AS Geduld Dez

GEOLOGICAL AND STRUCTURAL MODEL FOR THE TSHIPISE FAULT ZONE IN THE ALLDAYS AREA, DISTRICTS BOCHUM, PIETERSBURG AND SOUTPANSBERG, LIMPOPO PROVINCE

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Prepared for:

Department of Water Affairs and Forestry;
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1.2.4 (63)
2.2.(934)

GRUISFONTEIN 368 MS	LJ40	26-0470	22.50'34.7"	29.15'15.4"	120	2002-03-20	2002-03-21	
VOGELFONTEIN 372 MS	LJ41	26-0471	22.51'41.3"	29.11'57.2"	120			
VOGELFONTEIN 372 MS	LJ42	26-0472	22.50'51.9"	29.12'16.2"	120			
DE VREDE 382 MS	DV43	26-0483			95			
GOUDMYN 327 MR	GM 45	26-0484	22.53'07.0"	28.47'13.1"	100	2002-05-10	2002-05-13	23m/0.05l/s
FONTAINE DU CHAMP 367 MR	FDC46	26-0485	22.53'00.8"	28.51'14.1"	100	2002-05-13	2002-05-14	64,66
BREST 332 MS	BR47	26-0486	22.45'15.0"	29.02'01.0"	100	2002-05-15	2002-05-16	DRY
TAAIBOSHGROET 324 MR	TBG48	26-0487	22.51'32.8"	28.55'47.0"	265	2002-05-20	2002-05-22	25m/1.3l/s
TAAIBOSHGROET 324 MR	TBG49	26-0488	22.51'45.0"	28.55'35.4"	80	2002-05-23	2002-05-23	17m/1.8l/s
TAAIBOSHGROET 324 MR	TBG50	26-0489	22.51'49.8"	28.55'28.3"	80	2002-05-23	2002-05-24	18m/0.4l/s
TAAIBOSHGROET 324 MR	TBG51	26-0490	22.51'39.9"	28.55'19.9"	80	2002-05-24	2002-05-24	52m/0.2l/s
TAAIBOSHGROET 324 MR	TBG52	26-0491	22.51'42.0"	28.55'08.8"	200	2002-05-27	2002-05-28	25m/0.93l/s
HALY 329 MS	HALY53	26-0492	22.43'00.3"	29.06'18.1"	60	2002-06-10	2002-06-11	DRY
HALY 329 MS	HALY54	26-0497	22.42'56.6"	29.06'17.1"	60	2002-06-11	2002-06-11	DRY
HALY 329 MS	HALY55	26-0498	22.42'58.7"	29.06'16.1"		2002-06-11	2002-06-12	DRY
HALY 329 MS	HALY56	26-0499	22.43'03.2"	29.06'16.7"	120	2002-06-12	2002-06-12	70m/2.2l/s; 100m/5.5l/s
MAIDSTONE 371 MS	MS57	26-0500	22.49'19.8"	29.09'33.2"	200	2002-06-13	2002-06-14	0.6l/s
PITCAIRN 336 MS	PC58	26-0501	22.47'03.1"	29.04'36.6"	200	2002-06-18	2002-06-19	modder
GREENFIELD 333 MS	GF59	26-0502	22.48'45.6"	29.01'37.7"	30	2002-06-20	2002-06-20	12m/0.08l/s
GREENFIELD 333 MS	GF60	26-0503	22.49'12.4"	29.01'33.6"	30	2002-06-20	2002-06-20	DRY
GREENFIELD 333 MS	GF61	26-0504	22.48'36.5"	28.59'42.4"	30	2002-06-21	2002-06-21	DRY
GREENFIELD 333 MS	GF62	26-0505	22.47'44.1"	28.59'28.1"	80	2002-06-21	2002-06-21	DRY
GREENFIELD 333 MS	GF63	26-0506	22.47'15.3"	28.59'29.8"	80	2002-06-24	2002-06-24	DRY
GREENFIELD 333 MS	GF64	26-0507	22.48'44.0"	29.00'45.7"	30	2002-07-15	2002-07-15	DRY
GREENFIELD 333 MS	GF65	26-0508	22.48'45.7"	29.00'27.8"	30	2002-07-15	2002-07-15	Syfer water
GREENFIELD 333 MS	GF66	26-0509	22.48'48.1"	29.00'18.4"	30	2002-07-16	2002-07-16	Syfer water
GREENFIELD 333 MS	GF67	26-0510	22.50'20.9"	29.00'12.8"	195	2002-07-16	2002-07-19	
RHONE 321 MR	RO68	26-0512	22.48'05.2"	28.56'57.0"	80	2002-07-22	2002-07-22	DRY
RHONE 321 MR	RO69	26-0513	22.48'07.4"	28.56'55.8"	30	2002-07-23	2002-07-23	DRY
RHONE 321 MR	RO70	26-0514	22.48'10.6"	28.56'54.1"	80	2002-07-23	2002-07-23	Syfer water
PAX INTRANTIBUS 369 MR	PAX71	26-0515	22.56'48.0"	28.54'53.2"		2002-07-24		
DE VREDE 382 MS	DV44		22.53'13.8"	28.59'00.3"	162			

2229CD26
CC635
CC636
2228DD408
DD252
DD410
2229CC546
2228DD255
DD254
264
263
253
2229CA9
CA10
28
5
CC537
541
538
539
2228DD260
261
262
2229CC542
543
544
545
2228DD257
DD258
259
266

TACTICS PROJECT - LIMPOPO PROV.

FARM NAME/NO	BH NR	H NUMBER	LAT	LONG	DEPTH	DATE DRILLED	DATE COMPL	WATER STRIKE
TUSKOW 255LR	SEM07	11-1742	23.01'28.1"	28.52'25.0"	35	2001-11-23	2001-11-23	DRY ✓
DEVON 443 MS	BB08	11-1743	23.00'00.9"	29.02'39.9"	250	2001-11-26	2001-11-28	X
TUSKOW 255LR	SEM05	11-1744	23.01'25.7"	28.52'24.9"	110	2001-11-21	2001-11-22	DRY ✓
TUSKOW 255LR	SEM04	11-1745	23.01'25.2"	28.52'25.2"	165	2001-11-20	2001-11-21	140m/0.2l/s ✓
TUSKOW 255LR	SEM06	11-1746	23.01'24.4"	28.52'25.4"	160	2001-11-22	2001-11-23	DRY ✓
DEVON 443 MS	BB34	11-1787	23.00'27.7"	29.02'47.6"	65	2002-03-07	2002-03-07	✓
DEVON 443 MS	BB35	11-1788	23.00'27.5"	29.02'49.0"	25	2002-03-08	2002-03-08	✓
DEVON 443 MS	BB36	11-1789	23.00'26.7"	29.02'50.8"	25	2002-03-11	2002-03-11	✓
FONTAINE DU CHAMP 367 MR		26-0157						✓
FONTAINE DU CHAMP 367 MR		26-0161						1402 ✓
MELPOMENE 364 MR	MP01	26-0439	22.57'34.2"	28.47'00.1"	340	2001-11-08	2001-11-14	4012 60m/7l/s ✓
FONTAINE DU CHAMP 367 MR	FDC02	26-0440	22.52'50.3"	28.52'29.2"	250	2001-11-15	2001-11-16	DRY ✓
TERVEEN 381 MS	TER03	26-0441	22.57'00.4"	29.02'26.8"	110	2001-11-19	2001-11-19	21m/5l/s DW71 ✓
KROMHOEK 438 MS	KH9	26-0442	22.56'57.7"	29.02'27.8"	160	2001-11-29	2001-11-30	84m/3.23l/s;145m/9.46l/s
ROSYTH 378 MS	ROS10	26-0443	22.52'48.8"	29.04'23.1"	40			9m/0.2l/s
ROSYTH 378 MS	ROS11	26-0444	22.52'50.3"	29.04'22.4"	90	2001-12-03	2001-12-04	75m/0.2l/s
ROSYTH 378 MS	ROS12	26-0445	22.52'49.4"	29.04'22.7"	83	2001-12-04	2001-12-04	75m/2.25l/s
ROSYTH 378 MS	ROS13	26-0446	22.53'11.6"	29.04'07.5"	30	2001-12-05	2001-12-05	9m/0.2l/s
ROSYTH 378 MS	ROS14	26-0447	22.53'18.1"	29.04'07.5"	200	2001-12-05	2001-12-06	127m/1.59l/s
ROSYTH 378 MS	ROS15	26-0448	22.52'47.2"	29.04'24.1"	158	2002-01-18	2002-01-18	DRY
ROSYTH 378 MS	ROS16	26-0449	22.51'57.5"	29.04'54.5"	150	2002-01-21	2002-01-21	18m/3.6l/s
ULSTER 375 MS	UL17	26-0450	22.52'00.8"	29.08'14.1"	50	2002-01-28	2002-01-28	
ULSTER 375 MS	UL18	26-0451	22.52'01.4"	29.08'13.8"	70	2002-01-28	2002-01-29	
ULSTER 375 MS	UL19	26-0452	22.52'25.4"	29.08'11.6"	150	2002-01-29	2002-01-30	
ULSTER 375 MS	UL20	26-0453	22.52'26.0"	29.08'11.4"	130	2002-01-30	2002-01-30	
ULSTER 375 MS	UL21	26-0454	22.52'26.6"	29.08'11.4"	40	2002-01-31	2002-01-31	
ULSTER 375 MS	UL22	26-0455	22.52'27.2"	29.08'11.2"	245	2002-02-01	2002-02-05	
ULSTER 375 MS	UL23	26-0456	22.52'34.7"	29.08'09.6"	70	2002-02-06	2002-02-06	
KROMHOEK 438 MS	KH24	26-0457	22.57'03.0"	29.02'28.5"	237		2002-03-13	
DE VREDE 382 MS	DV25	26-0458	22.53'13.7"	28.59'00.5"	80			
DE VREDE 382 MS	DV26	26-0459	22.53'13.7"	28.59'00.3"	163		2002-05-09	
GANSPAN 829 MS	GP27	26-0460	22.56'25.5"	29.08'05.6"	190			
FRAAIFONTIEN 447 MS	FF28	26-0461	22.58'55.3"	29.11'06.8"	43	2002-02-28	2002-02-28	
FRAAIFONTIEN 447 MS	FF29	26-0462	22.58'55.3"	29.11'09.0"	23	2002-02-28	2002-02-28	
FRAAIFONTIEN 447 MS	FF30	26-0463	22.58'50.3"	29.11'07.7"	120	2002-03-01	2002-03-04	0.1l/s
FRAAIFONTIEN 447 MS	FF31	26-0464	22.58'49.6"	29.11'07.5"	125	2002-03-04	2002-03-04	
FRAAIFONTIEN 447 MS	FF32	26-0465	22.58'44.5"	29.11'06.2"	200	2002-03-05	2002-03-06	
FRAAIFONTIEN 447 MS	FF33	26-0466			120			0.9l/s
LANGJAN 370 MS	LJ37	26-0467	22.50'00.8"	29.13'10.1"	150	2002-03-18	2002-03-19	
LANGJAN 370 MS	LJ38	26-0468	22.49'55.2"	29.13'11.6"	45	2002-03-19	2002-03-19	
LANGJAN 370 MS	LJ39	26-0469	22.49'55.2"	29.13'11.8"	120	2002-03-19	2002-03-20	

2328 BB112
2329AA 12
2328 BB115
2328 BB 113
2328BB114
2329AA 805
2329AA 806
2329AA 807
2228DD238
2228DD377
2229 DD 174
2228 248
2228DD249
2229 CC 512
CC 513
514
515
517
511
634
524
520
519
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522
521
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2228DD250
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2229 CC 530
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CONTENTS

1. INTRODUCTION

1.1 Aim of the study

The aim of this study is to re-interpret the existing geological, structural and geophysical data, and to integrate them into a working model that will provide the tools to qualify the various tectonic structures and lithological units with regard to their groundwater potential.

1.2 Project area

The project area (Fig. 1) is situated south of Alldays, and covers approximately 1800 km^2 on Sheets 2229 CA Alldays, 2228 DD Raditshaba, 2229 CC Skeenshoek, 2328 BB Addney and 2329 AA Blouberg. It is part of the Magisterial Districts of Bochum, Pietersburg and Soutpansberg.
The project area is defined by the following corner points: Serala and Tlhagatsane Hills in the north, and Semaoko Hill and the southeastern corner of Stafford 431 MS in the south (Figures 1 & 2).

1.3 Topography

Most of the project area is underlain by compositionally uniform Karoo lava, and forms a monotonous, featureless landscape. In the northeast the area has an elevation of 750-800 m, rising gently to 900 m in the south. In the northwest which is underlain by Beit Bridge gneisses the monotony is partly broken by a few ridges with moderate height, formed mainly by resistant metaquartzite.

Just south of the project area the flat ground rises over a very short distance of a few kilometres to a height of just over 2 000 m at Blouberg. This exceptionally high ground extends for 35 km along the southern boundary of the project area.

1.4 Drainage

In the main area underlain by Karoo rocks there are virtually no streams developed, not even close to Blouberg Mountain in the south. The alluvial cover, i.e. mainly loose sand and scree, and decomposed Karoo lava appear to soak up like a sponge any natural precipitation, and also any run-off from the Blouberg Mountain.

1.5 Climate

The project area is characterized by cool dry winters and hot humid summers. Rain is precipitated generally as localized heavy thunderstorms. Mean annual precipitation varies in the area between 320 mm and 480 mm, but rises to about 1500 mm at Blouberg Mountain.

2. PREVIOUS INVESTIGATIONS

The first geological map at a scale of 1: 250 000 covering the area under consideration was

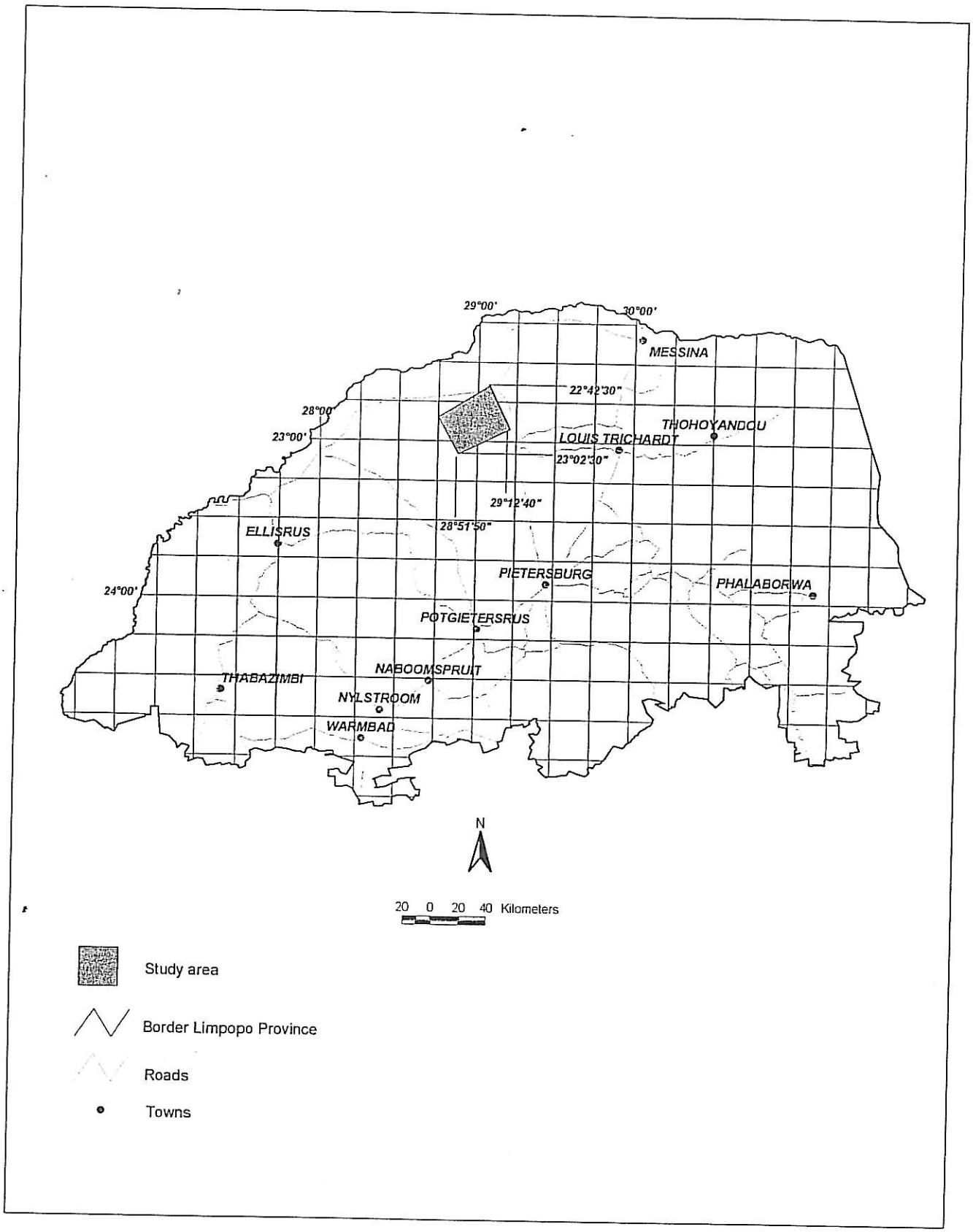


FIGURE 1: LOCALITY MAP OF PROJECT AREA

published in 1957, but without explanatory notes. This map gives a rough outline of the main structures and lithologies present. More recently detailed explanations (Brandl, 2001 & 2002) with accompanying geological maps at scales of 1: 500 000 and 1: 250 000, respectively, were published. These maps show the subdivisions of the Beit Bridge and Karoo rocks, and indicate the relevant structural features.

Comprehensive studies on the geohydrology of the area are available since 1982, and are detailed in Section 6. below.

3. GENERAL GEOLOGY

The rocks encountered in the study area comprise three major geological units, i.e. the Archaean Beit Bridge Complex, the Mid-Proterozoic Soutpansberg Group, and the Phanerozoic Karoo Supergroup. A satellite image of the project area and environs is provided as Fig. 2.

The Beit Bridge Complex is part of the Limpopo Belt which is subdivided into three domains, a Central Zone and two flanking Marginal Zones. They are separated from each other, and also from the neighbouring Kaapvaal and Zimbabwe Cratons, by major shear zones. Lithologically the Central Zone is markedly different from the Marginal Zones, and regarded as an exotic terrane.

In the study area the Beit Bridge Complex of the Central Zone is dominated by supracrustal gneisses such as metaquartzite, amphibolite, marble and calc-silicate rocks. These supracrustal gneisses are intruded in a lit-par-lit fashion by Messina Suite anorthosite, Alldays Gneiss and leucocratic quartzo-feldspathic gneisses, with the latter forming only poor outcrop. The supracrustal gneisses are believed to have an age in excess of 3.3 Ga, whereas the Messina anorthosite could be around 3.25 Ga. The Alldays Gneiss and leucogneisses are much younger, having ages around 2.65 and 2.5 Ga, respectively. The origin of the leucogneisses is not clear, though it appears that the majority of them are of igneous parentage. The Beit Bridge rocks were subjected to several high-grade metamorphic events, with the main granulite-grade event having taken place at 2.0 Ga (Kröner et al, 1999).

Rocks of the Soutpansberg Group (~1.97-1.80 Ga) were deposited on the uplifted granulite-grade Beit Bridge gneisses. The mainly volcanic lower part of the Group developed probably in a rifted environment, whereas the mainly arenaceous upper half was deposited in a broad basin. Both units are separated by an unconformity (Cheney et al., 1990).

After a long period of tectonic quiescence and possible non-deposition, mainly argillaceous sediments of the Karoo Supergroup were deposited on an almost featureless landscape. Interlayered coarse arenaceous horizons (Fripp and Klopperfontein Formations) developed in response to tectonic uplift in a northerly source area. The sediments are capped by flood basalts (Letaba Formation) which extruded from east-west trending fissures onto an uneven dune landscape.

3.1 Beit Bridge Complex

The supracrustal gneisses of Complex which include in the project area metaquartzite, amphibolite, marble and calc-silicate rocks are interpreted to represent mainly a shelf-type sequence.

3.1.1 Metaquartzite

Owing to its highly resistant nature, metaquartzite forms the main topographic features in the project area. They can be followed for many kilometres through the area, and the steep slopes are often littered by large blocks and scree. The width of individual horizons probably nowhere exceeds 50 m.

The rock is generally massive, medium- to coarse-grained, and where fresh has mostly a milky to greyish white colour, but pinkish, greenish or brownish varieties do occasionally occur. As the metaquartzite is in general largely recrystallized, it frequently assumes the appearance of vein quartz. A well developed joint system can often be seen in the competent rock.

The metaquartzite is entirely recrystallized, and consists of an interlocking mosaic of mainly quartz grains which show undulose extinction or extinction bands. Grain boundaries are often strongly sutured. Individual grains can be up to 5 mm in length, but are generally around 3 mm. Minor constituents of the massive variety include plagioclase, K-feldspar, pyroxene, grunerite and garnet.

Besides the common massive metaquartzite, foliated varieties can locally be developed in which the fabric is accentuated by biotite, muscovite, fuchsite or sillimanite. The foliation planes, which can be spaced from a few millimetre to several centimetres, may represent original bedding planes. Biotite-bearing metaquartzite is the most common foliated variety, and usually occurs where metaquartzite grades into metapelitic rocks..

Most of the metaquartzite, at least the fairly thick layers, are interpreted to be of sedimentary (quartz arenite) rather than of chemical (chert) origin. The complete lack of coarse material, and the often observed association with marble may indicate that the metaquartzite represents mainly a marine shelf deposit, with the adjacent hinterland having been a low lying, stable land surface.

