Shears have been recemented by calcite which, when leached leaves open fractures. Deep weathering in localized zones. Faint slickensides on most joints Core is epidotised in lower 20'.	50'			closely jointed and broken, clay on jts.
					Limonitic clay band 3"
		60'			← Xenoliths
				100%	
		70'			Grey clay on joints
					Calcite veins common.
		80'			
					Clay and limonite on all joints below 70'
		90'			
					Closely jointed and broken zone.
		100'			
		101'0" End of Hole			

DRILL NO 6-A-1B

TYPE BOYLES

DRILLER J. MORGAN

COMMENCED 1-12-59

COMPLETED 3-12-59

LOGGED P.S. WHITMEE.

VERTICAL SCALE 10'—1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site HOLE NO 18 R.L. 1831'

LOCATION 530' S. of river, on axis ANGLE FROM HORIZONTAL 90° DIRECTION

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
Sand, silt, and clay.		10' 20' 30'			Coring Commenced 30'0"
Weathered Porphyry	Weathered brown qtz-porphyry; limonite common on joints. Some slickensiding	NX ↓		100%	2" crushed zone. joints fairly open, slickensides
Fresh Porphyry	A light grey-green quartz-porphyry. Fairly closely jointed, limonite present on all joints; a few calcite veins. Slickensides on most joints.	40' 50' 60' 69'9"		100%	Frequent fairly open joints, with limonite and slickensiding. A fractured less compact zone with clayey material on joints. Joints less frequent and closer; clayey material on joints
	End of Hole				

DRILL NO 6-A-18

TYPE Boyles

DRILLER J. MORGAN

COMMENCED 12-12-59

COMPLETED 14-12-59

LOGGED P.S. Whitmee

VERTICAL SCALE 10'—1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT WODEN WEIR SITE HOLE NO. 19 R.L. 1841 ft

LOCATION 650'S of river; 580'E of axis ANGLE FROM HORIZONTAL 90° DIRECTION

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES, JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
Soil	Brown Soil	2'			
Sand	Fine buff sand	7'			
Clayey Sand	Buff coloured clay and sand	15'			
Slightly weathered porphyry	Slightly weathered but solid green-grey quarty porphyry. Epidote is present throughout, giving a characteristic colour. Limonite staining is common, and calcite is present in small quantities	NX 20'		100	Closely jointed; clay and limonite on joints crushed zone with limonite Slickensides common on joints Limonite staining common on the more open joints
	End of Hole	30' 38'1"			

DRILL NO 6-A-18

TYPE BOYLES

DRILLER J. MORGAN

COMMENCED 15-12-59

COMPLETED 16-12-59

LOGGED P.S. Whitmee

VERTICAL SCALE 10' = 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT WODEN WEIR SITE HOLE NO 20 R.L. 1829

LOCATION 480' S of river, 15' W. of axis ANGLE FROM HORIZONTAL 90° DIRECTION

Alluvial deposits	Silty clay and sand aeolianite(?)	NX 10' 20' 25'		72%		
Gravel.	River gravel	28'		33%		
Sand	Silty sand	30'		0%		
Porphyry	Brown weathered porphyry				Limonite + clay on joints Slickensiding on joints	
	Slightly weathered porphyry	40'		100%	Closely jointed	
	Fresh porphyry	50'		100%	Slickensiding on joints. Closely jointed	
	Fresh porphyry				Limonite on jts.	
		60' 70' 80'				

DRILL NO 6-A-18
TYPE BOYLES
DRILLER J. MORGAN
COMMENCED 16.12.59
COMPLETED 17.12.59

LOGGED P WHITMEE

VERTICAL SCALE 10' - 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT WODEN WEIR SITE HOLE NO R1 R.L 1829

LOCATION ANGLE FROM HORIZONTAL 90° DIRECTION

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIST & CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	
Alluvial deposits.		10' 20' 30'				
Porphyry	Weathered porphyry	40'			Crushed porphyry Limonite on joints Closely jointed Slickensiding on joints	
	Weathered porphyry	50'			Limonite on joints	
	Fresh porphyry				Closely jointed	
		60'			Crushed porphyry Slickensiding on joints.	