3.1.2 Amphibolite

Layers of amphibolite are only rarely developed, and are generally not wider than 100 m. In hand specimens the amphibolite is bluish black or brownish, depending on the amount of pyroxene present. Sometimes the rocks have a typically speckled appearance. Texturely two main varieties can be distinguished: a fine- to medium-grained type and a coarse-grained one. The latter forms massive outcrops, generally with no intercalations of other supracrustal gneisses.

The major constituents of the amphibolite are plagioclase, hornblende, clinopyroxene, hypersthene, quartz and biotite. Garnet is a major constituent in only a few units, and is often associated with thin felsic bands. Major units of garnetiferous amphibolite are rarely developed. Hornblende can be up to 6 mm in length, is greenish or olive brown, and occasionally is seen to be overgrown by hypersthene or partially replacing pyroxene. Plagioclase is mainly andesine, and generally shows zoning and partial alteration to sericite and epidote. Biotite occurs either as

relatively large subidioblastic grains or as an alteration product along fractures in hornblende. Garnet which can measure up to 20 mm across is poikiloblastic, displaying numerous inclusions of generally quartz and plagioclase..

The supracrustal amphibolites that have a relatively small grain size can be of igneous extrusive (basaltic lava) or sedimentary origin (marly sediment). Of sedimentary origin are probably those amphibolites which form thin bands, and which are intimately interlayered with clastic and calcareous rocks. Amphibolites forming layers of considerable thickness and having a uniform appearance are interpreted to represent mainly basaltic lavas. The coarse-grained amphibolites are thought to have derived from gabbroic sills or stocks.

3.1.3 Marble and calc-silicate rocks

Both lithologies are intimately associated, and are often seen to give rise to a number of prominent horizons. They form positive features due to the relatively dry climate of the area. Whereas the calc-silicate rocks generally give rise to narrow steep features, the marbles form rather wide, low ridges which are often covered by calcrete.

Marble

The marble is a medium-to coarse-grained, often massive recrystallized rock which weathers to a blackish grey or dark brown skin on which the more resistant accessory minerals stand out as small protuberances. The colour of fresh specimens can range from milky white through light grey to bluish grey, and locally an attractive pink colour is developed. Colour generally depends on the amount of the accessory minerals present, and where these accessories are more abundant the marble attains a rather banded appearance, showing gradations into a calc-silicate rock. Maximum thickness of individual marble horizons is at least 20 m.

The marble consists mainly of interlocking grains of calcite/dolomite which average 0.5-3 mm in size, but can range up to 20 mm. The accessory minerals can reach up to about one third of the rock, and consist mainly of olivine, pyroxene, phlogopite/biotite, spinel and amphibole.

With pure white marble being rare, the most common type is an olivine marble in which the olivine (forsterite) is variously altered to antigorite. Grain size of olivine is generally much smaller than that of calcite/dolomite, but occasionally grains can be up to 6.0 mm.

Geochemical analyses indicate that the precursors of the marbles were pure to slightly impure carbonates. Some carbonate horizons are almost entirely calcite, whereas others can be entirely dolomite.

Calc-silicate rocks

Calc-silicate rocks are in general intimately associated with the marbles in which they occur as narrow, discontinuous horizons. They probably rarely exceed a width of 10 m. Often the rocks are seen to exhibit a strong lineation. Unusual gradation along strike into amphibolite can be seen locally.

The calc-silicate rock when fresh is dark to pale grey or greenish, but weathers into a light brown, pitted or grooved surface which is caused by the differentiated weathering of the silicate- and carbonate-rich bands. Like elsewhere, the calc-silicate rocks of the project area consist of a great variety of mineral phases. They generally include clinopyroxene, quartz, microcline, scapolite, calcite/dolomite, plagioclase and minor opaques. Grains can be up to 6 mm in length.

The origin of the carbonates is not clear, but might be due to organically induced carbonate precipitation, probably in the form of aragonite. The relatively high MgO content of some marbles was probably caused by later selective dolomitisation. Protolith of the calc-silicate rocks was a calcareous shale, with a carbonate content varying widely.

3.1.4 Messina Suite anorthosite

The Messina anorthosite generally forms elongate layers of considerable map width, which can extend along strike continuously for tens of kilometres. In the map area, however, only a few occurrences are present.

Typical anorthosite is massive and slightly speckled. With an increase of the dark minerals it becomes streaky or has a banded appearance. In hand specimen the rock which is medium-grained is commonly greyish white to bluish grey, and only rarely has a greenish tint. The anorthosite is made up principally of plagioclase, together with very subordinate hornblende, pyroxene, quartz and biotite. Accessories include sphene, apatite, epidote, allanite and opaques. In the anorthosite east of Alldays pyroxene appears not to be developed. Where present the pyroxene can be partially replaced by hornblende, and there is good reason to speculate that a substantial part of the hornblende present formed during a late retrograde event.

3.1.5 Alldays Gneiss

Under the term Alldays Gneiss all greyish, biotite-bearing gneisses occurring in this area have been grouped together. The Alldays gneiss occurs either as large elongate or oval-shaped bodies, up to several km across, or more often as concordant sheets, which can vary in width from as little as 20 cm to several hundred meters. Characteristic forms of weathering are isolated boulder-strewn hills, large whaleback exposures or smooth pavements near rivers.

In the project area, on Tlhagatsane Hill, the main variety is a medium-grained, greyish or pinkish grey gneiss which shows augen or megacrysts of white feldspar, but is not layered. It contains an older component of dark grey gneiss, which is layered or migmatitic. This dark grey gneiss occurs mainly in an up to 1 m wide zone, but has often a schlieric appearance. Melt patches frequently occur along ductile shear zones. The presence of remnants of supracrustal gneisses at a number of localities demonstrates that the Alldays Gneiss is an orthogneiss, which has an intrusive relationship with the country rocks. Mineralogically the Alldays Gneiss is composed of plagioclase, quartz, K-feldspar, biotite, hornblende and opaque phases, with cummingtonite, pyroxene and garnet occurring only locally. Apatite, zircon and epidote are present as accessories.

3.1.6 Leucocratic quartzo-felspathic gneiss

The quartzo-feldspathic gneiss is volumetrically the most common rock-type of the Central Zone, estimated to make up about 50% of the gneisses present. However, exposures are in general poor, and the ground is often covered by a thin immature soil containing abundant quartz and feldspar.

The gneiss is a medium-to coarse-grained , in places pegmatitic, rock of whitish, whitish grey or, locally, pinkish colour. Where no ferromagnesian minerals are developed in the rock, it is massive and may locally form a few prominent outcrops. Otherwise the rock is well foliated, with the fabric defined by the parallel orientation of the platy minerals or by the dimensional orientation of quartz ribbons. The gneiss is dominated by quartz and feldspar (80-90% together) occurring in roughly equal amounts. The feldspars include orthoclase , microcline and plagioclase, with the proportions of K-feldspar and plagioclase varying widely. As minor additional phases garnet, biotite, hornblende and sillimanite can be present.Most of the quartzo-feldspathic gneisses are presently interpreted to represent intrusive granitoid rocks.

3.2 Soutpansberg Group

The Soutpansberg Group comprises a volcano-sedimentary sequence which constitutes seven formations. In the project area only the lower Sibasa Formation is present which forms a prominent ridge the highest point of which is known as Semaoko Hill.

3.2.1 Sibasa Formation

The formation comprises basaltic lava at the base, overlain by arenaceous sediments. Although the lavas are strongly epidotised, they appear to have an original basaltic composition. They are overlain by greyish white, coarse-grained quartzite, grit and conglomerate. The grit displays in places trough crossbedding, and is characterized by scattered clasts reaching up to 5 cm..

In the nearby, recently drilled borehole SEM 7 a 10 m thick unit of ferrugineous sandstone was encountered overlying leuco-gneisses of the Beit Bridge Complex. This unit either represents here the very base of the Sibasa Formation or it is part of the Blouberg Formation believed to predate the development of the Soutpansberg and Waterberg rocks.

It is thought that only the lower Soutpansberg rocks were deposited in a graben- or rift-like structure, which developed slightly oblique to the 2.0 Ga old strike-slip Palala Shear Belt, now marked by the presence of the Melinda and Senotwane Faults.. The upper Soutpansberg rocks, which have a lower unconformable contact, were laid down some time later in a broad basin. The lower Soutpansberg rocks would then represent a syn-rift sequence, and the upper rocks a post-rift sequence. The reported ages of deposition of Soutpansberg rocks are not well constrained. At the moment it is believed that the Soutpansberg Group, or at least its lower part, was deposited sometime between 1974 Ma and c. 1800 Ma.

3.3 Karoo Supergroup

The Karoo Supergroup represents a variety of sedimentary environments linked to the migration of Gondwana from polar to tropical latitudes over a time span of some 200 Million years. The final phase of sedimentary deposition was terminated by voluminous Jurassic outpourings of basaltic magma associated with the final break-up of Gondwana.

The Karoo strata occurring in the project area are part of the so-called Tshipise basin, which extends along the northern margin of the Soutpansberg mountains from the Mogalakwena River to the Kruger National Park in the east. The basal sedimentary package is divided into eight formations which are capped by basaltic lavas of the Letaba Formation. With the exception of the arenaceous strata, exposure of the Karoo rocks is generally very poor, and the delineation of formation boundaries is often only possible where borehole data are available.

3.3.1 Tshidzi, Madzaringwe and Mikambeni Formations

The *Tshidzi Formation* which forms the basal unit of the Supergroup constitutes diamictite overlain by grit and conglomerate.The diamictite which is only a few metres thick is generally a massive structureless rock consisting of angular to rounded clasts dispersed in a sandy slightly ferrugineous matrix. The clasts are mainly not densely packed, measure up to 50 cm across, and are composed of pink Soutpansberg quartzite. The diamictite is overlain by whitish coarse feldspathic sandstone, grit and conglomerate. Clasts in the conglomerate are semi-angular to semi-rounded, and up to 5 cm in diameter.

Although no glacial pavements or faceted clasts have yet been observed, the diamictite can possibly be regarded as a product of re-sedimentation of glacial detritus, and emplaced by subaqueous mass-flow. The conglomerates and gritty sandstones could represent subaqueous outwash fans.

The overlying *Madzaringwe Formation* comprises, according to borehole data, mainly grey to blackish grey carbonaceous shale with numerous stringers and seamlets of bright coal. The individual coal seamlets are generally not thicker than 20 cm. The shale near the base is characterized by the presence of small white dropstones that have an angular shape. The top of the formation is defined by a 1 m thick sandstone. The formation has a thickness of 10 m in the western part of the project area.

The top of the succession is formed by the *Mikambeni Formation* consisting of grey mudstone and minor carbonaceous shale. It is characterized by the almost complete absence of bright coal. A thickness of 27 m has been established.

3.3.2 Fripp Formation

This formation is almost entirely arenaceous, and gives rise to a low ridge on Brest 332 MS and adjacent farms. This signals a dramatic change in climatic conditions, causing on one side the almost complete disappearance of coaly material, and on the other side the appearance of reddish and greenish colours in the succession.

The formation which rests unconformably on the underlying mudstones comprises white feldspathic medium- to coarse-grained sandstone and grit with occasional pebble washes. The rock is well bedded, with planar and trough crossbedding occasional present. Drill core reveals the frequent presence of thin shale lenses.

Borehole data suggest that the sandstone has a general thickness of about 20-40 m. The locally high feldspar content points to rapid deposition from an uplifted granitoid source, probably as

point-bar and channel lag deposits.

3.3.3 Solitude Formation

This formation has a gradational contact with the underlying Fripp sandstone, and constitutes alternating mudstone, shale and siltstone. Colour of the rocks varies greatly, and can range from grey through red or green to purplish. Locally thin horizons of fine sandstone or even grit can be present. Rare carbonaceous shale is sometimes encountered near the base of the formation. The thickness of the succession is around 60 m.

3.3.4 Klopperfontein Formation

This formation comprises mainly sandstone and grit, which have an unconformable relationship with the underlying Solitude rocks. Unlike the Fripp sandstone it hardly forms outcrops. In general the sandstone is medium- to coarse-grained, and varies in colour from greyish white through reddish to brown. Red colouration is probably caused by the presence of potassium feldspar. Lenses of reddish brown shale and mudstone are frequently intercalated, and are probably the reason for the poor outcrop of the formation. The formation has a thickness of about 5 m. The coarse character of the Klopperfontein sediments indicates renewed uplift and erosion of a northerly granitoid source terrain.

3.3.5 Bosbokpoort Formation

Massive mudstone grading into siltstone towards the top dominates this succession which seems to be nowhere exposed. The rocks are mainly brick-red or, occasionally, purplish, and can sometimes be mottled. Calcareous nodules are a characteristic feature of these rocks. Local intercalations of red sandstone and even grit do occur, but they do not exceed a thickness of 1 m. The thickness of the succession seems to vary between 30-60 m in the project area. The ubiquitous presence of calcareous material in the formation signals the onset of semi-arid oxidising climatic conditions.

3.3.6 Clarens Formation

The Clarens Formation which forms the uppermost unit of the sedimentary package has been divided into two units, the Red Rocks and Tshipise Members.

Red Rocks Member

The Red Rocks Member consists entirely of very fine- to fine-grained argillaceous sandstone, and its contact with the underlying siltstones of the Bosbokpoort Formation is generally gradational. Exposures are generally scarce. The sandstone is pink, red or brownish red in colour, and characterized by the presence of scattered irregular patches of a cream-coloured sandstone. The latter sandstone can locally form thin lenses, in particular in the upper half of the succession. Calcareous concretions are present, but appear less frequent than in the underlying formation. The member seems to have fairly constant thickness of about 100 m throughout the area. The fine-grained sediments were possibly transported by ephemeral, suspension-load rivers and deposited on floodplains under increasingly arid conditions.

Tshipise Member

In contrast to most of the underlying less resistant formations, the Tshipise Member which is composed essentially of fine-grained sandstone locally forms spectacular topographic features, like e.g. Sentlhane Hill on Greenfield 333 MS. More often, however, the sandstone has disintegrated and the area underlain by the Tshipise Member is typically blanketed by loose pinkish sand.

The colour of the sandstone is whitish or cream, and only occasionally, as in the basal parts, it is pinkish. In thin sections the rock is seen to consist of rounded and only rarely subrounded grains of quartz (95%) in a recrystallized quartz matrix. Grain size is generally around 300 μm, with a few grains measuring up to 800 μm.

Most of the sandstone seems to have a massive structure, though outside the project area the sandstone displays large aeolian cross-beds which indicate a westerly direction of the palaeowinds. The aeolian bedforms appear to be present mainly in the upper half of the succession and generally resemble barchan-type dunes.

Calcareous concretions can be developed near the base, but are rare. The base of the member is generally ill-defined since the transition from the Red Rocks argillaceous sandstone to the Tshipise sandstone is not sharp, but progressive. The top part of the sandstone member tends to be more siliceous and hence more resistant, which could be due to the "baking " effect of the overlying lava. The thickness of the Tshipise sandstone appears to be c. 130 m. Environment of most of the sandstone is generally believed to have been large dune fields, with barchan-type dunes being the dominant form.

3.3.7 Letaba Formation

This formation which comprises almost entirely basaltic lava covers an extensive portion of the project area. The basalt underlies flat country, often covered with red clayey soil, brown turfy soil or calcrete. Outcrop is very poor, and where developed the rock is very rarely fresh. A few notable good exposures could be observed just outside of the project area on Gruisfontein 368 MS and Berseba 332 MR. At these localities the lava is seen to have extruded onto a uneven dune surface, and no pyroclastic rocks are apparently present.

Where relatively fresh the basalt is a massive, blackish grey rock containing numerous small yellowish green crystals. Amygdales do not seem to be well developed, and only in a few borrow pits have thin intercalated amygdaloidal flows been observed. Thin sections indicate that the rock consists of pyroxene, plagioclase, olivine and some ilmenite in a microcrystalline groundmass. Pyroxene generally occurs as clusters of small grains (< 1 mm). Plagioclase is acicular (1 mm long), and grows in sheaf-like clusters which are radially arranged. Olivine is present as fairly large phenocrysts (up to 2 mm), but is invariably pseudomorphed to a pale green mineral. Ilmenite occurs as skeletal, about 1 mm long needles.
At a few localities a strongly amygdaloidal, reddish weathering lava is interlayered with the blackish grey variety.

Compositionally the Letaba lava is a picrite basalt, with a MgO content of c. 13% , and shows many similarities to the picritic, olivine-rich lavas of the northern part of the Kruger National Park.

The *preserved* maximum thickness of the formation is difficult to estimate, but since inliers of Tshipise sandstone are frequently present within the lava it might be not more than 200 m.

Within the volcanic succession a number of apparently discontinuous arenaceous horizons are developed. They are at least several metres thick, and show a much greater resistance against weathering than the surrounding lavas. A fine-grained, brownish red quartzite with a possible tuffaceous component is developed at a number of places. The rock which weathers into large blocks is typified by the presence of scattered small and large fragments of a greenish material. The quartzite is made up of small angular to rounded grains of mainly quartz. The matrix can sometimes be slightly calcareous. The greenish material seems to be altered tuffaceous material, and is now entirely represented by corrensite, a rare zeolite mineral, not previously recorded from this area.
Occasionally this rock is associated with a greenish grey fine quartzite containing very small fragments of red shale.

Quartzite not showing any tuffaceous aspect occurs on Louisenthal 366 MR. Here the very resistant rock forms a few low hillocks, is reddish in colour, and in places well bedded. It might be 10 m thick, with the top part being typically pitted. The rock is composed of small, mainly rounded grains of quartz (80%) in a recrystallized quartzitic matrix which contains some opaque material. An aeolian origin for this quartzite is suggested.

For the *Tshipise Basin*, available information suggests that the Letaba lava is represented only by picrite basalts. They are very similar to those occurring in the northern part of the Kruger National Park, where they overly nephelinites. No tholeiitic basalts have been identified in the project area, but they are reported to occur in nearby Botswana and Zimbabwe, where they form the upper half of the Letaba lava succession. No isotopic age is available for the picrite basalt of the map area, but similar lavas from the Kruger National Park area yielded a K-Ar age of about 177 Ma.

3.4 Karoo intrusives

The Karoo intrusives occur as a variety of sills and dykes, and as a prominent plug. A sill encountered in borehole MP 01 is made up of clusters of plagioclase laths (1-2 mm) in a fine groundmass of plagioclase and pyroxene. A sill exposed on Gansvley 335 MS has an almost diabase-like appearance, is medium-grained equigranular, and composed of stubby laths of plagioclase and large pyroxene (3 mm)(GB 01-66).

The dolerite dykes are generally inferred from aerial photos, have a very limited strike length, and are poorly exposed.

Dykes of the Louisiana swarm form locally good exposures, and are blackish grey fine-grained rocks. They are composed of scattered clusters of plagioclase laths (up to 3-4 mm) and small pyroxene (0.2 mm) in a very fine groundmass of plagioclase and ferromagnesian minerals (GB

01-65; 02-89 & 90).

The dolerite plug, which might have a diameter between 500-1 000 m, is a bluish grey, fine-grained rock comprising large twinned plagioclase in a fine groundmass of plagioclase needles and pyroxene (GB 02-82 & 83). It might be associated with the emplacement of the Louisiana dyke swarm.

Chemical analyses of selected Karoo igneous rocks are given in Table 1. There are significant differences (e.g. MgO and Cr) between olivine basalt and the intrusive rocks, and also between the "diabase-like" sill and the remainder (e.g. Ba, Sr and Zr).

3.5 Quaternary Deposits

3.5.1 High level gravels

A few small deposits of high-lying gravel which is unconsolidated have been noticed on Wentworth 377 MS. Here the gravels contain much jasper and agate.

3.5..2 Scree

Extensive scree which could be up to 10 m thick is present along the steep northern slopes of Blouberg Mountain. It is also prevalent on the slopes of highly inclined metaquartzite horizons.

3.5.3 Alluvium

Alluvium is only rarely developed in the project area, and comprises a few metres of light-grey to brownish muddy soil.

3.5.4 Sand

Loose sand which could be several metres thick covers large tracts in the southern part of the project area. Some of the sand has clearly originated from underlying sandstone of the Tshipise Member, but most of it could be of aeolian origin and represent Kalahari sand.

3.5.5 Sandy soil

A cover of pink sandy soil is present mainly in the northwestern part of the area. This cover is generally thin, can in places be gritty, and occurs preferentially on leucogneiss of the Beit Bridge Complex.