DRILL NO 6-A-18

TYPE BOYLES

DRILLER J. MORGAN

COMMENCED 17.12.59

COMPLETED 18.12.59

LOGGED P WHITMEE

SCALE 10' = 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: WOODEN WEIR SITE HOLE NO. 22

LOCATION 320' S of river, 100' W of axis ANGLE FROM HORIZONTAL 90° DIRECTION

Alluvial Clay Silt, Sand		10' 20' 30' 34'		100%		
Partly Weathered Porphyry	Partly weathered grey-green porphyry, with a high proportion of clay	NX ↓ 39' 40'		88%	very closely jointed zone, deeply weathered with clay and limonite	
Unweathered Porphyry	Fresh, unweathered grey-green quartz porphyry, with calcite and quartz veins, and limonite, clay, on joints. Slickensides on joints	50' 59¼"		100%	Highly fractured (?crushed) zone with a little clay. limonite and slicken sides on most joints	
	END OF HOLE					

DRILL NO 6-A-18
TYPE BOYLES
DRILLER
COMMENCED 19-12-59
COMPLETED 20-12-59

LOGGED P. S. WHITMEE.
VERTICAL SCALE 10' – 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site HOLE NO. 23 R.L. 1775'

LOCATION On island in middle of river, 100' W of axis ANGLE FROM HORIZONTAL 90° DIRECTION

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES JOINTS VEINS, SEAMS FAULTS CRUSHED ZONES	
Alluvial Sand and silt		10'	Washed to 10'	0%		
Fresh Porphyry	Fresh unweathered grey-green quartz porphyry, sparsely jointed but highly epidotised in the lower 20' of the core. Quartz and calcite veins occur in the upper portion. Limonite and slickensides occur on most joints throughout core.	20'		100%	} calcite veins.	
					← Pyrite and epidote on joint.	
		30'			← Slickensides ∥ to axis	
					← closely jointed zone	
		40'			} Epidotised zone	
		43'3"				

DRILL NO 6-A-18

TYPE BOYLES

DRILLER J. MORGAN

COMMENCED 20-12-59

COMPLETED 22-12-69

LOGGED P. WHITMEE

VERTICAL SCALE 10' – 1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Sheet 1.

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site HOLE NO 24 R.L. 1783'

LOCATION 50' N. of river, 100' W of axis ANGLE FROM HORIZONTAL 50° DIRECTION 110°M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES	
Soil and Sand.		10' 20'	Washed to 20'	0%		
Weathered Porphyry	Fairly deeply weathered and partly crushed greyish-brown quartz porphyry.	NX ↓ 30' 40'		100%	Limonite and calcite crystals are present on the joints. A large proportion of the dominant fractures are at 10-15° to the core axis. Granulated zone. ← Clay. Calcite xtals on joints.	
Fairly Fresh Porphyry	Fresh unweathered greyish-green qtz-porphyry with a small number of joints and a few quartz and calcite veins. Joints are fairly tight	50' 60' 70' 80' 90' 100'		100%	Core recovered in large pieces often up to 2' long. Limonite, clay, and slickensides on occasional joints	

DRILL NO 6-A-18
TYPE Boyles
DRILLER J. MORGAN
COMMENCED 29-12-59
COMPLETED 2-1-60

LOGGED P. WHITMEE

VERTICAL SCALE 10'-1"

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Sheet 2

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Woden Weir Site HOLE NO. 24 R.L. 1783'

LOCATION 50° N. of river, 100' W of axis ANGLE FROM HORIZONTAL 50° DIRECTION 110°M

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES, JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	
Fresh Porphyry	See Sheet 1	NX ↓ 110' 115'			Limonite on some joints	
Slightly weathered and crushed porphyry	Slightly weathered and crushed green-grey quartz porphyry, deeply weathered in parts, and closely jointed Some crushing and granulation has occurred.	120' 130' 140' lost 150' 151'0"		100% 63%	Alternating zones of very close jointing and fairly fresh material. Slickensides are common. Crushed zone with clay and limonite. Crushed zone, with very angular fragments and clay. } unweathered zone.	
	END OF HOLE.					

DRILL NO. 6-A-1B

TYPE B.OYLES

DRILLER J. MORGAN

COMMENCED 29-12-59

FINISHED 2-1-60

LOGGED P. WHITMEE

VERTICAL SCALE 10' — 1"

PLATE I

GEOLOGICAL MAP
WODEN WEIR SITE

Scale: 40 Ft. to 1 Inch.