4. STRUCTURAL GEOLOGY

The rocks of the area mirror a complex deformational history. Ductile deformation was superimposed onto the Beit Bridge rocks in Archaean and early Proterozoic times, succeeded by brittle deformation of the Soutpansberg and Karoo rocks in Phanerozoic times. The major

Table 1. Major and trace element analyses of selected Karoo igneous rocks from the project area

	1	2	3	4
Sample	GB01-62	GB01-64	GB01-65	GB01-66
wt.%				
SiO_2	51.62	50.24	51.16	53.19
TiO_2	4.34	2.97	4.27	0.94
Al_2O_3	13.66	8.82	13.63	15.76
Fe_2O_3(t)	12.58	12.85	12.65	11.45
MnO	0.14	0.15	0.14	0.17
MgO	4.41	12.63	4.43	5.03
CaO	8.17	7.20	8.20	9.75
Na_2O	2.19	0.83	2.03	1.70
K_2O	1.58	1.78	1.64	0.95
P_2O_3	0.62	0.45	0.61	0.10
Cr_2O_3	<0.02	0.15	<0.02	<0.02
L.O.I.	0.16	1.48	0.22	0.45
H_2O^+	0.23	0.62	0.60	<0.01
H_2O^-	1.05	1.53	1.11	1.00
Total	99.48	99.55	98.98	99.49
ppm				
As	<10	<10	<10	<10
Ba	1294	956	1098	322
Ce	134	111	132	34
Co	38	63	30	36
Cr	62	914	51	37
Cu	120	82	124	105
Ga	26	17	25	18
Hf	14	14	14	<5
Mo	2	<2	2	<2
Nb	25	14	26	5
Ni	82	499	81	50
Pb	9	7	9	10
Rb	15	34	38	40
Sc	21	21	21	33
Sr	1187	756	1109	156
Ta	<5	<5	<5	<5
Th	<5	6	<5	8
U	<3	<3	<3	3
V	467	331	468	185
W	<3	<3	<3	<3
Y	43	27	44	24
Zn	115	110	118	68
Zr	445	352	458	104

Samples 1 & 3: Louisiana dykes
Sample 2: Olivine basalt; Letaba Formation
Sample 4: "Diabase-like" sill

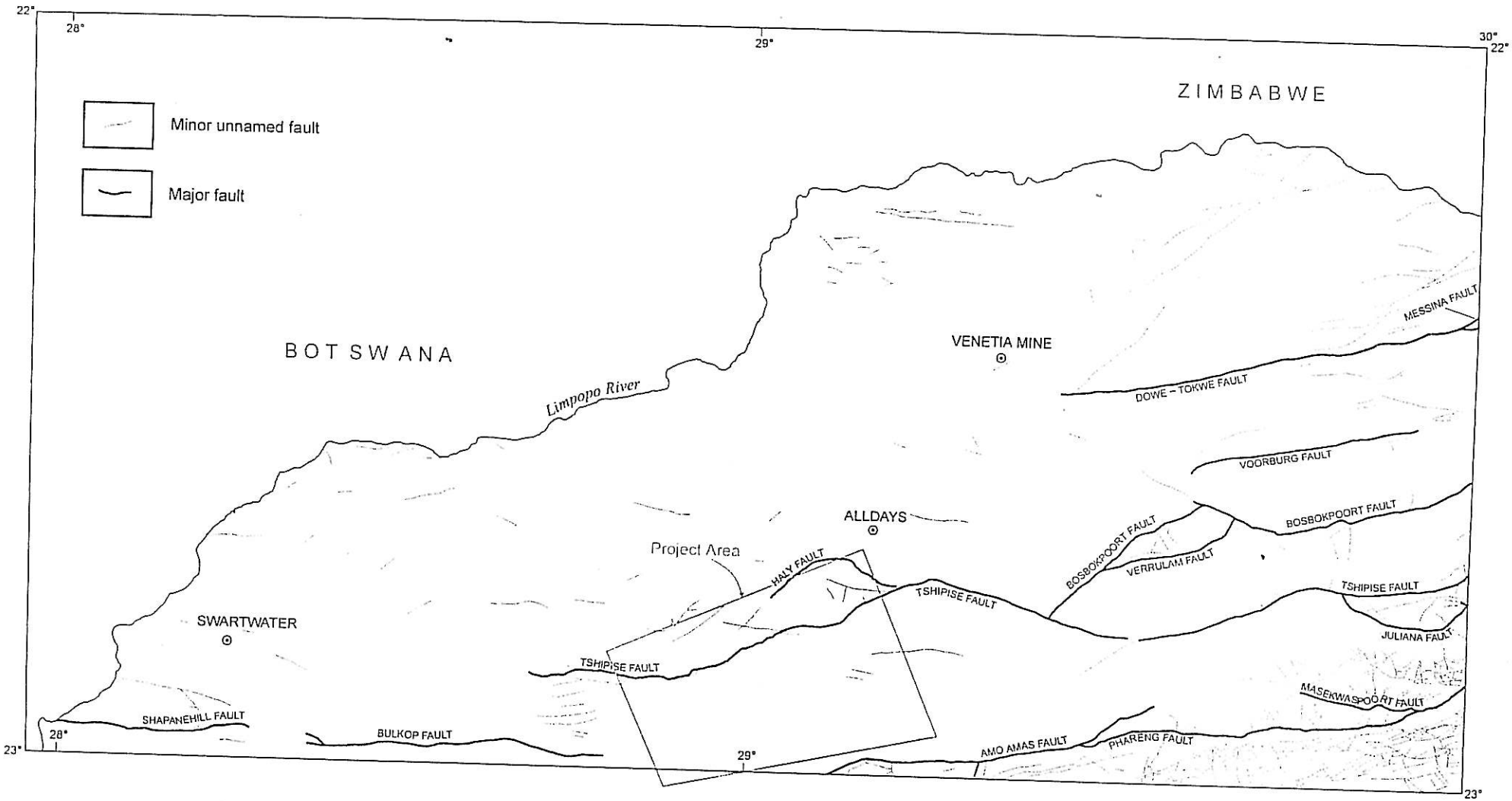


Figure 3. Tectonic map showing structural pattern of the region surrounding the project

structural features of this region are given in Figure 3.

4.1 Beit Bridge Complex

Large-scale north-trending folds, together with large closed structures define the regional grain of the area. Its deformational history is still a controversy, and a number of opposing views have been expressed.

One school of thoughts proposed that the collision (c. 2.7 Ga) of the Kaapvaal Craton with the Zimbabwe Craton was accompanied by a major northward-verging thrust system. Evidence cited for deep crustal northward directed shearing are a number of circular to oval-shaped structures. The foliation associated with these features define cylindrical structures that plunge moderately to the south. Since an accompanying mineral extension lineation plunges in the same direction, these structures are interpreted as large-scale sheath folds. Shear deformation, therefore, is thought to have played a dominant role during the Limpopo orogeny.

A different view is expressed by other workers who maintain that several distinct deformational events, spaced in time, have affected the Central Zone. The first structure (D_1) generally recognized is a prominent foliation defined by mafic minerals, which is parallel to lithological layering. This was followed by isoclinal recumbant folding (D_2) about east-trending horizontal axes. Subsequently the rocks were folded (D_3) about upright axial surfaces which trend mainly in a northwesterly direction, but locally, as in the Mogalakwena River area, in a northerly direction. In the last, less severe event (D_4) all these structures were modified about northeast trending axes, and this gave rise to prominent dome- and basin- structures.

Presently ongoing isotopic work (Kröner et al., 1999) now strongly suggests that the main deformational and metamorphic event in the Central Zone took place much later, around about 2.0 Ga.

4.2 Soutpansberg strata

Strata of the Soutpansberg Group occur only around Semaoko Hill, and dip at a shallow angle of 15-25° towards the north. It is not known whether this regional tilting has occurred in pre- or post-Karoo times.

4.3 Karoo strata

The Karoo strata of the Tshipise Basin are - like the Soutpansberg rocks - in general slightly tilted towards the north, at an angle of 10-20°. However, in the project area only the small block between the Haly and Tshipise faults shows slight tilting towards the northeast. In the main block, which forms a graben-like structure between the Tshipise and the Amo Amas faults, the Karoo strata appear to be tilted towards the south. Along the Tshipise fault and in the eastern part of the project area Clarens sandstone forms occasional outcrops, but further south, on Kromhoek 438 MS, drilling penetrated more than 160 m of Letaba basalt. Also for the intercalated tuffaceous sandstone a southerly dip is locally indicated by drilling results.

4.4 Brittle shear zones

A substantial number of brittle shear zones are developed in the project area, and they generally trend in an east-northeasterly or easterly direction (Fig. 2). The more prominent ones are the Amo Amas, Bulkop, Haly, Tshipise and Senotwane faults and the Presumption shear. They were active during a strong extensional phase that can be related to the fragmentation of Gondwana.

4.4.1 Tshipise fault zone

General remarks

The Tshipise fault zone which has a strike length of over 200 km can be followed from a point some 50 km east of Tshipise, where it branches off the Bosbokpoort fault, to the Mogalakwena River in the west. It has an overall east-northeasterly trend, and is an extensional fault with a downthrow to the southeast. Vertical displacement is estimated to be generally between 400 - 500 m along strike. From the Tshipise area exploration drillholes and stream exposures indicate that the fault zone is a shallow feature there, having a dip between 34° and 54°.

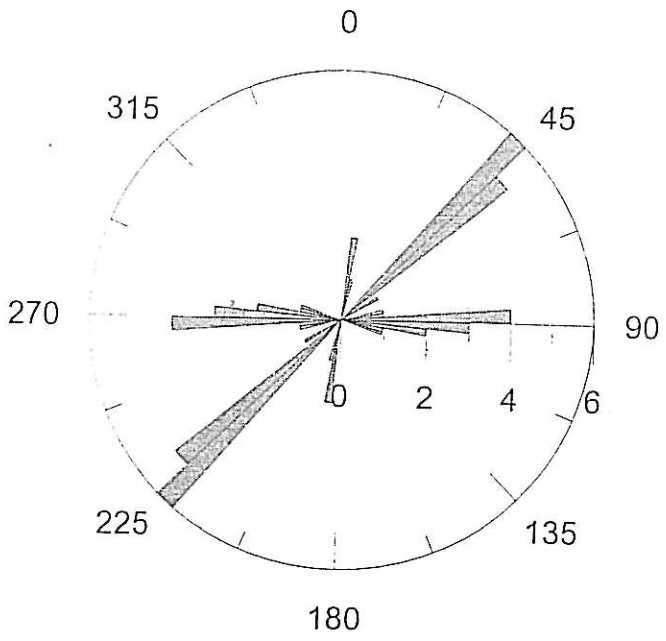
From a point just east of the study area towards Zimbabwe the Tshipise fault and then further east the Bosbokpoort fault are characterized by the presence of fairly recent fault scarps varying in height between two and ten metres. These scarps are explained by a re-activation of existing fault segments during Late Pleistocene times (Brandl, 1995). Reasons for the extensional event in the recent past can be sought in the re-arrangement of the regional stress field, caused by the southward extension of the Western Branch of the East African rift system into the Maputo area of southern Mozambique.

Fault geometry

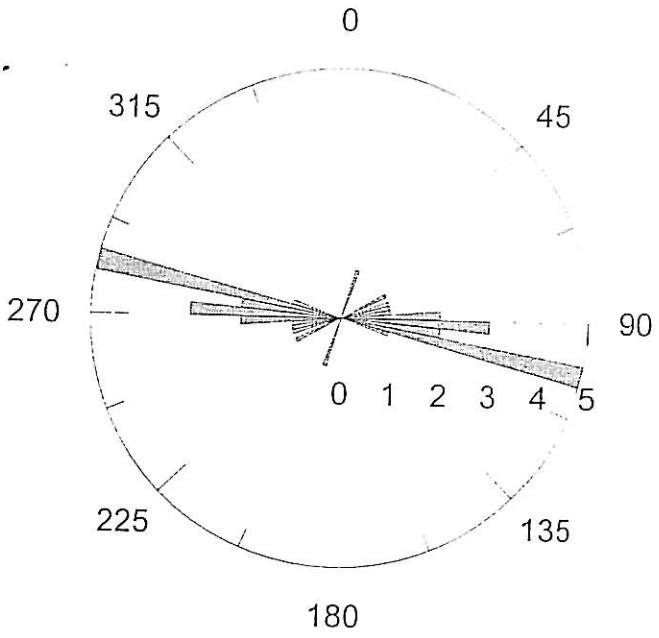
Throughout the project area the trace of the Tshipise fault zone is generally easily identifiable on aerial photos as a line of dense vegetation, in particular where Karoo basalt is juxtaposed against lower Karoo sediments. Vertical displacement of the fault seems to vary between 400 m and 500 m, but the fault peters out rapidly west of the Mogalakwena River. At the western edge of the project area the fault is exposed on Goudmyn 327 MR, where it forms a prominent siliceous breccia that can be traced over a distance of 3 km. The bluish grey breccia is here up to 15 m wide, dips between 47° and 67° to the south, and juxtaposes Beit Bridge gneisses against mainly Tshipise sandstone. Over a short distance minor barytes and lead mineralization is associated with the breccia. Dissolution of quartz grains present in the felsic gneisses and the sandstones next to the brittle shear zone appears to have led to the local development of siliceous fluids that precipitated the breccia material. The quartz sealing of the shear zone is thought to have taken place at a depth greater than 3 km. Outside of the Goudmyn area, borehole logs intersecting the fault plane never indicate the presence of a siliceous breccia.

A characteristic feature of the fault zone is the presence of subsidiary parallel faults south of the main fault. In the Goudmyn 327 MR, Fontaine du Champ 367 MR and Greenfield 333 MS areas it can be seen that the Tshipise fault bifurcates, with the subsidiary fault linking up with the main fault plane after a short distance. Within these lozenge-shaped boudins, formed by the two parallel fault planes, the strata represented mainly by Tshipise sandstone dip shallowly to moderately to the north, and most probably form a so-called roll over structure. The boudins are generally strongly fractured (see Fig. 4), and this is in particular evident in the Goudmyn area where a prominent conjugate shear fracture system (42°/90° and 110°/60° SW) is developed. Locally as on Fontaine du Champ minor antithetic or counter faults to the main fault set are

Fontaine du Champ 367 KS



Senthlane Hill, Greenfield 333 MS



Maela Hill, Goudmyn 327 MR

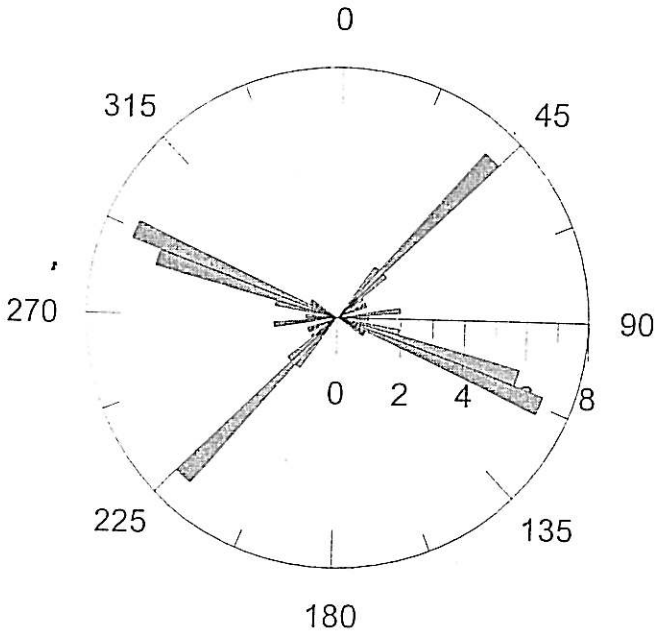


Figure 4. Rose diagram showing the strike orientation of fractures of the Tshipise sandstone within the Tshipise fault zone.

developed within the boudins. The subsidiary faults have a throw probably not exceeding 100 m. The Tshipise fault zone seems to have been initiated as an *en echelon* group of normal faults.

4.4.2 Haly fault

From a point close to the Alldays - Vivo road the Haly fault splays off the Tshipise fault, but peters out in the Rhone 321 MR area. It has a maximum vertical displacement of 300 m, and a downthrow to the south.

4.4.3 Presumption shear

This brittle shear zone connects the Haly and Tshipise faults, and trends in a northwesterly direction. On Presumption 337 MS the shear zone is up to 50 m wide, and displays an anastomosing network of thin, closely spaced quartz-filled fractures. It probably has only a minor displacement.

4.4.4 Bulkop fault

The Bulkop fault (Figure 2) which has a southerly throw shows a minimum displacement of 500 m west of the Mogalakwena River, but the displacement diminishes rapidly where the fault enters the project area. After a short distance the fault seems to peter out.

4.4.5 Amo Amas fault

The Amos Amas Fault previously thought to be a branch fault of the Senotwane Fault (Brandl, 2002, Fig. 2) is now, based on recent drilling, interpreted to mark the northern outline of the Soutpansberg rocks at Blouberg. The fault which has a northerly throw is developed only in the southwestern part of the project area, where it shows a minimum displacement of 400-600 m. Further west, just south of the project area (Auf Der Haard 445 MS), the fault has a vertical throw of about 1500 m, but displacement decreases again further east. The fault has an E -W trend, and roughly parallels the Tshipise fault, with both features outlining a 70-100 km wide graben structure. Boreholes drilled across the Amo Amas Fault on Tuskow 255 LR (SEM 04-07) and Fraaifontein 447 MS (FF 28-33) indicate that the fault plane dips at an angle of about 57° to the north. In all instances these boreholes were dry.

4.4.6 Terveen Lineament

The Terveen Lineament which is evident on aerial photographs, but less obvious on satellite images, is the only north-south trending feature so far recognized in the project area. Several boreholes were recently drilled into this feature, but no dyke rock as expected was encountered. Hence it is interpreted to represent a prominent fracture zone which most probably developed in recent times. One of the boreholes drilled into this feature yielded around 40 l/s at the contact between basalt and Tshipise sandstone.

4.4.7 Profiles

Three N-S profiles across the project area are given in Fig. 5 indicating the positions of the

various faults and dykes.

5. REGIONAL GEOPHYSICAL SURVEY

A high resolution airborne geophysical survey was recently conducted across the study area by the Council for Geoscience for the Department of Water Affairs and Forestry (Cole, 2001). Flying height was 50 m, line spacing was 200 m, and the flight direction was north-south. Compared with existing data, the resulting aeromagnetic and radiometric maps represent a greatly improved data set, and give a clear indication of the structural grain of the area. On both the aeromagnetic and radiometric images the dominant Karoo basalts are easily identifiable by their mottled anomalies. The Beit Bridge gneisses stand out particularly on the radiometric images by having a high intensity signature.

The most prominent feature to be seen on the images is, however, a swarm of highly magnetic dykes, termed here the "Louisiana dyke swarm". About five to six dykes occur in a 10 km wide zone, trending about 110-120°. Within the Karoo outcrop they have a straight appearance, but have a slighly irregular trend where intruded into the complexly folded Beit Bridge gneisses. From the aeromagnetic image it appears that most of these prominent dykes cross the Tshipise fault zone with hardly any distortion, and are therefore interpreted to postdate the fault zone. Other significant features to be clearly seen on the aeromagnetic map are the outline of the Amo Amas fault, showing extremely low magnetic properties, and a doleritic plug forming a strong magnetic anomaly.

A number of moderately magnetic features are recognizable within the Letaba basalt outcrop, and they have been interpreted to represent intrusive sills or dykes. However, subsequent drilling into some of those features clearly disproved the presence of any dykes or sills. These moderately magnetic features are therefore thought to define specific basalt flows with higher than average magnetic properties. Also in the Ulster 375 MS area drilling disproved the possible presence of sills interconnecting dykes of the Louisiana swarm.

6. GEOHYDROLOGY

The first comprehensive geohydrological studies of the groundwater potential of the project area were carried out by Orpen et al. (1982) and van der Westhuizen (1983).They were followed up by detailed reports by Jolly (1986), Fayazi and Orpen (1989) and Orpen and Fayazi (1989). These studies were commissioned in connection with a planned, though never materialized upgrading of Alldays to a regional economic growth point. In more recent years studies by Calitz and Myburgh (1998), Levin et al. (1998), Raath et al. (2000) and VSA Geoconsultants (2000) were mainly aimed at establishing a reliable water supply for the many villages of the area.

From these studies it is evident that most of the high-yielding boreholes are associated with the Tshipise fault zone, also often referred to in reports as the Taaibosch fault. High yields were also occasionally obtained from the Tshipise sandstone and the Letaba basalt south of the Tshipise fault. In contrast the lower Karoo argillaceous sediments and the Beit Bridge gneisses occurring north of the Tshipise fault are characterized by low borehole yields.

6.1 Tshipise fault zone

High-yielding boreholes occur between Fontaine du Champ 367 MR and Greenfield 333 MS along the fault trace, and are in particular concentrated where subsidiary faults are present. The study by van der Westhuizen (1983) clearly demonstrates that major water strikes generally do not occur where the boreholes intersect the main fault plane, but rather where the boreholes are situated just a short distance south of the main fault plane. This is explained by the fact that the fractures associated with the main fault plane are generally sealed by finely comminuted material or clay gouge produced by the brittle deformation. Fractures away from the main fault plane, but still within the deformation zone, are generally not sealed by secondary material and therefore can possess high-yielding characteristics. Where subsidiary faults are present, they produce wedge-shaped horses or boudins which are strongly fractured caused by differential rotation. These boudins obviously increase the normal width of the fractured deformation zone and therefore also the storage potential for groundwater.

From the Haly fault, which splays off the Tshipise fault, no hydrological data seems to be available.

6.2 Letaba Basalt

A number of boreholes with fair yields are located in the Letaba basalt. As the rock has no primary permeability, a fracture system caused probably by localised stress or minor faulting has to be invoked in fairly fresh basalt to create a high secondary permeability. However, fault traces within the basalt are almost impossible to detect since, with the exception of a tuffaceous sandstone, marker horizons are absent. As noticed in the recently drilled borehole KH 09 (see Section 7.), this sandstone horizon seems not to impede the flow of groundwater in a vertical direction.

The basalts which are olivine-rich and requently amygdaloidal are, however, often altered to a considerable depth caused by the differential weathering of the various minerals present. Any fracturing present in a strongly decomposed basalt would therefore be effectively sealed by clayey material, resulting in very low yielding characteristics.

6.3 Tshipise Sandstone

The Tshipise Sandstone has a low primary permeability, and therefore only secondary permeability created by fracturing or brittle shearing can be responsible for some moderate yields known from the project area. Shearing is generally easily observed in the massive sandstone since it has led to extensive recrystallisation of the rock matrix producing a very resistant quartzite.

Contrary to general belief the contact sandstone/Letaba basalt appears not to act as an impermeable barrier to the groundwater flow. This is corroborated by recent drilling where in a number of boreholes (see Section 7.) water strikes only occurred some distance below this contact.

6.4 Dykes in the Karoo rocks

Since groundwater flow is believed to be from south to north (Fayazi and Orpen, 1989) and most of the dolerite dykes, in particular the Louisiana dykes, have a trend perpendicular to this flow,

they should be a prime target for groundwater abstraction. In contrast to the picritic composition of the basalts, the Louisiana dykes are tholeiitic, lack olivine and hence are more resistant, with good outcrops being quite common.

Results of drilling into the contact zones of dykes are, however, described generally as disappointing. Similarly our boreholes ROS 10 to 15 and UL 19 to 23 (see Section 7.) drilled recently on both sides of the Louisiana dykes did not strike any water.

It is therefore believed that regional fracturing as displayed in the Karoo sediments has also, at least locally, affected the dolerite dykes, and that this process postdates dyke emplacement.

6.5 Lower Karoo sediments

The lower Karoo sediments occur north of the Tshipise fault, and comprise a package of alternating mudstone, siltstone and weakly cemented sandstone and conglomerate. Since no open fractures are to be expected in these mainly argillaceous sediments, which are generally deeply weathered, only a few low-yielding boreholes are reported to occur.

6.6 Beit Bridge gneisses

In the strongly folded, high-grade gneisses of the Beit Bridge Complex groundwater is reported to occur generally in restricted shallow basins where deep weathering is associated with surface drainage channels (van der Westhuizen, 1983). Boreholes drilled have generally low yields. A few are reported to have moderate yields, but these relatively higher yields are maintained only for short periods. In general the area underlain by these gneisses is not regarded as a groundwater reserve of significance.

7. RESULTS OF PRESENT DRILLING PROGRAM

7.1 Borehole summary

In total 71 percussion boreholes were drilled during the present investigation. A brief summary of the more relevant findings is as follows:

MP 01 - Melpomene 364 MR; depth 340 m; water strike (7 l/sec) at 60 m in Tshipise sandstone; at 240 m an unusual sill with the rare mineral corrensite.

FDC 02 - Fontaine Du Champ 367 MR; depth 250 m; dry; no indication of a magnetic dyke or sill, only basalt encountered.

TER 03 - Terveen 381 MR; depth 110 m; water strike (5 l/sec) at 21 m; no indication of a prominent N-S trending dyke or fracture zone; only basalt encountered.

SEM 04 - Tuskow 255 LR; depth 165 m; minor water (0.2 l/sec) at 114 m; Amo Amas fault intersected at 124 m; fault plane dips about 45° N.

SEM 05 - Tuskow 255 LR; depth 110 m; dry; Amo Amas fault intersected at 105 m.

SEM 06 - Tuskow 255 LR; depth 160 m; dry; Amo Amas fault intersected at 159 m.

SEM 07 - Tuskow 255 LR; depth 35 m; dry.

BB 08 - Devon 443 MS; depth 250 m; dry; dolerite plug

KH 09 - Kromhoek 438 MS; depth 160 m; water strikes (2 and 7.6 l/sec) at 84 m and 155 m, respectively; only basalt encountered

ROS 10 - Rosyth 378 MS; depth 40 m; minor water strike (0.2 l/sec) at 9 m; drilled intoa tholeiitic dyke.

ROS 11 - Rosyth 378 MS; depth 90 m; minor water strike (0.2 l/sec) at 75 m; only basalt encountered.

ROS 12 - Rosyth 378 MS; depth 50 m; minor water strike (0.2 l/sec) at 75 m.

ROS 13 - Rosyth 378 MS; depth 30 m; minor water strike (0.2 l/sec) at 9m; only basalt encountered.

ROS 14 - Rosyth 378 MS; depth 200 m; water strike (1.5 l/sec) at 127 m in Tshipise sandstone; basalt/sandstone contact at 116m, but no water strike.

ROS 15 - Rosyth 378 MS; depth 155 m; no water strike at basalt/sandstone contact at 145 m.

ROS 16 - Rosyth 378 MS; depth 148 m; water strike (3.6 l/s) at 18 m at contact between severely weathered and fresh basalt; no water strike at basalt/sandstone contact at 143 m.

UL 17 - Ulster 375 MS; depth 50 m; at 5 m a south-dipping fault encountered; dry borehole.

UL 18 - Ulster 375 MS; depth 70 m; at 10 m a south-dipping fault encountered; dry borehole.

UL 19 - Ulster 375 MS; depth 150 m; no water strike at basalt/sandstone contact at 65 m.

UL 20 - Ulster 375 MS; depth 130 m; no water strike at basalt/sandstone contact at 65 m.

UL 21 - Ulster 375 MS; depth 40 m; dry borehole; possible dyke encountered between 1-25 m.

UL 22 - Ulster 375 MS; depth 245 m; dry borehole; possible dykes between 27-37 m and 128-195 m; at 195 m a north-dipping fault plane intersected, but no water strike.

UL 23 - Ulster 375 MS; depth 70 m; water strike (1.06 l/s) at 59 m, but no water strike at basalt/sandstone contact at 25 m.

KH 24 - Kromhoek 438 MS; depth 240 m; major water strike (40 l/s) at 118 m, but no water strike at basalt/sandstone contact at 202 m.

DV 25 - De Vrede 382 MS; depth 80 m; water strike (3.8 l/s) at 17-24 m in basalt; no indication of a dyke as expected.

DV 26 - De Vrede 382 MS; depth 167 m; major water strike (40 l/s) at 167 m at basalt/sandstone contact; no indication of a dyke as expected.

GP 27 - Ganspan 829 MS; depth 190 m; water strike (2.25 l/s) at 15-19 m, but no water strike at basalt/sandstone contact at 174 m.

FF 28 - Fraaifontein 447 MS; depth 43 m; minor water strike (0.2 l/s) at 23 m in basalt.

FF 29 - Fraaifontein 447 MS; depth 23 m; dry borehole.

FF 30 - Fraaifontein 447 MS; depth 120 m; minor water strike (0.1 l/s) at 65 m in quartzite; north-dipping fault plane intersected at 57 m, but no water strike.

FF 31 - Fraaifontein 447 MS; depth 125 m; minor water strike (0.1 l/s) at 115 m in quartzite; north-dipping fault plane intersected at 105 m, but no water strike.

FF 32 - Fraaifontein 447 MS; depth 200 m; minor water strike (0.2 l/s) at 68 m in basalt.

FF 33 - Fraaifontein 447 MS; depth 120 m; dry borehole.

BB 34 - Devon 443 MS; depth 65 m; dry borehole; scree and palaeo-soil 30 m thick.

BB 35 - Devon 443 MS; depth 25 m; dry borehole; scree 10 m thick.

BB 36 - Devon 443 MS; depth 25 m; dry borehole; scree 10 m thick.

LJ 37 - Langjan Nature Reserve; depth 150 m; water strikes at 75 m (1.16 l/s) and 95 m (2.25 l/s) in sandstone.

LJ 38 - Langjan Nature Reserve; depth 45 m; dry borehole.

LJ 39 - Langjan Nature Reserve; depth 120 m; water strike (1.36 l/s) at 79 m in basalt.

LJ 40 - Langjan Nature Reserve; depth 150 m; dry borehole.

LJ 41 - Langjan Nature Reserve; depth 120 m; minor water strike (0.2 l/s) at 85 m in sandstone; no water strike at basalt/sandstone contact at 34 m.

LJ 42 - Langjan Nature Reserve; depth 120 m; water strike (1.97 l/s) at 103 m in sandstone; no water strike at basalt/sandstone contact at 22 m.

DV 43- De Vrede 382 MS; depth 93 m;

DV 44 - De Vrede 382 MS; depth 163 m;

GM 45 - Goudmyn 327 MR; depth 100 m; minor water strike (0.05 l/s) at 23 m; basalt is severely weathered dodwn to a depth of > 100 m

FDC 46 - Fontaine Du Champ 367 MR; depth 100 m;

BR 47 - Brest 332 MS; depth 100 m; dry borehole

TBG 48 - Taaiboschgroet 324 MR; depth 260 m; minor water strike (1.3 l/sec) at 25 m; possible Louisiana dyke between 137-162 m

TBG 49 - Taaiboschgroet 324 MR; depth 80 m; minor water strike (1.8 l/sec) at 17 m.

TBG 50 - Taaiboschgroet 324 MR; depth 80 m; minor water strike (0.4 l/sec) at 18 m.

TBG 51 - Taaiboschgroet 324 MR; depth 80 m; possibly dyke; minor water strike (0.2 l/sec) at 52 m.

TBG 52 - Taaiboschgroet 324 MR; depth 200 m; possible Louisiana dyke between 38-155 m; minor water strike (0.93 l/s) at 25 m

HALY 53 - Haly 329 MS; depth 60 m; dry borehole; Haly Fault intersected at 39 m.

HALY 54 - Haly 329 MS; depth 60 m; dry borehole; Haly Fault intersected at 35 m.

HALY 55 - Haly 329 MS; depth 51 m; dry borehole; Haly Fault intersected at 15 m.

HALY 56 - Haly 329 MS; depth 120 m; water strikes (2.2 l/s and 5.5 l/s) at 70 and 100 m, respectively.

MS 57 - Maidstone 371 MS: depth 200 m; possible dyle between 40-48 m; minor water strike (0.6 l/s) at

PC 58 - Pitcairn 336 MS; depth 200 m; muddy water .

GF 59 - Greenfield 333 MS; depth 30 m; minor water strike (0.08 l/s) at 12 m.

GF 60 - Greenfiled 333 MS; depth 30 m; dry borehole.

GF 61 - Greenfield 333 MS; depth 30 m; dry borehole.

GF 62 - Greenfield 333 MS; depth 80 m; dolerite dyke from 65 m down to bottom; dry borehole.

GF 63 - Grenfield 333 MS; depth 80 m; possible dyke between 8-25 m; dry borehole.

GF 64 - Greenfield 333 MS; depth 30 m; dolerite dyke.

GF 65 - Greenfield 333 MS; depth 30 m; dolerite dyke; seepage

GF 66 - Greenfield 333 MS; depth 30 m; basalt is not amygdaloidal; seepage

GF 67 - Greenfield 333 MS; depth 195 m; deep weathering zone; siltstone at top not indurated; water strikes (0.67 l/s and 5.59 l/s) at 15 m and 130 m, respectively.

RO 68 - Rhone 321 MR; depth 80 m; dry borehole.

RO 69 - Rhone 321 MR; depth 30 m; dolerite dyke (Louisiana dyke?); dry borehole.

RO 70 - Rhone 321 MR; depth 80 m; seepage

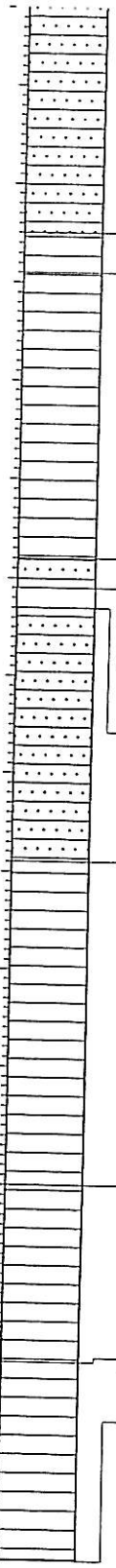
PAX 71 - Pax Intrantibus 369 MR; depth 204 m; water strikes (0.53 l/s, 2.11 l/s and 5.34 l/s) at 61 m, 165 m and 181 m, respectively.

7.2 Detailed logs of 71 percussion boreholes drilled during the present investigation:

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: MP 01
Sheet 2 of 2

JOB NUMBER: 000



Sandstone, argillaceous, pale greenish grey, fine-grained; between 202-203 m thin intercalations of siltstone, purplish red

205.00

Siltstone, purplish red, with thin intercalations of siltstone, greenish grey

209.00

Siltstone, moderate reddish brown, with small (5 mm across) greenish white spots; between 232-234 m thin intercalations of sandstone, reddish brown, argillaceous, fine- grained; between 234-236 thin alternating bands of bluish grey siltstone and whitish fine-grained sandstone, containing very small sulphide grains; between 236-237 m thin intercalations of fine-grained, greenish grey sandstone

238.00

Sandstone, yellowish grey, fine-grained; very small (<0.5 mm) hematite spots

241.00

Tuff (?), greenish blue, medium-grained

243.00

Sandstone, argillaceous, purplish red, fine-grained; with small white spots; at 265 m a 10 cm thick chalcedony-rich band

269.00

Siltstone, purplish red, in places an argillaceous sandstone; grading into a mudstone at bottom

302.00

Mudstone, bluish grey; at bottom thin intercalations of grey, fine-grained sandstone with minute sulphides

320.00

Mudstone and Siltstone alternating; greyish

340.00

End of hole.

NOTES

1) Water strike at 60 m (7 l/s)

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 14/11/2001
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 57' 34.176"
Y-COORD : 28 47' 00.112"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

HOLE No: MP 01

C017

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: FDC 02
Sheet 1 of 1

JOB NUMBER: 000

0.00	Soil, dark brown, calcareous
1.00	Basalt, weathered, greyish red or pale brownish red, medium-grained, strongly amygdaloidal
15.00	Basalt, slightly weathered, dark grey, fine- to medium-grained, amygdaloidal
20.00	Basalt, slightly weathered, greyish to greenish grey, fine-grained
24.00	Olivine basalt, slightly weathered down to 40 m, medium dark grey; occasionally grey or greenish grey, fine- to medium-grained
85.00	Basalt, medium-grained, pale greenish red or pale red; between 85-87 m maroon to greenish maroon
105.00	Olivine basalt, dark grey, fine- to medium-grained
135.00	Basalt, pale red, medium-grained; between 135-137 m strongly amygdaloidal
155.00	Olivine basalt, dark grey; grey in upper half; fine-grained
160.00	Basalt, pale red, medium-grained; occasionally amygdaloidal
165.00	Olivine basalt, dark grey; in places grey or greenish grey; fine-grained; amygdaloidal at 164 m
183.00	Basalt, pale brown or brownish grey, fine- to medium-grained, strongly amygdaloidal
193.00	Olivine basalt, dark grey, fine-grained
200.00	Basalt, pale red, in places pinkish grey or reddish grey; medium-grained; between 200- 203 m strongly amygdaloidal
210.00	Olivine basalt, grey to dark grey, fine-grained
233.00	Basalt, pale red, medium-grained
250.00	End of hole.

NOTES

1) Dry borehole; no highly magnetic sills or dykes encountered as expected.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 16/11/2001
DATE PROFILED :

DATE : 20/02/03 13:36
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 52' 50.309"
Y-COORD : 28 52' 29.196"

HOLE No: FDC 02

:017

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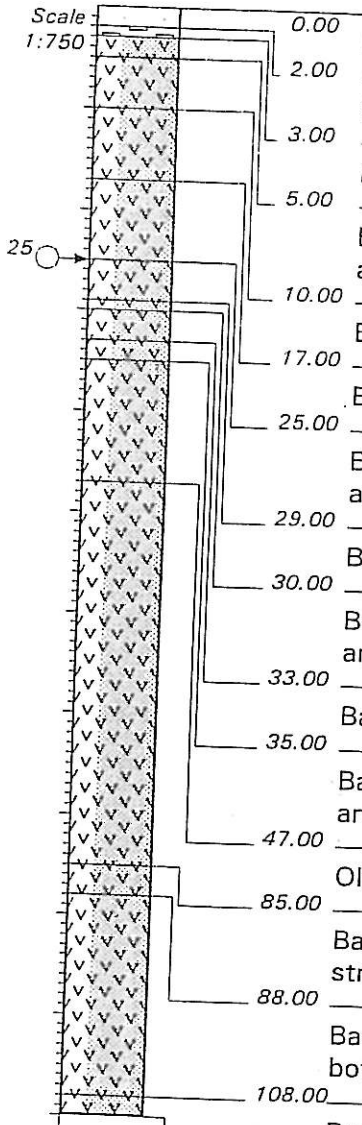
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: TER 03
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, turfy, dark brown
2.00	Calcrete, whitish
3.00	Basalt, strongly weathered, light brown
5.00	Basalt, weathered, reddish brown, medium-grained, strongly amygdaloidal
10.00	Basalt, weathered, pale brown, medium-grained
17.00	Basalt, weathered, greyish, medium-grained
25.00	Basalt, slightly weathered, pinkish grey, medium-grained, strongly amygdaloidal
29.00	Basalt, blackish grey, fine-grained; occasionally amygdaloidal
30.00	Basalt, slightly weathered, reddish brown, fine-grained, strongly amygdaloidal
33.00	Basalt, greenish grey, medium-grained, strongly amygdaloidal
35.00	Basalt, blackish grey, fine-grained; only very occasionally amygdaloidal
47.00	Olivine basalt, dark greenish grey or dark grey, medium-grained
85.00	Basalt, slightly weathered, grey to light grey, medium-grained; strongly amygdaloidal
88.00	Basalt, dark greenish grey, dark grey or grey; blackish grey at bottom; fine- to medium-grained
108.00	Basalt, pale reddish brown, fine- to medium-grained, strongly amygdaloidal
110.00	End of hole.

NOTES

1) Water strike at 25 m (5 l/s); no indications for a dyke as expected.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 19 /11/2001
DATE PROFILED :

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 52' 19.909"
Y-COORD : 28 59' 07.994"

HOLE No: TER 03

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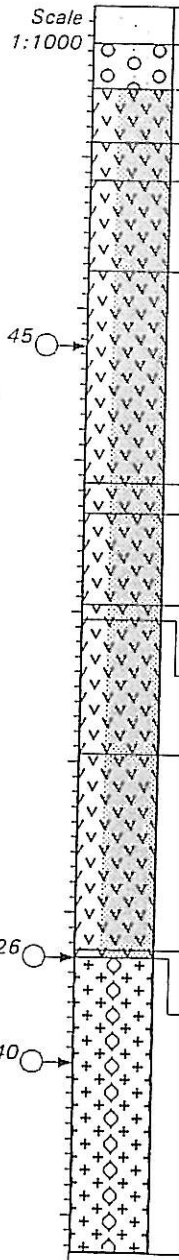
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: SEM 04
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Soil, sandy, pinkish red
5.00	
	Soil, sandy, pinkish red, with basalt fragments
11.00	
	Basalt, strongly weathered, pale brown, medium-grained
18.00	
	Basalt, purplish red or maroon, medium-grained, amygdaloidal
23.00	
	Basalt, pale reddish brown; medium-, in places fine-grained
35.00	
	Basalt, medium grey, medium-grained; in places a slight greenish tint
63.00	
	Basalt, reddish brown, medium-grained; very small amygdales
67.00	
	Basalt, grey to dark grey, medium-grained
79.00	
	Basalt, reddish brown, medium-grained, amygdaloidal
81.00	
	Basalt, dark grey, in places grey, medium-grained
99.00	
	Basalt, very fresh, dark grey with a greenish tint, medium-grained, slightly amygdaloidal
125.00	
	Basalt, greenish grey, medium-grained
126.00	
	Gneiss, leucocratic, reddish
165.00	
	End of hole.

NOTES

1) Fault plane at 126 m dipping 45, to north; at 140 m minor water strike (0.2 l/s)

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 21/11/2001
DATE PROFILED :

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 23 01' 25.200"
Y-COORD : 28 52' 25.199"

HOLE No: SEM 04

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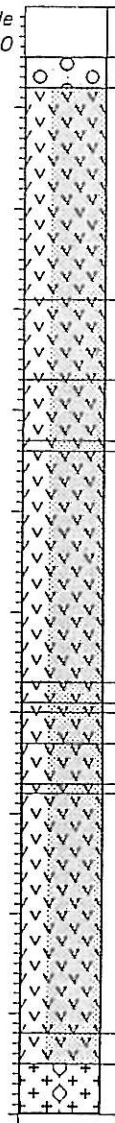
Geohydrology

HOLE No: SEM 05
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, pinkish, sandy
5.00	
	Soil, pinkish, sandy; with basalt fragments
8.00	
	Basalt, weathered, dark yellowish brown, medium-grained
29.00	
	Basalt, purplish red, fine-grained, strongly amygdaloidal
37.00	
	Basalt, dark yellowish brown or occasionally medium grey, fine- to medium-grained
43.00	
	Basalt, greyish red, fine- to medium-grained, strongly amygdaloidal
44.00	
	Basalt, medium grey, medium-grained; occasionally amygdaloidal
67.00	
	Basalt, purplish red, fine-grained, strongly amygdaloidal
69.00	
	Basalt, dark grey, medium-grained
70.00	
	Basalt, greyish red, medium-grained, strongly amygdaloidal
73.00	
	Basalt, medium- to dark grey, fine- to medium-grained
77.00	
	Basalt, greyish red, fine-grained
78.00	
	Olivine basalt, dark grey or dark greenish grey, medium-grained
102.00	
	Basalt, dark to blackish grey, medium-grained, strongly amygdaloidal
105.00	
	Gneiss, leucocratic, moderate red, medium-grained
110.00	
	End of hole.