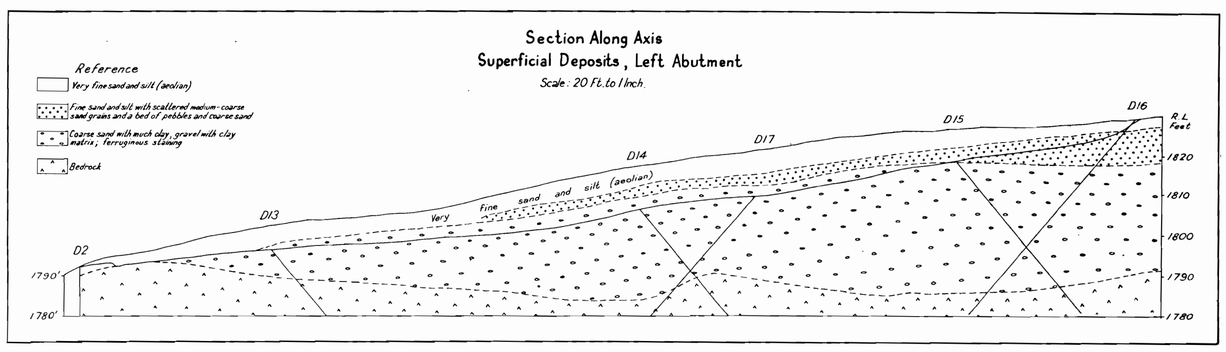
Plane-table and telescopic alidade survey by:
J. T. Harding, P. S. Whitmee & D. E. Gardner

Reference

- Recent — River alluvium
- Fine sand and silt (aeolian)
- (?) Pleistocene — Silty sand, gravel and clay in lenticular beds (lacustrine ?)
- Silurian — Mt. Painter porphyry (quartz porphyry)
- Strike and dip of joint
- Vertical joint
- Minor shear zone
- Possible boundary of crushed zone beneath alluvium
- 1810 Contour based on Canberra City datum
- 1822 Proposed top water level
- 220 Diamond drill hole
- A9 11' Auger hole showing depth to "gravel" reported in log of auger operator
- Fence
- A — A' Section Line
- C4 Costean

Section Along Axis
Superficial Deposits, Left Abutment

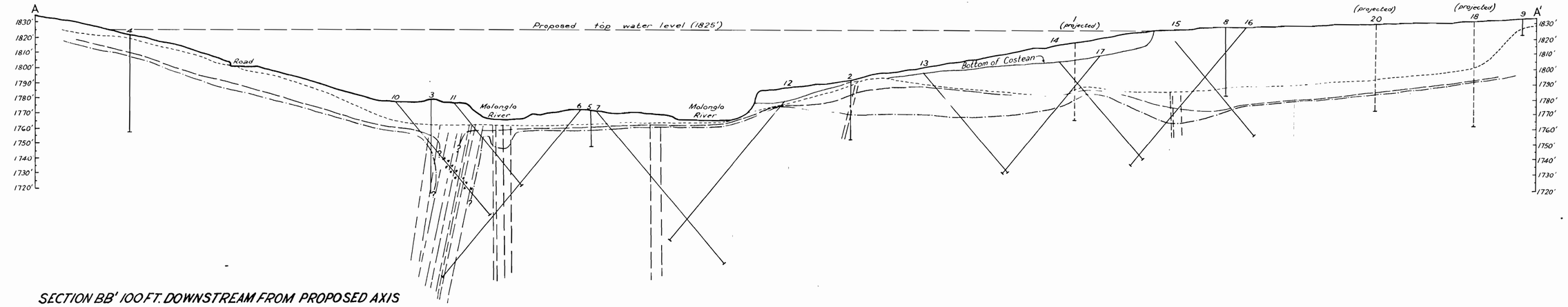
Scale: 20 Ft. to 1 Inch.