NOTES

1) Dry borehole; fault plane intersected at 106 m

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 22/11/2001
DATE PROFILED :

GROUND LEVEL :
X-COORD : 23 01' 25.760"
Y-COORD : 28 52' 24.987"

HOLE No: SEM 05

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

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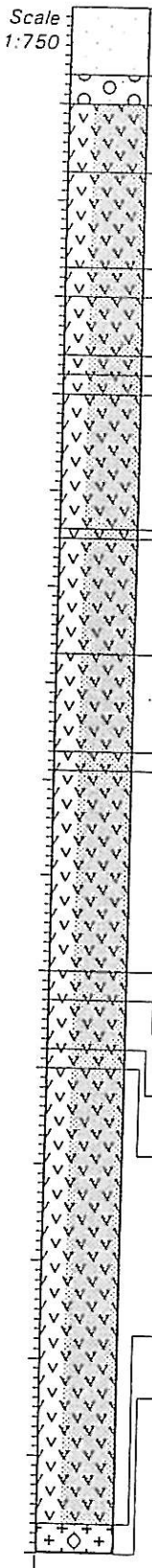
Geohydrology

HOLE No: SEM 06
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, light red, sandy
7.00	
	Soil, light red, sandy; with fragments of basalt
10.00	
	Basalt, severely weathered, yellowish brown, medium-grained
17.00	
	Basalt, weathered, pale brown, medium-grained
27.00	
	Basalt, slightly weathered, pale brownish grey, medium-grained
30.00	
	Basalt, dark grey, medium-grained
36.00	
	Basalt, pale greenish red, lmedium-grained, strongly amygdaloidal
38.00	
	Basalt, pale greenish grey, medium-grained
40.00	
	Basalt, medium grey, medium-grained
54.00	
	Basalt, pale greenish brown, medium-grained, highly amygdaloidal
55.00	
	Basalt, dark grey, medium-grained; between 61-63m amygdaloidal
67.00	
	Basalt, dark greenish grey, medium-grained
77.00	
	Basalt, reddish brown or pale greenish brown, medium-grained, amygdaloidal
79.00	
	Basalt, dark grey, in places pale greenish grey; medium-grained
100.00	
	Basalt, greyish red, medium-grained, strongly amygdaloidal
103.00	
	Basalt, dark grey, medium-grained
108.00	
	Basalt, greyish red, medium-grained, amygdaloidal
110.00	
	Basalt, dark grey, occasionally greenish grey, medium-grained; between 111-116 m amygdaloidal
157.00	
	Gneiss, leucocratic, moderate red, medium-grained
160.00	
	End of hole.

NOTES

1) Dry borehole; fault plane intersected at 157 m

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 23/11/2001
DATE PROFILED :

GROUND LEVEL :
X-COORD : 23 01' 24.370"
Y-COORD : 28 52' 25.373"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

HOLE No: SEM 06

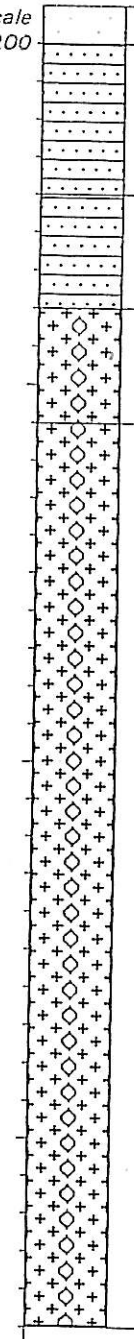
C017

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: SEM 07
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, dark brown, coarse
1.00	Sandstone, weathered, light brown
5.00	Sandstone, ferrugineous, dark brown to purplish, fine-grained
8.00	Gneiss, strongly weathered, leucocratic, light brown or yellowish brown
11.00	Gneiss, leucocratic, reddish, medium-grained
35.00	End of hole.

NOTES

1) Dry borehole; sandstone is probably part of Soutpansberg Group.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 23/11/2001
DATE PROFILED :
DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 23 01' 28.097"
Y-COORD : 28 52' 25.006"

HOLE No: SEM 07

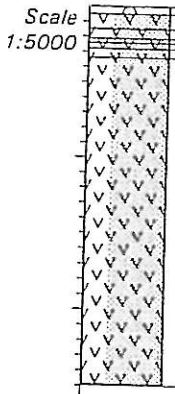
C017

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: BB 08
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, reddish, coarse, with large fragments of quartzite
5.00	Basaltic rock, slightly weathered, yellowish grey or pale brownish grey, medium-grained
15.00	Basaltic rock, slightly weathered, grey to pale brownish grey, medium-grained
21.00	Basaltic rock, bluish grey, fine-grained
24.00	Basaltic rock, pale brownish grey, medium-grained, olivine-rich
28.00	Basaltic rock, reddish brown, fine-grained
34.00	Basaltic rock; bluish grey to dark grey, occasionally dark greenish grey; fine- grained; no amygdales; occasional thin veins of quartz or carbonate
250.00	End of hole.

NOTES

1) Seepage; highly magnetic dolerite plug

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 28/11/2001
DATE PROFILED :

GROUND LEVEL :
X-COORD : 23 00' 00.993"
Y-COORD : 29 02' 39.898"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:36
TEXT : a:\BRANDDOT.TXT

HOLE No: BB 08

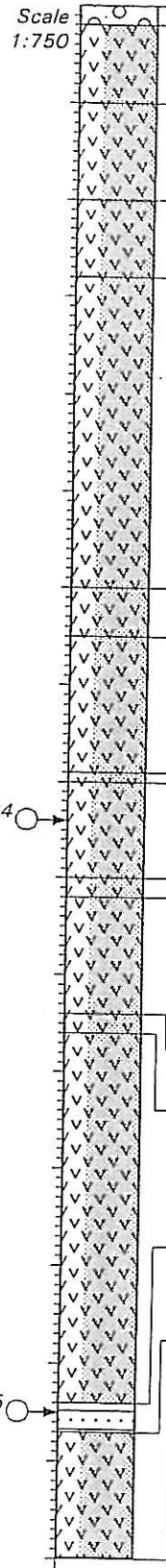
:017

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: KH 09
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 2.00	Soil, brownish, with fragments of basalt
2.00 – 10.00	Basalt, severely weathered, pale brownish red or honey brown, medium-grained
10.00 – 20.00	Olivine basalt, weathered, dark grey or pale yellowish grey, medium-grained
20.00 – 28.00	Basalt, slightly weathered, pale greenish brown, medium-grained
28.00 – 60.00	Basalt; slightly weathered down to 40 m, then fresh; dark grey to blackish grey, upper third in places pale greenish grey or pale brown; medium-grained
60.00 – 65.00	Basalt, pale brownish red, medium-grained
65.00 – 79.00	Basalt, pale brown, medium-grained
79.00 – 80.00	Basalt, dark grey, medium-grained
80.00 – 90.00	Basalt, greyish red, fine-to medium-grained, amygdaloidal
90.00 – 92.00	Basalt, greenish grey, medium-grained
92.00 – 104.00	Olivine basalt, dark grey to blackish grey, medium-grained; between 97-98 m amygdaloidal
104.00 – 106.00	Basalt, pale pinkish grey, medium-grained, strongly amygdaloidal
106.00 – 144.00	Basalt; dark grey, pale reddish grey at 120 m; medium-grained; amygdaloidal from 140 m downwards
144.00 – 147.00	Sandstone, off-white and pinkish, fine-grained; upper contact dips 05 N, lower one 20 E
147.00 – 160.00	Basalt, dark grey, medium-grained; amygdaloidal at bottom.
160.00	End of hole.

NOTES

1) Water strikes at 84 m (3.23 l/s) and 145 m (9.46 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 30/11/2001
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 56' 57.730"
Y-COORD : 29 02' 27.848"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

HOLE No: KH 09

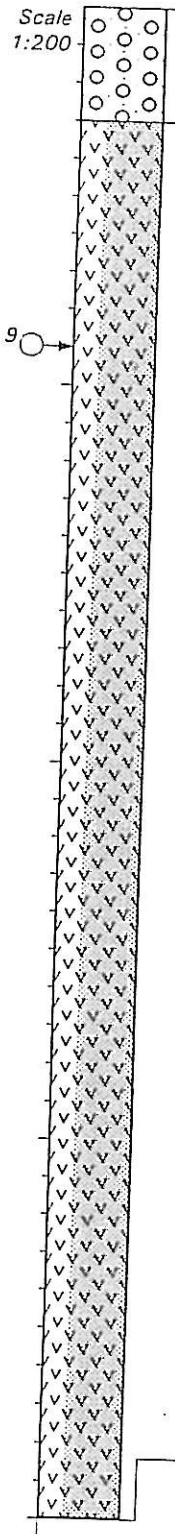
C017

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: ROS 10
Sheet 1 of 1

JOB NUMBER: 000



0.00 Soil, brownish, with fragments of dolerite and basalt

3.00 Basaltic rock, dyke, massive, blackish grey, fine-grained porphyritic

40.00 End of hole.

NOTES

1) Minor water strike at 9 m (0.2 l/s); drilled into subvertical dyke

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 3/12/01
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 52' 48.782"
Y-COORD : 29 04' 23.117"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

HOLE No: ROS 10

C017

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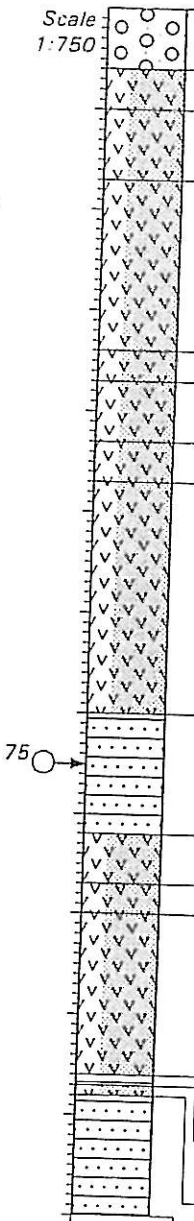
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: ROS 11
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soildark brown, with fragments of basalt
6.00	Basalt, weathered, pale brown
10.00	Basalt, slightly weathered, greyish brown, medium-grained
17.00	Basalt; dark grey, occasionally greenish grey; medium-grained
34.00	Basalt, pale red, medium-grained
37.00	Basalt, pale brownish red, medium-grained
43.00	Basalt, medium grey, medium-grained
47.00	Basalt, dark grey, medium-grained
70.00	Sandstone, whitish, fine-grained
82.00	Basalt, dark grey, medium-grained
87.00	Basalt, medium grey, medium-grained
90.00	Olivine basalt; dark to blackish grey, maroon at around 93 m;
106.00	Sandstone, siliceous, grey, fine-grained
107.00	Basalt, dark grey, medium-grained
108.00	Sandstone, very light grey, fine-grained; top 2 m are siliceous, rest is fine powder
120.00	End of hole.

NOTES

1) Minor water strike at 75 m (0.2 l/s)

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 4/12/2001
DATE PROFILED :

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 52' 50.307"
Y-COORD : 29 04' 22.422"

HOLE No: ROS 11

117

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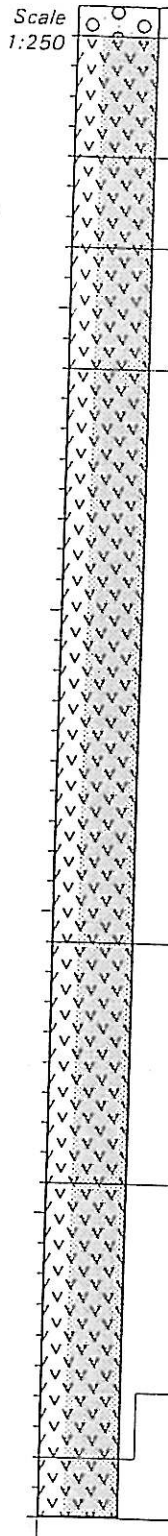
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: ROS 12
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Soil, dark brown, calcareous, with fragments of basalt
1.00	
	Basalt, severely weathered, yellowish brown
5.00	
	Basalt, slightly weathered, pale brown, medium-grained
8.00	
	Basalt, pale reddish grey, medium-grained
12.00	
	Basalt; dark grey, in places dark greenish grey; medium-grained
31.00	
	Basalt, pale red, fine-grained
39.00	
	Basalt, dark grey, medium-grained
48.00	
	Basalt, medium grey, medium-grained
50.00	
	End of hole.

NOTES

1) Dry borehole; no indication of a dyke.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 4/12/2001
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 52' 49.400"
Y-COORD : 29 04' 22.711"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

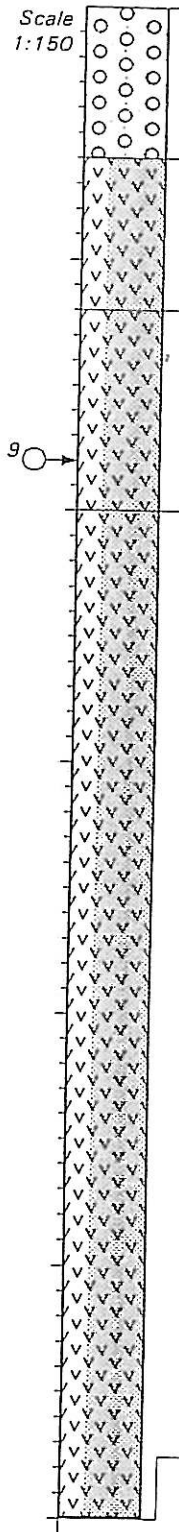
HOLE No: ROS 12

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: ROS 13
Sheet 1 of 1

JOB NUMBER: 000



0.00 Soil, grey, with fragments of basalt

3.00 Basalt, slightly weathered, grey, medium-grained

6.00 Basalt, dark grey, medium-grained

10.00 Basalt, very fresh, blackish grey, medium-grained

30.00 End of hole.

NOTES

1) Minor water strike at 9 m (0.2 l/s); basalt is strongly fractured.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 5/12/2001
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 53' 11.600"
Y-COORD : 29 04' 07.500"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

HOLE No: ROS 13

2017

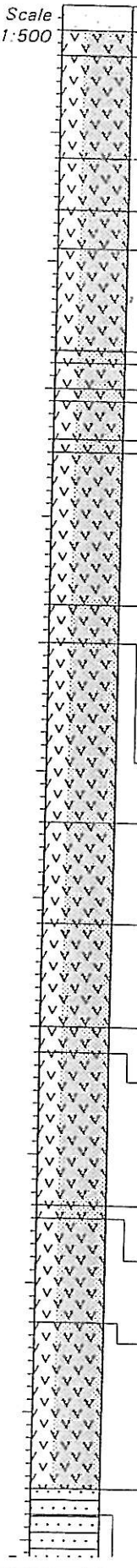
dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: ROS 14
Sheet 1 of 2

JOB NUMBER: 000

Scale 1:500

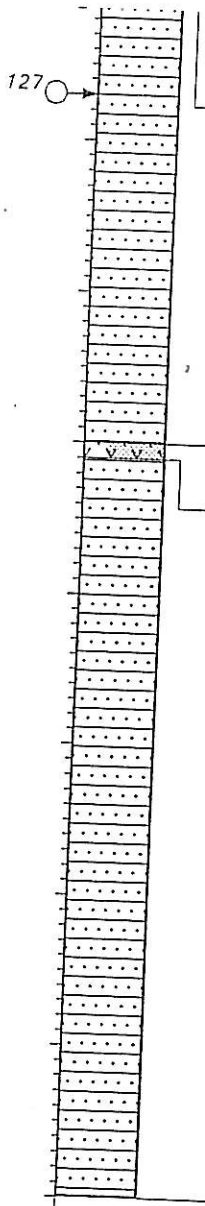


0.00	
	Soil, pinkish grey, sandy, calcareous
2.00	
	Basalt, severely weathered, dark brown, medium-grained
4.00	
	Basalt, severely weathered, medium brown, medium-grained
12.00	
	Basalt, fresh, dark grey, medium-grained; between 12-13 m minute specks of sulphide
16.00	
	Basalt, blackish grey, medium-grained
19.00	
	Basalt, dark grey, medium-grained
27.00	
	Basalt, blackish grey, medium-grained
28.00	
	Basalt, dark grey, medium-grained
30.00	
	Basalt, blackish grey, medium-grained
31.00	
	Basalt, dark grey, medium-grained
34.00	
	Basalt, blackish grey, medium-grained
35.00	
	Basalt; dark grey, in places pale greenish grey; medium-grained; between 44-45 m minute specks of sulphide
47.00	
	Basalt, blackish grey, medium-grained
50.00	
	Basalt, dark grey, medium-grained; amygdaloidal between 55-56 m
64.00	
	Basalt; blackish grey, in places pale greenish grey; medium-grained
72.00	
	Basalt, dark grey, medium-grained; amygdaloidal between 79-80 m
80.00	
	Basalt, blackish grey, medium-grained; amygdaloidal
82.00	
	Basalt; dark grey, in places medium grey or pale greenish grey; medium-grained
94.00	
	Basalt, pale red, medium-grained; amygdaloidal
95.00	
	Basalt, dark grey, medium-grained; between 98-99 m minute specks of sulphide
103.00	
	Basalt, blackish grey, medium-grained; amygdaloidal between 109-110 m, and strongly amygdaloidal between 114-116 m
116.00	

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: ROS 14
Sheet 2 of 2

JOB NUMBER: 000



Sandstone, siliceous (indurated), off-white, fine-grained; fractured, large chips

118.00

Sandstone, off-white, fine-grained; fine powder

150.00

Basalt, blackish grey, medium-grained

151.00

Sandstone, off-white, fine-grained; fine powder

200.00

End of hole.

NOTES

1) Water strike at 127 m (1.59 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 6/12/2001
DATE PROFILED :

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 53' 18.100"
Y-COORD : 29 04' 07.500"

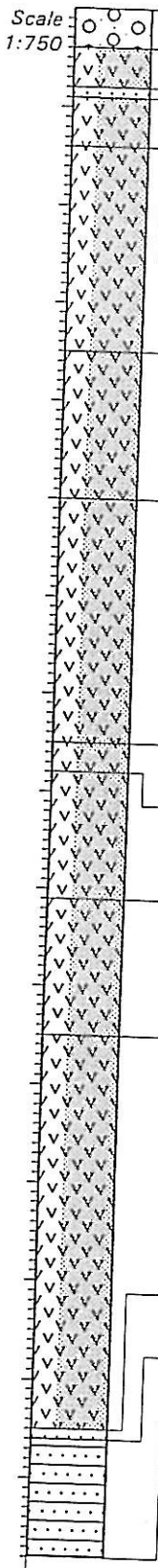
HOLE No: ROS 14

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: ROS 15
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, brownish grey, with fragments of basalt
4.00	Basalt, weathered, pale brownish grey, medium-grained
8.00	Sandstone, siliceous (indurated), pink, fine-grained
9.00	Basalt, weathered, greenish grey, medium-grained
14.00	Basalt; dark to blackish grey, in places pale reddish grey; medium-grained
35.00	Basalt, slightly weathered, pale greenish maroon, medium-grained; amygdaloidal
50.00	Basalt; dark grey, in places pale greenish or pale reddish grey; medium-grained; slightly amygdaloidal
75.00	Basalt, slightly weathered, light grey, medium-grained
78.00	Basalt, dark grey, medium-grained
91.00	Basalt, slightly weathered, light to medium grey, medium-grained
105.00	Basalt, dark grey, medium-grained; fine-grained between 144-145 m
145.00	Sandstone, siliceous (indurated), whitish, fine-grained (chips)
146.00	Sandstone, whitish, fine-grained (fine powder)
158.00	End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 18/01/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 52' 47.200"
Y-COORD : 29 04' 24.100"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

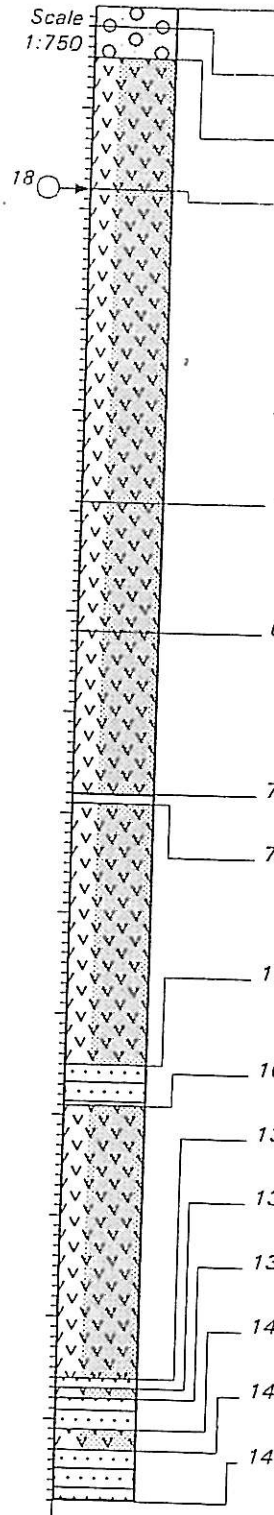
HOLE No: ROS 15

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: ROS 16
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, reddish brown, with fragments of agate, basalt and calcrete
2.00	Soil, light brown, with fragments of basalt
5.00	Basalt, severely weathered, brownish
18.00	Basalt, relatively fresh, dark to blackish grey, in places pale greenish grey; medium- grained
49.00	Basalt, pale reddish grey and pale greenish maroon, medium-grained, amygdaloidal
62.00	Basalt, dark grey and greenish grey, medium-grained
78.00	Sandstone, greyish white, fine-grained (chips)
79.00	Basalt, dark grey and pale greenish grey, medium-grained; slightly amygdaloidal between 100-101m
105.00	Sandstone, whitish, fine-grained (fine powder); top 20 cm pinkish and siliceous
109.00	Basalt, dark grey, medium-grained; occasionally amygdaloidal
136.00	Sandstone, siliceous, pinkish grey, fine-grained (chips)
137.00	Basalt, dark grey, medium-grained
138.00	Sandstone, whitish, fine-grained (fine powder)
141.00	Basalt, dark grey, medium-grained
143.00	Sandstone, whitish, fine-grained (fine powder)
148.00	End of hole.

NOTES

1) Water strike at 18 m (3.6 l/s)

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 21/01/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 51' 57.500"
Y-COORD : 29 04' 54.500"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

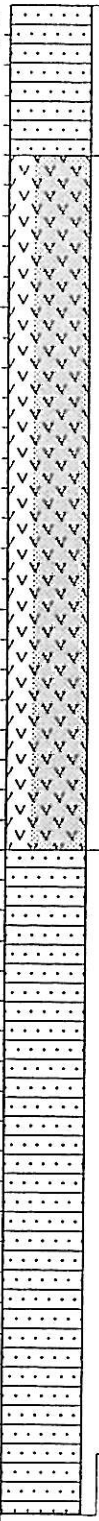
HOLE No: ROS 16

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: UL 17
Sheet 1 of 1

JOB NUMBER: 000



0.00 Sandstone; off-white, in places yellowish white; fine-grained; fractured (large fragments)

5.00 Basalt, weathered, yellowish grey to pale brownish grey, medium-grained

28.00 Sandstone, off-white to yellowish white, fine-grained (fine powder)

50.00 End of hole.

NOTES

1) Dry borehole; at 5 m a south-dipping fault intersected

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 28/01/2002
DATE PROFILED :
DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 52' 00.800"
Y-COORD : 29 08' 14.100"

HOLE No: UL 17

C017

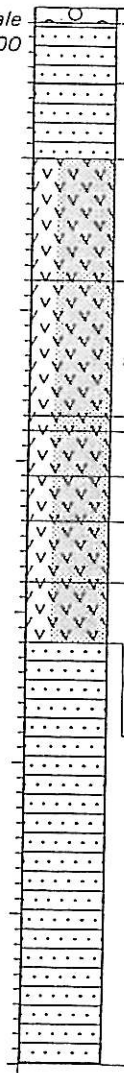
dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: UL 18
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:500



0.00	Soil, dark brown, with fragments of sandstone
1.00	Sandstone, off-white, fine-grained, fractured (large fragments up to 6 cm across)
5.00	Sandstone, off-white, fine-grained (fine powder)
10.00	Basalt, weathered, brownish or honey brown, medium-grained; slightly amygdaloidal
18.00	Basalt, almost completely weathered (muddy matrix)
27.00	Basalt, weathered, grey
28.00	Basalt, almost completely weathered (muddy matrix)
31.00	Basalt, weathered, grey, medium-grained
34.00	Basalt, almost completely weathered (muddy matrix)
38.00	Basalt, relatively fresh, dark grey, medium-grained
42.00	Sandstone; yellowish white, upper two metres pinkish white (fine powder)
70.00	End of hole.

NOTES

1) Dry borehole; at 10 m a south-dipping fault intersected.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 29/01/2002
DATE PROFILED :

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 52' 01.400"
Y-COORD : 29 08' 13.800"

HOLE No: UL 18

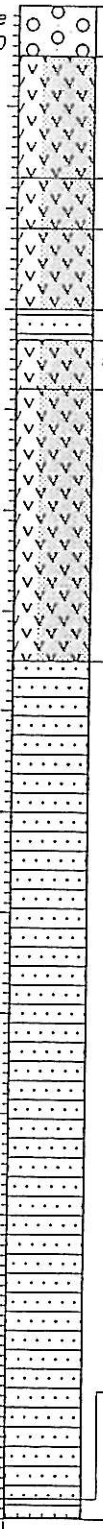
017

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: UL 19
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, pale pinkish brown, with fragments of calcrete and basalt
5.00	Basalt, slightly weathered; grey to dark grey, in places dark brownish grey; medium-grained
17.00	Basalt, weathered, light brown or yellowish brown, medium-grained
22.00	Basalt, dark grey, medium-grained
30.00	Sandstone, whitish, fine-grained (chips)
33.00	Basalt, weathered, light brown or grey, amygdaloidal; a few thin veinlets of quartz and carbonate
38.00	Basalt, fresh, pale greenish grey to dark grey, medium-grained
65.00	Sandstone, mainly off-white, fine-grained (mainly fine powder); yellowish white between 126-127 m and 136-137 m
148.00	Sandstone, pinkish, fine-grained (fine powder)
150.00	End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 30/01/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 52' 25.400"
Y-COORD : 29 08' 11.600"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

HOLE No: UL 19

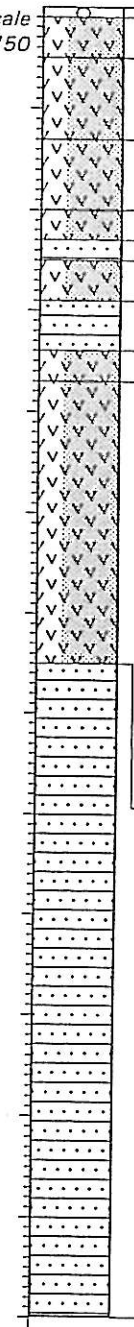
C017

dot.PLOT 3037 J&W Inc

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: UL 20
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, dark brown, with fragments of basalt
1.00	Basalt, fractured, weathered, grey, medium-grained (very large chips)
5.00	Olivine basalt, weathered, honey brown or yellowish brown, medium-grained
13.00	Olivine basalt, dark grey, medium-grained
20.00	Basalt, slightly weathered, grey, medium-grained
23.00	Sandstone, yellowish grey, fine-grained (fine powder)
25.00	Basalt, weathered, brownish grey to light brown, medium-grained; veinlets of carbonate and opal
29.00	Sandstone, off-white, fine-grained (fine powder)
34.00	Basalt, weathered, brownish grey or light brown, medium-grained; slightly amygdaloidal
37.00	Basalt, fresh, dark to blackish grey, medium-grained; slightly amygdaloidal between 43-44 m, 60-61 m and 64-65 m
65.00	Sandstone; off-white, yellowish white at top; fine-grained (fine powder)
130.00	End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 30/01/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 52' 26.000"
Y-COORD : 29 08' 11.400"

HOLE No: UL 20

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

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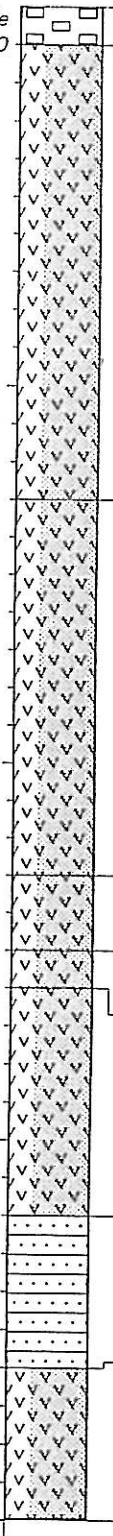
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: UL 21
Sheet 1 of 1

JOB NUMBER: 000



0.00	Calcrete, light grey
1.00	Basaltic rock, relatively fresh, pale brown to dark grey, fine- to medium- grained; fractured between 1-3 m, 5-7m and 12-13 m
13.00	Basaltic rock; dark grey, fine- to medium-grained; in places pale brownish grey, and fine-grained;
23.00	Basaltic rock, dark grey, fine- to medium-grained
25.00	Basalt, very weathered, light brown, lots of carbonates
26.00	Basalt, slightly weathered; grey, brownish towards bottom; medium-grained, slightly amygdaloidal
32.00	Sandstone, yellowish white, fine-grained (mainly fine powder)
36.00	Basalt, weathered, grey and light brown, medium-grained; veinlets of carbonate at top; slightly amygdaloidal
40.00	End of hole.

NOTES

1) Dry borehole; possible dyke between 1-25 m.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 31/01/2002
DATE PROFILED :
DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 52' 26.600"
Y-COORD : 29 08' 11.400"

HOLE No: UL 21

C017

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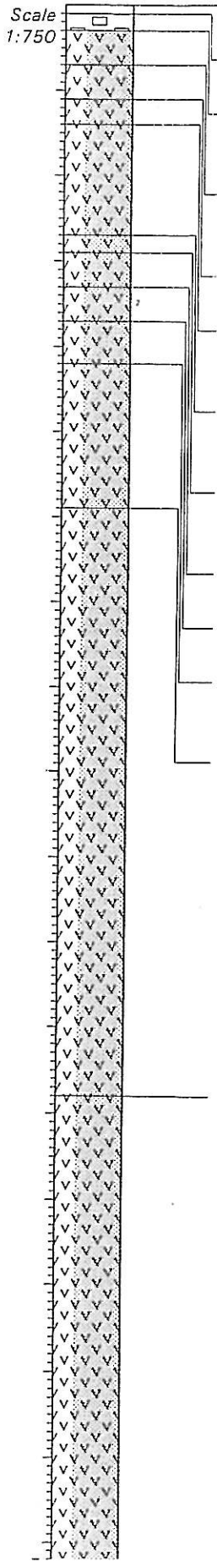
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: UL 22
Sheet 1 of 2

JOB NUMBER: 000

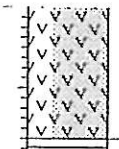


0.00	Soil, dark brown
1.00	Calcrete.
3.00	Basalt, severely weathered, brownish grey, medium-grained; calcareous in places
7.00	Basalt, weathered, greyish to pale brownish grey, medium-grained; calcareous in places
11.00	Basalt, weathered, pale brownish grey, medium-grained
14.00	Basalt, slightly weathered; greyish, in places pale greenish grey; medium-grained
27.00	Basaltic rock, highly magnetic, fresh rock, dense, reddish brown, fine-grained
29.00	Basaltic rock, highly magnetic, fresh, dense; pale brownish grey, fine-grained
33.00	Basaltic rock, highly magnetic, fresh, dense; grey, fine-grained
37.00	Basalt, weathered, brownish grey, medium-grained
42.00	Basalt, fresh, dark to blackish grey, medium-grained; occasionally specks of sulphide, and veinlets of opal and carbonates
59.00	Basalt, dark to blackish grey, medium-grained; specks of sulphide between 76-77 m
128.00	Basaltic rock, dark grey or bluish grey; fine-, in places medium-grained;

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: UL 22
Sheet 2 of 2

JOB NUMBER: 000



195.00	
	Siltstone, grey
197.00	
	Sandstone, argillaceous, brownish red
198.00	
	Siltstone, grey
199.00	
	Sandstone, argillaceous, brownish red
200.00	
	Sandstone, greenish white, fine-grained
202.00	
	Sandstone, argillaceous, brownish red
207.00	
	Siltstone, dark reddish brown
210.00	
	Sandstone, argillaceous, brownish red
217.00	
	Siltstone, dark reddish brown
219.00	
	Sandstone, argillaceous, brownish red
220.00	
	Siltstone, dark reddish brown
226.00	
	Sandstone, argillaceous, brownish red
227.00	
	Siltstone, dark reddish brown
245.00	
	End of hole.

NOTES

1) Seepage; possible dykes between 27-37 m and 128-195 m; at 195m a north-dipping fault

2) plane intersected

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 05/02/2002
DATE PROFILED :

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 52' 27.200"
Y-COORD : 29 08' 11.200"

HOLE No: UL 22

2017

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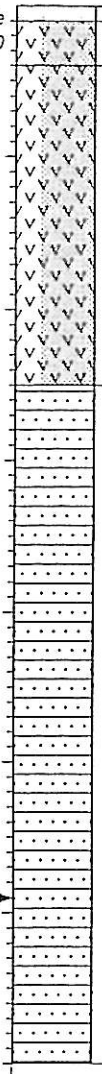
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: UL 23
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, brownish, and calcrete
1.00	Basalt, weathered, fractured, pale brownish grey, medium-grained
4.00	Basalt, slightly weathered; greyish, occasionally pale brownish grey, medium-grained
25.00	Sandstone, off-white, fine-grained (fine powder)
70.00	End of hole.

NOTES

1) Water strike at 59 m (1.06 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 06/02/2002
DATE PROFILED :

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

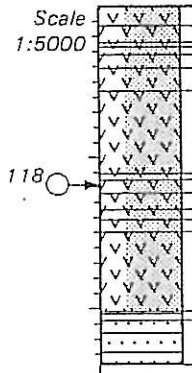
GROUND LEVEL :
X-COORD : 22 52' 34.700"
Y-COORD : 29 08' 09.600"

HOLE No: UL 23

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: KH 24
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, pale brown
1.00	Basalt, severely weathered, light grey, amygdaloidal
13.00	Basalt, weathered, medium grey
24.00	Basalt, fresh, greyish red, medium-grained, amygdaloidal
27.00	Basalt, greenish red, medium-grained, amygdaloidal
32.00	Basalt, slightly weathered, greyish and reddish grey, medium-grained
41.00	Basalt, slightly weathered; dark grey, in places greenish grey, medium-grained; occasionally amygdaloidal
56.00	Basalt, fresh, dark grey, medium-grained, amygdaloidal between 95-96m and 105- 106m
111.00	Basalt, greyish red, medium-grained, amygdaloidal
115.00	Basalt, dark grey, medium-grained
124.00	Basalt, greyish red, medium-grained, strongly amygdaloidal
135.00	Basalt, dark grey, medium-grained
142.00	Basalt; greyish red at top, reddish lower down; medium-grained, strongly amygdaloidal
150.00	Basalt; dark grey, in places dark greenish grey, blackish grey at bottom; medium- grained
202.00	Sandstone, siliceous (indurated), light and medium grey laminations, fine-grained; a few thin intercalations of indurated bluish grey mudstone
208.00	Sandstone, off-white, fine-grained (fine powder)
237.00	End of hole.

NOTES

1) Major water strike at 118 m (40 l/s)

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 27/03/2002
DATE PROFILED :
DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 57' 00.200"
Y-COORD : 29 02' 29.600"

HOLE No: KH 24

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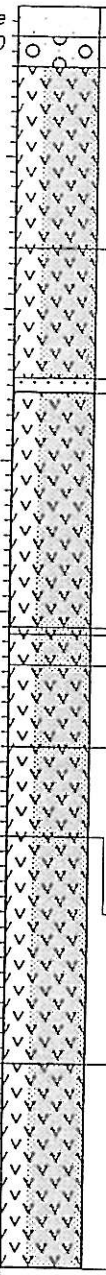
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: DV 26
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 4.00	Soil, turfy
4.00 – 8.00	Soil, reddish brown, with fragments of basalt and calcrete
8.00 – 32.00	Basalt, severely weathered, brownish red, medium-grained; slightly amygdaloidal
32.00 – 49.00	Basalt, slightly weathered, reddish grey, medium-grained
49.00 – 51.00	Sandstone, siliceous (indurated), grey and pinkish grey, fine-grained
51.00 – 82.00	Basalt, fresh; grey to dark grey, in places with a reddish tinge; medium-grained,
82.00 – 83.00	Basalt, reddish brown, medium-grained; strongly amygdaloidal
83.00 – 87.00	Basalt, greyish red, medium-grained
87.00 – 98.00	Basalt, reddish grey, medium-grained
98.00 – 110.00	Basalt; grey with a red tinge in upper half, dark grey in lower half; medium- grained; amygdaloidal
110.00 – 140.00	Basalt, pinkish grey, medium-grained; in places amygdaloidal
140.00 – 167.00	Basalt, dark grey, medium-grained; in places amygdaloidal
167.00	End of hole.

NOTES

1) Major water strike at 167 m (40 l/s), at basalt/sandstone contact; no dyke encountered as

2) expected.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 21/02/2002
DATE PROFILED :
DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 53' 11.100"
Y-COORD : 28 59' 01.300"

HOLE No: DV 26

C017

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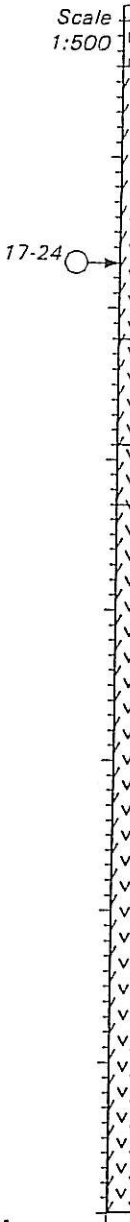
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: DV 25
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, turfy
1.00	Calcrete.
4.00	Basalt, weathered, fractured, greyish red, medium-grained, strongly amygdaloidal
22.00	Basalt, reddish grey, medium-grained
29.00	Basalt, greyish red, medium-grained; strongly amygdaloidal
33.00	Basalt; dark grey, with a reddish tinge
80.00	End of hole.

NOTES

1) Water strike at 17-24 m (3.8 l/s); no indication of a dyke as expected.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 12/02/2002
DATE PROFILED :

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 53' 10.800"
Y-COORD : 28 59' 01.500"

HOLE No: DV 25

C017

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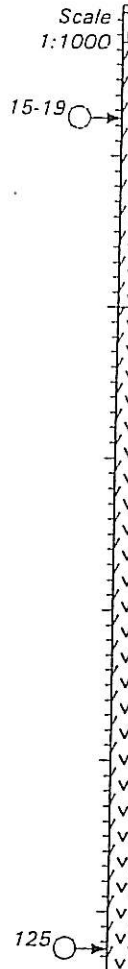
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GP 27
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, darkbrown
1.00	Calcrete, greyish white
5.00	Basalt, weathered, greyish red, medium-grained; strongly amygdaloidal
40.00	Basalt, fresh; grey and dark grey, greyish red between 80-81 m; medium-grained, amygdaloidal
139.00	Basalt, pale greenish grey, medium-grained
141.00	Basalt, greyish red, medium-grained
150.00	Basalt; dark grey, in places with a greenish tinge; medium-grained, amygdaloidal; strongly amygdaloidal between 169-170 m
172.00	Sandstone, siliceous (indurated), off-white, fine-grained (chips)
173.00	Basalt, blackish grey, medium-grained
174.00	Sandstone, off-white, fine-grained (fine powder)
190.00	End of hole.

NOTES

1) Water strike at 15-19 m (2.25 l/s) and at 125 m (6.38 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 18/02/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 56' 25.500"
Y-COORD : 29 08' 05.600"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:38
TEXT : a:\BRANDDOT.TXT

HOLE No: GP 27

C017

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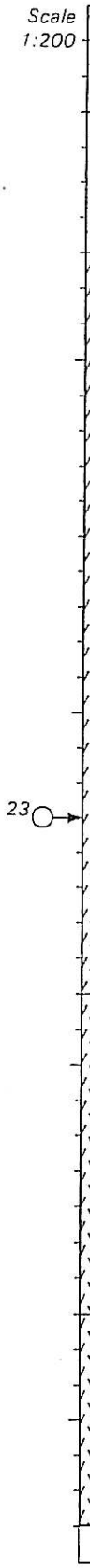
Geohydrology

HOLE No: FF 28
Sheet 1 of 1

JOB NUMBER: 000



0.00 Soil, dark brown

3.00 Soil, calcareous, pale brownish grey

7.00 Basalt, severely weathered, greyish, medium-grained

28.00 Basalt, slightly weathered, pale greenish red, medium-grained; strongly amygdaloidal

37.00 Basalt, slightly weathered, medium grey, medium-grained

43.00 End of hole.

NOTES

1) Minor water strike at 23 m (0.2 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 28/02/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 58' 46.700"
Y-COORD : 29 11' 06.800"

HOLE No: FF 28

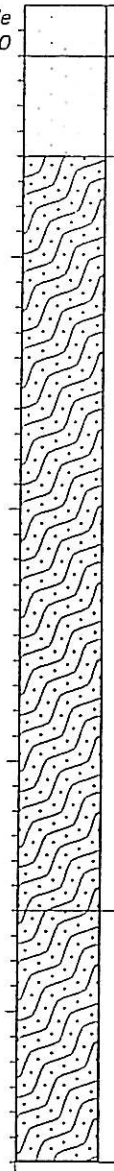
TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:36
TEXT : a:\BRANDDOT.TXT

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: FF 29
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, dark brown
1.00	Soil, moderate brown
3.00	Quartzite, severely weathered; pale red, pinkish and whitish; medium-grained
18.00	Quartzite, pale red, medium-grained
23.00	End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 28/02/2002
DATE PROFILED :

DATE : 20/02/03 13:36
TEXT : a:\BRANDDOT.TXT

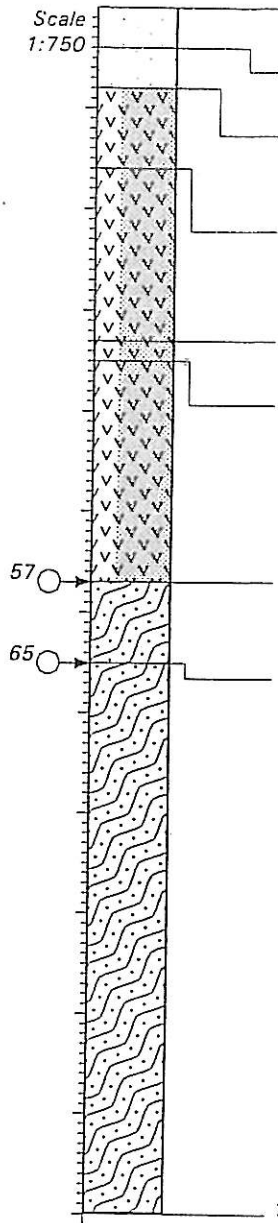
GROUND LEVEL :
X-COORD : 22 58' 55.300"
Y-COORD : 29 11' 09.000"

HOLE No: FF 29

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: FF 30
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, reddish brown
4.00	Soil, pale brownish grey, calcareous
8.00	Basalt, severely weathered, grey and brownish grey, medium-grained
16.00	Basalt, weathered, brownish grey and medium grey, medium-grained
33.00	Basalt, slightly weathered, reddish grey, medium-grained
35.00	Basalt, slightly weathered, dark grey and pale greenish grey, medium-grained
57.00	Quartzite; greyish white, pale red and light greenish grey; medium-grained
65.00	Quartzite, greyish red and pale reddish brown, fine-grained; small whish spots
120.00	End of hole.