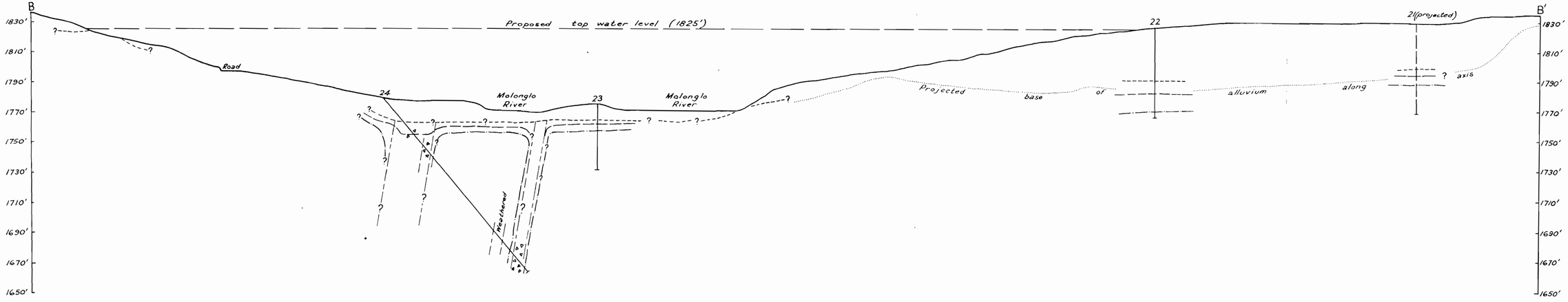
ACT8-9

PLATE 2

SECTION A A' ALONG PROPOSED AXIS OF WEIR



SECTION BB' 100 FT. DOWNSTREAM FROM PROPOSED AXIS



Reference

- Natural surface
- Base of alluvium (top of unweathered porphyry)
- Suggested foundation level (hard weathered porphyry)
- Top of unweathered porphyry
- Fracture zone
- Crushed rock
- Diamond drill-hole

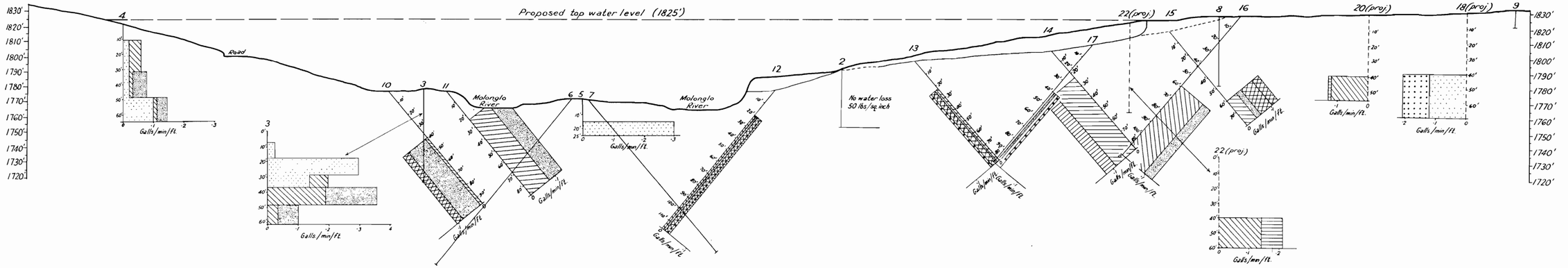
Interpretation of boundaries and structure between drill-holes 24 and 23 is diagrammatic. The crushed bands are probably lenticular and discontinuous down dip and along the strike.

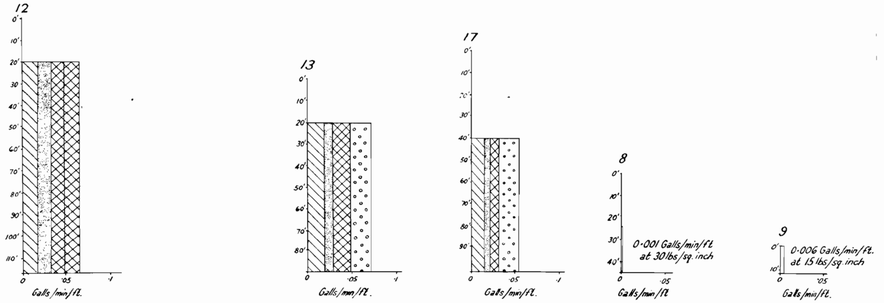
GEOLOGICAL SECTIONS
WODEN WEIR SITE

Scale: 40 Ft. to 1 Inch.

ACT 8-10

PLATE 3





Note.: Above 5 dwgs. on enlarged horizontal scale

Reference

Water Pressures lbs. per sq. inch

- 15 - 20
- 25 - 30
- 40 - 44
- 45 - 54
- 55 - 65
- 70 - 85
- 100

4 — Diamond drill hole

WATER PRESSURE TESTING

Water Loss in Gallons Per Minute Per Foot

WODEN WEIR SITE

Scale: 40 Ft. to 1 Inch

ACT8-11