NOTES

1) Minor water strike at 65 m (0.1 l/s); at 57 m a north-dipping fault plane was intersected.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 04/03/2002
DATE PROFILED :

DATE : 20/02/03 13:36
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 58' 50.300"
Y-COORD : 29 11' 07.700"

HOLE No: FF 30

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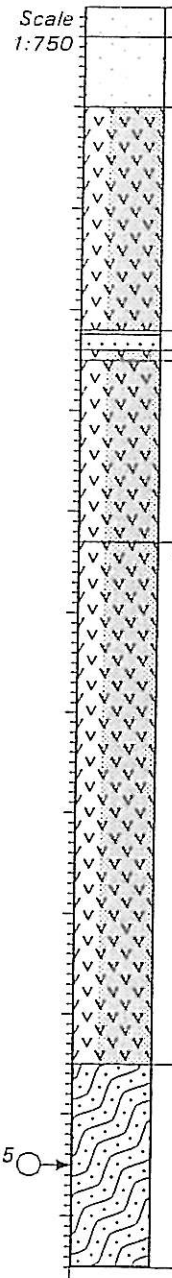
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: FF 31
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Soil, dark brown
3.00	
	Soil, calcareous, light brown
10.00	
	Basalt, weathered, grey, medium-grained
32.00	
	Sandstone, pale red, fine-grained
34.00	
	Basalt, reddish grey, medium-grained
35.00	
	Basalt, slightly weathered, dark grey, medium-grained; amygdaloidal between 40- 41 m and 50-51 m
53.00	
	Basalt, fresh; medium to dark grey, rarely greenish or reddish grey; medium- grained; amygdaloidal between 89-90 m
105.00	
	Quartzite, pale red, fine-grained
125.00	
	End of hole.

NOTES

1) Minor water strike at 115 m (0.1 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 04/03/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 58' 49.600"
Y-COORD : 29 11' 07.500"

HOLE No: FF 31

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

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Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: FF 32
Sheet 1 of 1

JOB NUMBER: 000

0.00	Soil, light brown
5.00	Soil, calcareous, grey
9.00	Basalt, severely weathered, brownish grey, medium-grained
19.00	Basalt, weathered, pale greenish red, medium-grained; strongly amygdaloidal
24.00	Basalt, slightly weathered, dark grey, medium-grained; strongly amygdaloidal between 48-49 m
52.00	Basalt, fresh, blackish grey, medium-grained
77.00	Sandstone, pale red, fine-grained
78.00	Basalt; mainly dark grey, pale greenish grey between 103-104 m; medium-grained; amygdaloidal between 84-85 m, 108-109 m and 121-130 m
157.00	Basalt; blackish grey, pale greenish grey between 163-164 m; medium-grained
200.00	End of hole.

NOTES

1) Minor water strike at 68 m (0.2 l/s); basalt has fairly uniform composition throughout.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 06/03/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 58' 44.500"
Y-COORD : 29 11' 06.200"

HOLE No: FF 32

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

C017

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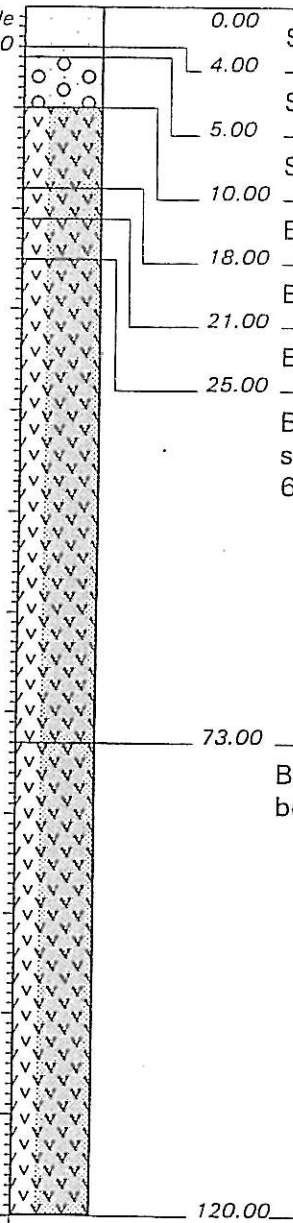
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: FF 33
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, reddish brown
4.00	Soil, brownish grey
5.00	Soil, calcareous, medium grey; with fragments of quartzite
10.00	Basalt, severely weathered, brownish grey, medium-grained
18.00	Basalt, slightly weathered, pale brown, medium-grained
21.00	Basalt, slightly weathered, pale red, strongly amygdaloidal
25.00	Basalt; slightly weathered down to 52 m; medium dark grey; strongly amygdaloidal between 29-30 m, 48-49 m, 57-58m and 66-67 m
73.00	Basalt, fresh, blackish grey, medium-grained; amygdaloidal between 73-85 m and 103 m
120.00	End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 06/03/2002
DATE PROFILED :

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 58' ??
Y-COORD : 29 11' ??

HOLE No: FF 33

C017

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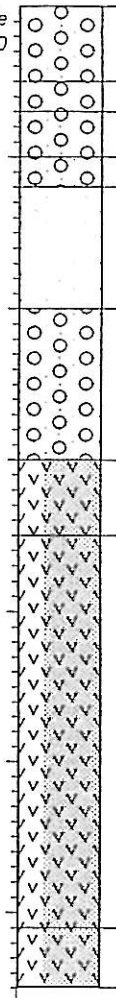
Geohydrology

HOLE No: BB 34
Sheet 1 of 1

JOB NUMBER: 000



0.00	Scree; fragments of pinkish red quartzite in a reddish grey sandy matrix
5.00	Scree; light grey sand with fragments of pinkish red quartzite
7.00	Scree; fragments of pinkish red quartzite in a reddish grey sandy matrix
10.00	Palaeo-soil, light grey, with minor fragments of pinkish red quartzite
12.00	Palaeo-soil, pale reddish brown, probably derived from basaltic rocks
20.00	Palaeo-soil, calcareous, light grey, with small fragments of basalt
30.00	Basalt, slightly weathered, medium grey, medium-grained, amygdaloidal
35.00	Basalt, slightly weathered, greyish red, medium-grained
61.00	Basalt, fresh, dark grey, medium-grained
65.00	End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 07/03/2002
DATE PROFILED :
DATE : 20/02/03 13:36
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 23 00' 27.700"
Y-COORD : 29 02' 47.600"

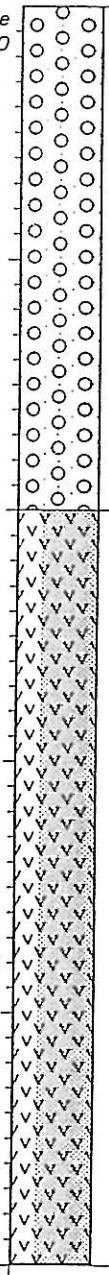
HOLE No: BB 34

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: BB 35
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:150



0.00 Scree; fragments of pinkish red quartzite in a reddish grey sandy matrix

10.00 Basalt, weathered, yellowish grey

25.00 End of hole.

NOTES

1) Dry borehole.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 08/03/2002
DATE PROFILED :

DATE : 20/02/03 13:36
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 23 00' 27.500"
Y-COORD : 29 02' 49.000"

HOLE No: BB 35

017

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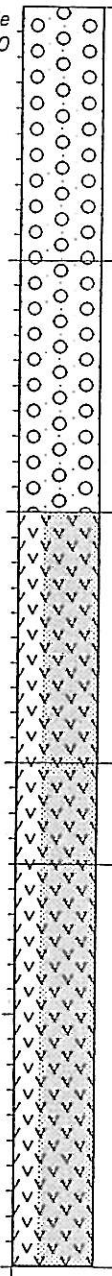
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: BB 36
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:150



0.00 Scree; red sandy matrix with small fragments of pinkish red quartzite

5.00 Scree; fragments of pinkish red quartzite in a reddish grey sandy matrix

10.00 Basalt, severely weathered, pale reddish brown

15.00 Basalt, severely weathered, yellowish grey

17.00 Basalt, slightly weathered, dark yellowish brown, medium-grained

25.00 End of hole.

NOTES

1) Dry borehole.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 11/03/2002
DATE PROFILED :

DATE : 20/02/03 13:36
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 23 00' 26.700"
Y-COORD : 29 02' 50.800"

HOLE No: BB 36

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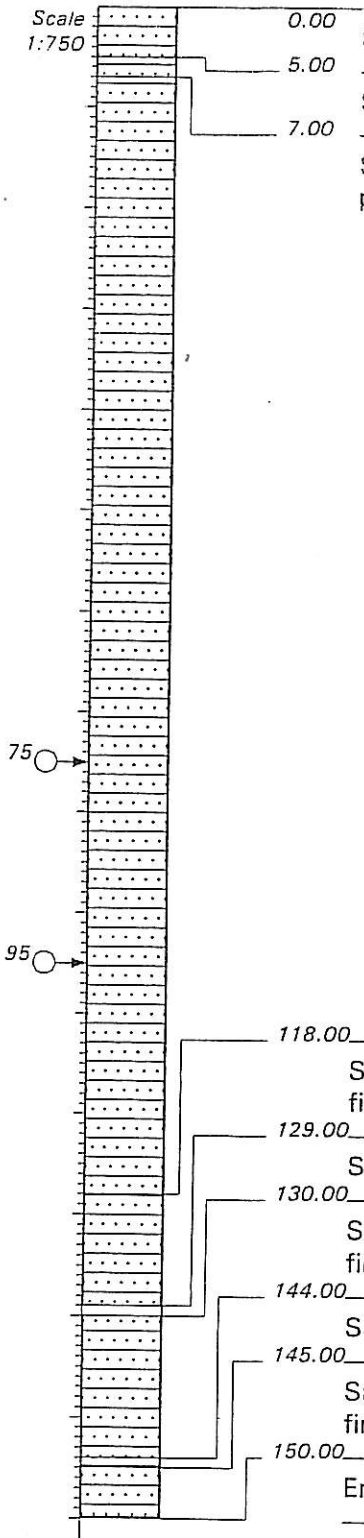
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: LJ 37
Sheet 1 of 1

JOB NUMBER: 000



0.00	Sandstone, weathered, pinkish red
5.00	Sandstone, weathered, light brown
7.00	Sandstone, fresh, massive, off-white, fine-grained (mainly fine powder)
118.00	Sandstone, argillaceous, pale red and very light grey mottled, fine-grained
129.00	Sanstone, pale greenish grey, fine-grained
130.00	Sandstone, argillaceous, pale red and very light grey mottled, fine-grained
144.00	Sandstone, very light grey, fine-grained
145.00	Sandstone, argillaceous, pale red and very light grey mottled, fine-grained
150.00	End of hole.

NOTES

1) Water strikes at 75 m (1.16 l/s) and 95 m (2.25 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 19/03/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 50' 00.800"
Y-COORD : 29 13' 10.100"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

HOLE No: LJ 37

C017

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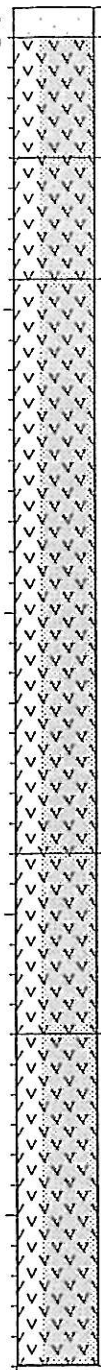
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: LJ 38
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, dark brown
1.00	Basalt, weathered, light brownish grey, medium-grained
5.00	Basalt, slightly weathered, brownish grey, medium-grained
9.00	Basalt, weathered, pale to dark yellowish brown, medium-grained
28.00	Basalt, slightly weathered, greyish red, medium-grained, numerous small dark green amygdales
34.00	Basalt, fresh, dark to blackish grey, medium-grained, slightly amygdaloidal
45.00	End of hole.

NOTES

1) Dry borehole.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 19/03/2002
DATE PROFILED :

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

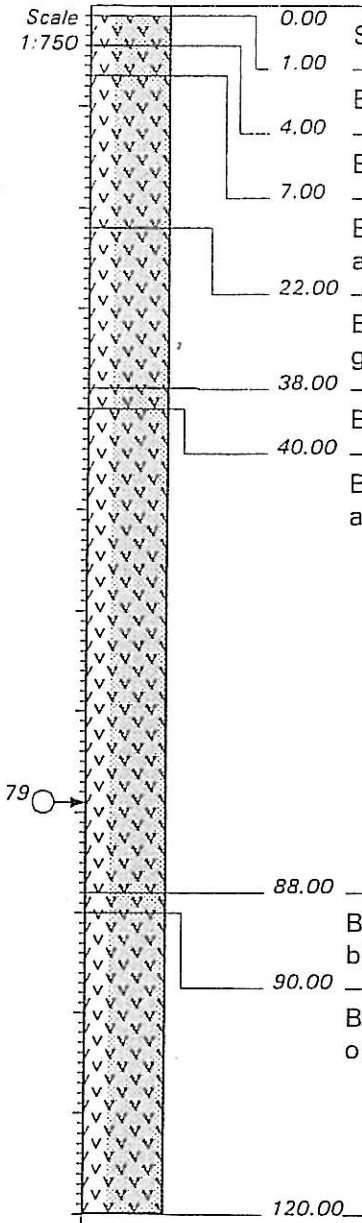
GROUND LEVEL :
X-COORD : 22 49' 56.700"
Y-COORD : 29 13' 11.600"

HOLE No: LJ 38

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: LJ 39
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Soil, dark brown
1.00	
	Basalt, weathered, light brownish grey
4.00	
	Basalt, slightly weathered, brownish grey, medium-grained
7.00	
	Basalt, weathered, light olive grey, medium-grained, slightly amygdaloidal
22.00	
	Basalt, fresh; dark grey, in places blackish grey or dark greenish grey; medium- grained
38.00	
	Basalt, slightly weathered, greyish red, medium-grained
40.00	
	Basalt, fresh, dark grey, medium-grained; in places slightly amygdaloidal
88.00	
	Basalt, greyish red, medium-grained; numerous dark green or bluish green amygdales
90.00	
	Basalt; dark grey, in places greenish grey; medium-grained; occasionally slightly amygdaloidal
120.00	
	End of hole.

NOTES

1) Water strike at 79 m (1.36 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 20/03/2002
DATE PROFILED :

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

GROUND LEVEL :
X-COORD : 22 49' 55.200"
Y-COORD : 29 13' 11.800"

HOLE No: LJ 39

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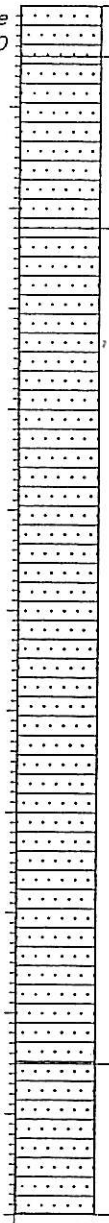
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: LJ 40
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:750



0.00	Sandstone, slightly weathered, pinkish yellow, fine-grained
5.00	Sandstone, massive, pale yellowish white, fine-grained (fine powder)
22.00	Sandstone, massive, off-white, fine-grained (fine powder)
105.00	Sandstone, massive, slightly argillaceous, pale red, fine-grained (fine powder)
120.00	End of hole.

NOTES

1) Dry borehole.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 21/03/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 50' 34.700"
Y-COORD : 29 15' 15.400"

HOLE No: LJ 40

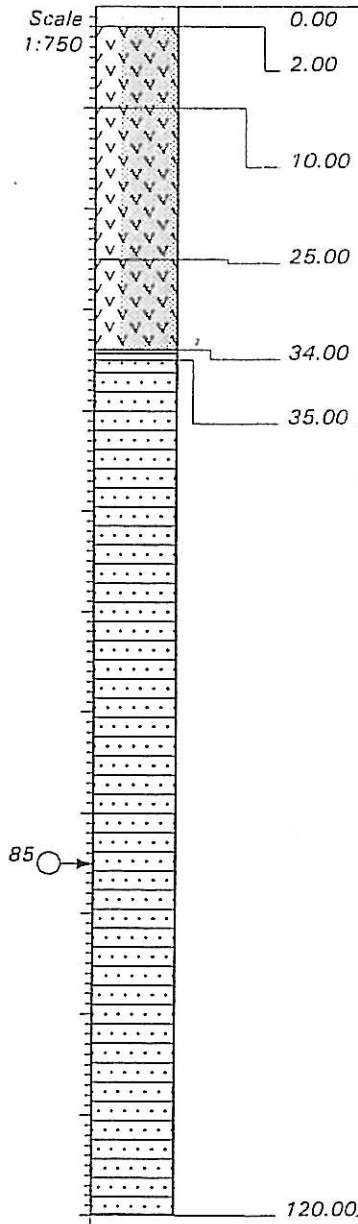
TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: LJ 41
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 2.00	Soil, dark brown, calcareous
2.00 – 10.00	Basalt, weathered, yellowish grey, medium-grained, slightly amygdaloidal
10.00 – 25.00	Basalt, slightly weathered, light grey and pale yellowish grey, medium-grained
25.00 – 34.00	Basalt, fresh; dark grey, in places pale greenish grey, medium-grained
34.00 – 35.00	Sandstone, light grey, fine-grained
35.00 – 120.00	Sandstone; off-white, yellowish white between 38-41 m; fine-grained (fine powder)
120.00	End of hole.

NOTES

1) Minor water strike at 85 m (0.2 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 22/03/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 51' 41.400"
Y-COORD : 29 11' 57.200"

HOLE No: LJ 41

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

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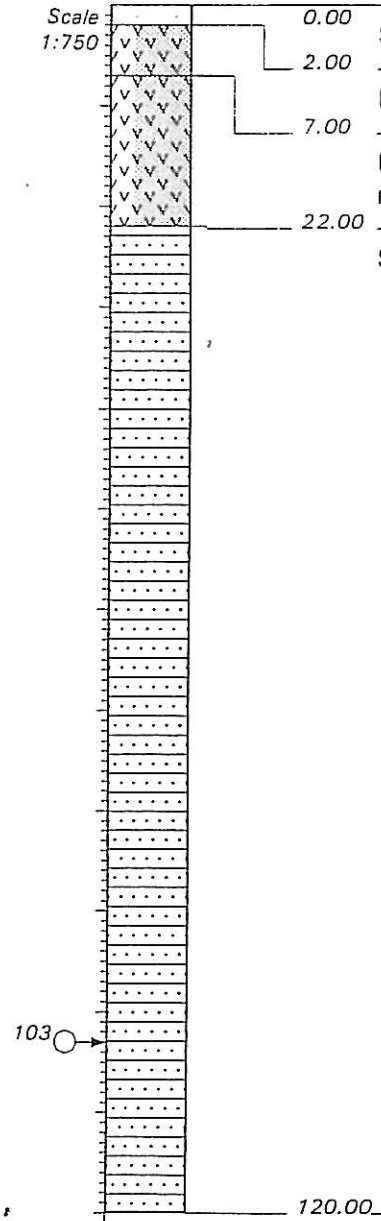
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: LJ 42
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, reddish brown
2.00	Basalt, severely weathered, light grey, medium-grained
7.00	Basalt, weathered; medium grey, in places pale yellowish grey; medium-grained
22.00	Sandstone, massive, off-white, fine-grained (fine powder)
120.00	End of hole.

NOTES

1) Water strike at 103 m (1.97 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 22/03/2002
DATE PROFILED :

DATE : 20/02/03 13:37
TEXT : a:\BRANDDOT.TXT

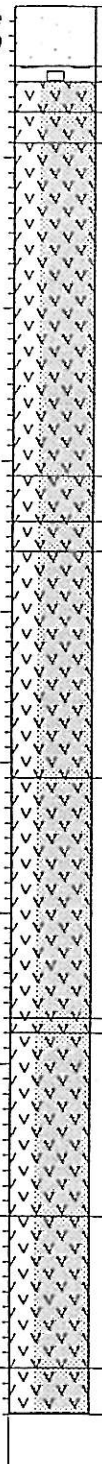
GROUND LEVEL :
X-COORD : 22 50' 51.900"
Y-COORD : 29 12' 16.100"

HOLE No: LJ 42

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: DV 43
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, turfy, dark brown
4.00	Calcrete, light grey
5.00	Basalt, severely weathered, greenish red, strongly amygdaloidal
7.00	Basalt, weathered, dark grey, medium-grained
9.00	Basalt, severely weathered, reddish grey, medium-grained, strongly amygdaloidal
31.00	Basalt, fairly fresh, dark grey, medium-grained
34.00	Basalt, weathered, greenish red, medium-grained, strongly amygdaloidal
36.00	Basalt, fairly fresh, dark grey, medium-grained; alternating with horizons of basalt, weathered, reddish grey, medium-grained
51.00	Basalt, fresh, dark grey, medium-grained
67.00	Basalt, weathered, reddish grey, medium-grained
68.00	Basalt, fresh; dark grey, occasionally pale greenish grey; medium-grained,; weathered horizons between 70-71 m & 77-78 m
80.00	Basalt, weathered, greenish grey and reddish grey, medium-grained, strongly amygdaloidal
90.00	Basalt; fractured, with fragments up to 8 cm across; severely weathered; pale brownish grey, medium-grained
93.00	End of hole.

NOTES

1) Water~~table~~ strike (20 l/sec)

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 07/05/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 53' 13.7"
Y-COORD : 28 59' 00.3"

HOLE No: DV 43

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

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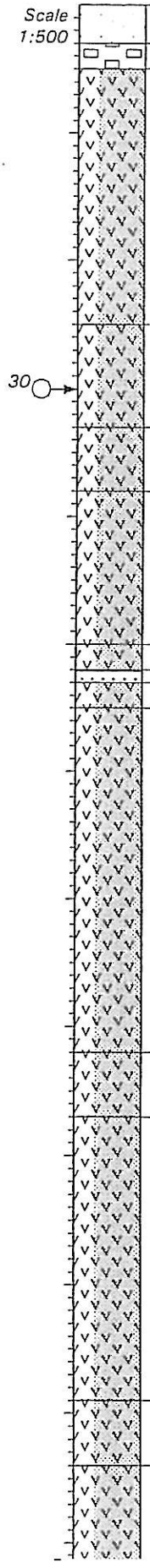
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: DV 44
Sheet 1 of 2

JOB NUMBER: 000

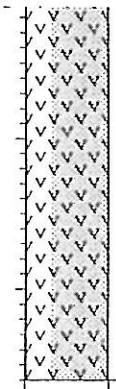


0.00	Soil, turfy, dark brown
3.00	Calcrete, light grey
5.00	Basalt, severely weathered; brownish red, in places brown; medium-grained, amygdaloidal
25.00	Basalt, slightly weathered; dark grey, in places greenish grey; medium-grained, amygdaloidal
33.00	Basalt, severely weathered, purplish grey, medium-grained, amygdaloidal
38.00	Basalt, slightly weathered; dark grey or pale red, with a slight reddish tinge; medium-grained, amygdaloidal
50.00	Basalt, relatively fresh, dark grey, medium-grained
52.00	Sandstone, quartzitic, grey or greenish grey, fine-grained
53.00	Basalt, relatively fresh, dark grey, medium-grained
55.00	Basalt, fresh; blackish grey, in places dark grey; medium-grained
82.00	Basalt, pale red or pale greenish red, medium-grained
87.00	Basalt; dark grey, in places reddish grey; medium-grained, occasionally amygdaloidal
109.00	Basalt, slightly weathered; pale purplish grey, medium-grained, lots of greenish amygdales
114.00	Basalt, dark grey, medium-grained

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: DV 44
Sheet 2 of 2

JOB NUMBER: 000



146.00

Calcite, white, crystalline

149.00

Basalt, slightly weathered, grey or pale greenish grey, medium-grained

160.00

Sandstone, pink, fine-grained

161.00

Basalt, dark grey, medium-grained

162.00

Sandstone, pink or greyish white, fine-grained

163.00

End of hole.

NOTES

1) See video logging for borehole DV 44

2) Water strike 30 l/sec

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 09/05/2002
DATE PROFILED :
DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

GROUND LEVEL :
X-COORD : 22 53' 13.8"
Y-COORD : 28 59' 00.3"

HOLE No: DV 44

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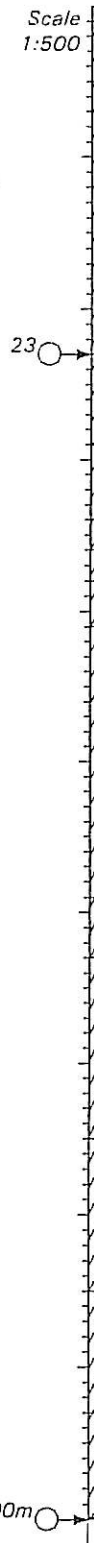
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GM 45
Sheet 1 of 1

JOB NUMBER: 000



0.00	Calcrete, light grey
1.00	Basalt, slightly weathered, pale red, medium-grained, slightly amyddaloidal
5.00	Basalt, severely weathered, grey, medium-grained
23.00	Basalt, severely weathered, dark grey, medium-grained
29.00	Basalt, severely weathered, pale red, medium-grained
34.00	Basalt, severely weathered, grey, medium-grained
36.00	Basalt, severely weathered, dark grey, medium-grained
38.00	Basalt, severely weathered, grey, medium-grained
41.00	Basalt, severely weathered, dark grey, medium-grained
59.00	Basalt, severely weathered, pale red or pale greenish red, medium-grained, slightly amygdaloidal
63.00	Basalt, severely weathered, grey, medium-grained
75.00	Basalt, severely weathered, pale red or pale greenish red, medium-grained, slightly amygdaloidal
85.00	Basalt, severely weathered, pale greenish red, medium-grained, slightly amygdaloidal
93.00	Basalt, severely weathered, grey or pale red grey, medium-grained
100.00	End of hole.

NOTES

1) Minor water strike at 23 m (0.05 l/s); Basalt is severely weathered down to a depth of > 100m.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED :
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 53' 07.0"
Y-COORD : 29 47' 13.1"

HOLE No: GM 45

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

C017

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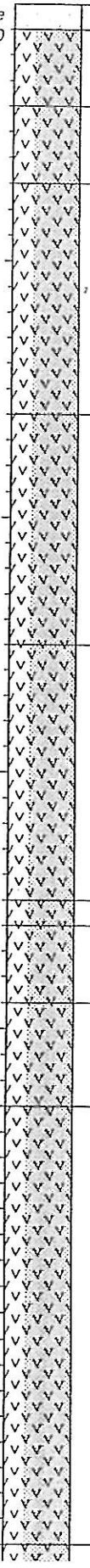
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: FDC 46
Sheet 1 of 2

JOB NUMBER: 000

Scale 1:250

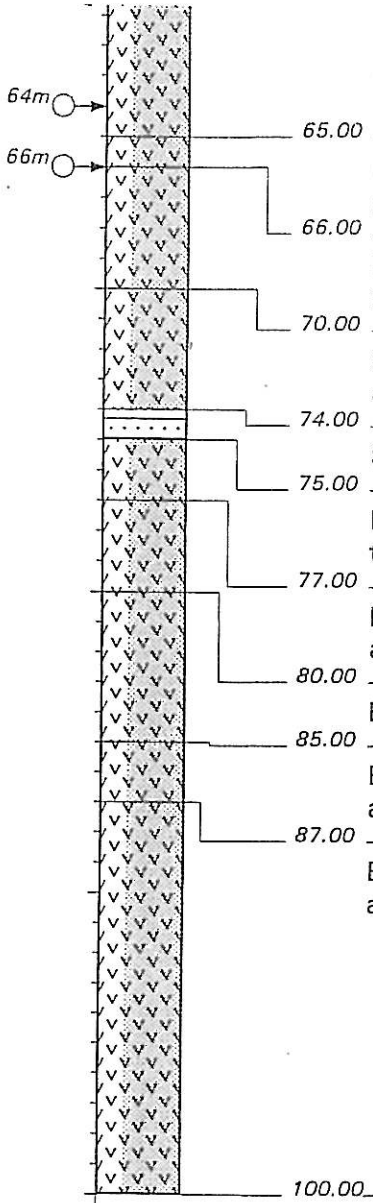


0.00	
1.00	Soil, reddish brown
	Basalt, severely weathered, greyish
4.00	
	Basalt, weathered, greyish red, medium-grained
7.00	
	Basalt, weathered, greenish red, medium-grained, strongly amygdaloidal
16.00	
	Basalt, weathered, moderate olive brown, medium-grained
25.00	
	Basalt, weathered, grey ato greenish grey, medium-grained
35.00	
36.00	Basalt, slightly weathered, dark grey, medium-grained
	Basalt, fresh, dark grey, medium-grained
39.00	
	Basalt, weathered, greyish red, medium-grained
43.00	
	Basalt, fresh; dark grey, in places greyish black; medium-grained
60.00	

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: FDC 46
Sheet 2 of 2

JOB NUMBER: 000



	Basalt, severely weathered, greyish red, medium-grained, amygdaloidal
65.00	
	Basalt; fractured, with fragments up to 4 cm across; weathered, grey to greenish grey, medium-grained, strongly amygdaloidal
66.00	
	Basalt, weathered, light brownish grey, medium-grained, strongly amygdaloidal
70.00	
	Basalt, weathered, grey to greenish grey, medium-grained, amygdaloidal
74.00	
	Sandstone, siliceous, pale red, fine-grained
75.00	
	Basalt, weathered, greenish grey, amyagdaloidal; fractured towards bottom with fragments up to 3 cm across
77.00	
	Basalt, weathered, light brownish grey, medium-grained, strongly amygdaloidal
80.00	
	Basalt, fresh, dark grey, medium-grained
85.00	
	Basalt, weathered, light brownish grey, medium-grained, strongly amygdaloidal
87.00	
	Basalt, slightly weathered, medium grey, medium-grained, slightly amygdaloidal
100.00	
	End of hole.

NOTES

1) Water strike at 64m (1.06 l/sec) and at 66m (7.0 l/sec)

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 14/05/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 53' 00.8"
Y-COORD : 28 51' 14.1"

HOLE No: FDC 46

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:49
TEXT : a:\BRAND4DO.TXT

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Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: BR 47
Sheet 1 of 2

JOB NUMBER: 000

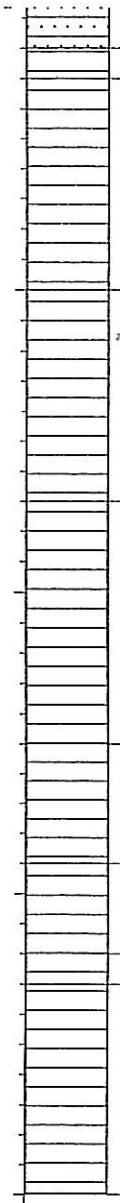
Scale 1:250

0.00	Sand, loose, pale yellowish brown
1.00	Sandstone, off-white, fine-grained
4.00	Sandstone, argillaceous, pale red, fine-grained
9.00	Sandstone, moderate red, medium-grained
10.00	Sandstone, argillaceous; pale red, occasionally slightly mottled red-white; fine-grained
12.00	Mudstone, occasionally slightly silty; moderate red, in places pale red; a few sand grains in upper part
28.00	Sandstone, pale red purple, fine- to medium-grained, slightly argillaceous; grading downwards into Sandstone, whitish, fine- to medium-grained
29.00	Siltstone, yellowish grey
30.00	Mudstone, in places slightly silty, moderate red to pale red
38.00	Mudstone, greyish red purple
40.00	Siltstone, purplish grey
42.00	Siltstone, laminated, purplish grey
44.00	Siltstone, greyish red, becoming purplish grey towards bottom; a few scattered sand grains
46.00	Mudstone; light grey, in places reddish grey or purplish grey
52.00	Siltstone, greyish red
54.00	Siltstone, light grey; becoming less silty towards bottom
56.00	Sandstone, massive, very light grey, fine- to medium-grained (fine powder mainly)

Dept. for Water Affairs and Forestry:
Geohydrology

HOLE No: BR 47
Sheet 2 of 2

JOB NUMBER: 000



62.00 —

Mudstone, dusky yellow

63.00 —

Mudstone, medium light grey to medium grey

70.00 —

Mudstone, medium dark grey; carbonaceous between 75-77 m

77.00 —

Mudstone, medium grey

85.00 —

Mudstone, medium light grey

89.00 —

Mudstone, dark grey, carbonaceous

92.00 —

Mudstone, blackish grey, with coal seamlets

93.00 —

Mudstone, medium grey

100.00 —

End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 16/05/2002
DATE PROFILED :

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

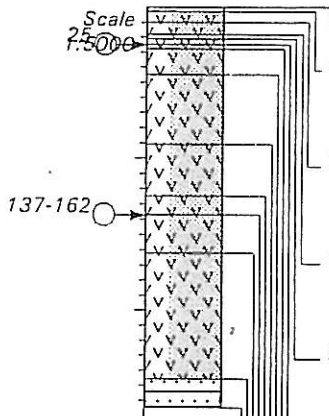
GROUND LEVEL :
X-COORD : 22 45' 15.0"
Y-COORD : 29 02' 01.0"

HOLE No: BR 47

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: TBG 48
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, light brown, with Calcrete nodules
3.00	Basalt, weathered, greyish red, medium-grained, slightly amygdaloidal
10.00	Basalt, severely weathered, light brown, medium-grained, slightly amygdaloidal
18.00	Basalt, slightly weathered, dark grey, medium-grained, slightly amygdaloidal
21.00	Basalt, severely weathered, greyish brown, medium-grained, slightly amygdaloidal
25.00	Basalt, weathered, greyish red, medium-grained, strongly amygdaloidal
28.00	Basalt, weathered, medium grey to greyish red, medium-grained, strongly amygdaloidal
45.00	Basalt, fresh; medium grey, in places a slight reddish tinge; medium-grained, strongly amygdaloidal; at 90-91 m interval a 10 cm thick band of reddish material
91.00	Basalt, dark grey, medium-grained, strongly amygdalaoidal
125.00	Basalt, slightly weathered, medium grey, medium-grained, slightly amygdaloidal
137.00	Basaltic rock, possibly dyke, dark grey, medium-grained
162.00	Basalt; dark grey with a slight reddish tinge, in places pale greenish grey; medium-grained, slightly amygdaloidal; at 163-164 m, 173-174 m and 178-179 m intervals pink or red jaspery material
246.00	Sandstone, light grey white, fine-grained (only fine powder)
265.00	End of hole.

NOTES

1) Minor water strike at 25 m (1.3 l/s); possible Louisiana dyke between 137-162 m

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 22/05/2002
DATE PROFILED :
DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

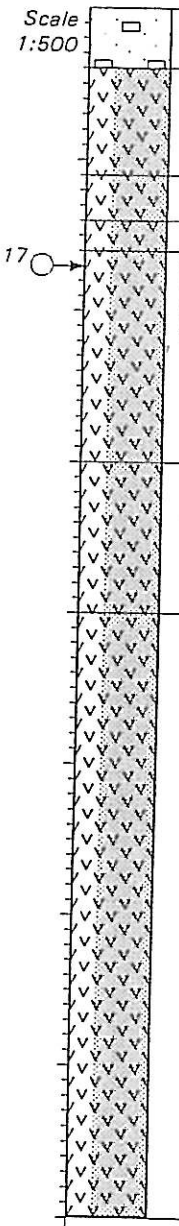
GROUND LEVEL :
X-COORD : 22 51' 32.8"
Y-COORD : 22 51' 32.8"

HOLE No: TBG 48

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: TBG 49
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, pale brownish grey, with Calcrete nodules
4.00	Basalt, severely weathered, brownish grey
11.00	Basalt, weathered, greyish red, medium-grained
14.00	Basalt, weathered, dark red, medium-grained, strongly amygdaloidal
16.00	Basalt, weathered, greyish red, medium-grained, amygdaloidal
30.00	Basalt, fresh, greyish red, medium-grained, strongly amygdaloidal between 30-33m
40.00	Basalt, medium grey with a pale green tinge; occasionally pale reddish grey; medium-grained, amygdaloidal; strongly amygdaloidal between 50-52
80.00	End of hole.

NOTES

1) Minor water strike at 17 m (1.8 l/s)

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 23/05/2002
DATE PROFILED :

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

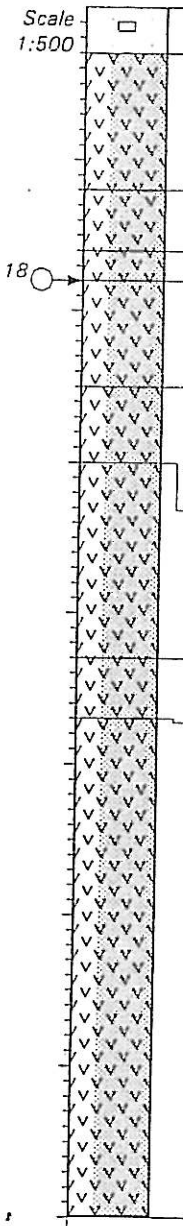
GROUND LEVEL :
X-COORD : 22 51' 45.0"
Y-COORD : 28 55' 35.4"

HOLE No: TBG 49

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: TBG 50
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, greyish brown, with minor Calcrete nodules
3.00	Basalt, severely weathered, reddish brown
12.00	Basalt, weathered, light grey
16.00	Basalt, weathered, greyish red, medium-grained, strongly amygdaloidal
18.00	Basalt, weathered, reddish grey
25.00	Basalt, slightly weathered, medium grey with a slight reddish tinge, medium-grained, amygdaloidal
30.00	Basalt, fresh, medium grey with a slight reddish tinge, medium-grained, amygdaloidal
43.00	Basalt, greyish red, medium-grained, strongly amygdaloidal
47.00	Basalt, medium grey with a slight reddish tinge, medium-grained, amygdaloidal
80.00	End of hole.

NOTES

1) Minor water strike at 18 m (0.4 l/s)

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 24/5/2002
DATE PROFILED :

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

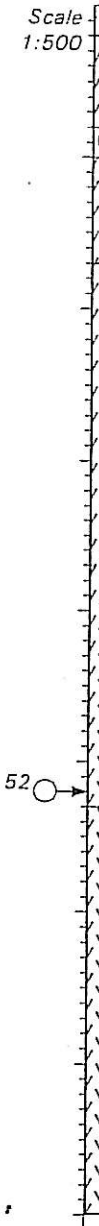
GROUND LEVEL :
X-COORD : 22 51' 49.8"
Y-COORD : 28 55' 28.3"

HOLE No: TBG 50

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: TBG 51
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, light brown, with Calcrete nodules
2.00	Basaltic rock, severely weathered, greenish grey
8.00	Calcrete.
10.00	Basaltic rock, weathered, brownish grey
17.00	Basaltic rock, fresh; medium grey, occasionally with a slight greenish or reddish tinge; medium-grained
53.00	Basaltic rock, medium grey, becoming dark grey towards bottom; medium-grained
80.00	End of hole.

NOTES

1) Minor water strike at 52 m (0.2 l/s); most possibly dyke.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 24/05/2002
DATE PROFILED :
DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

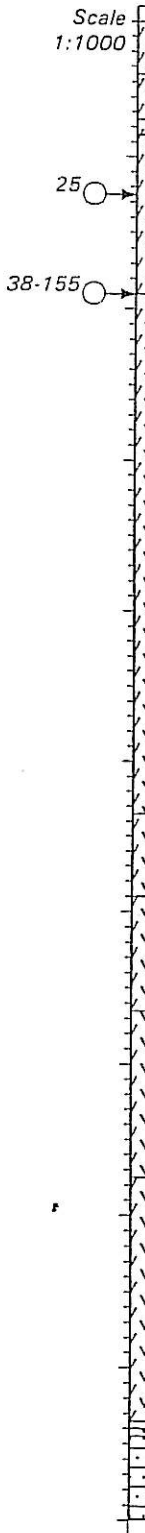
GROUND LEVEL :
X-COORD : 22 51' 39.9"
Y-COORD : 28 55' 19.9"

HOLE No: TBG 51

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: TBG 52
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, greyish olive, with Calcrete nodules
2.00	Basalt, severely weathered, dark yellowish brown
9.00	Basalt, weathered; medium grey, occasionally yellowish grey; medium-grained
15.00	Basalt, severely weathered, light brown
17.00	Basaltic rock, fresh, medium grey with a red tinge, medium-grained
38.00	Basaltic rock, very fresh; dark grey, occasionally medium grey with a slight greenish tinge; medium-grained; sulphide stringers between 45-46 m and 106-107; a few very small amygdales between 52-53 m, 55-56 m and 77-78 m
107.00	Basaltic rock, medium grey, medium-grained
118.00	Basaltic rock, dark grey, medium-grained; a few very small amygdales and sulphide stringers between 126-127 m
133.00	Basaltic rock, medium grey, medium-grained; amygdaloidal between 138-139m, and a few very small amygdales between 133-134 m
155.00	Basalt, slightly weathered, medium light grey, medium-grained; amygdaloidal between 172-173 m; at 158-159 m interval a 10 cm thick band of reddish material
187.00	Sandstone, siliceous, whitish, fine-grained
188.00	Basalt, slightly weathered, medium light grey, medium-grained
189.00	Sandstone, very light grey, fine-grained, top 3 m siliceous
200.00	End of hole.

NOTES

1) Minor water strike at 25 m (0.93 l/s); possible Louisiana dyke between 38-155 m

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 28/5/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 51' 42.0"
Y-COORD : 28 55' 08.8"

HOLE No: TBG 52

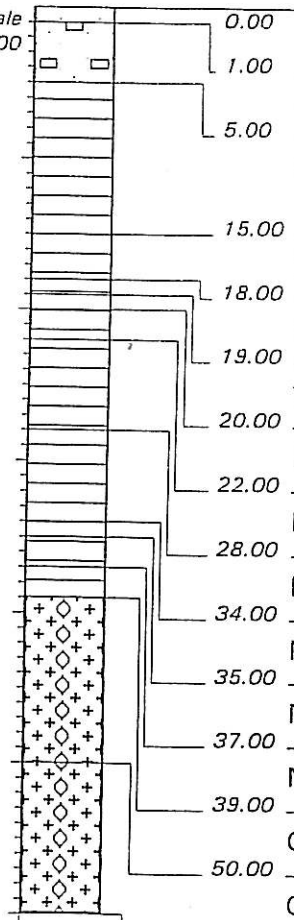
TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: Haly 53
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, dark brown
1.00	
	Soil, pink; with Calcrete nodules, grey
5.00	
	Mudstone, moderate orange pink to pale reddish brown
15.00	
	Mudstone, very light grey
18.00	
	Mudstone, pale reddish brown
19.00	
	Mudstone, very light grey
20.00	
	Mudstone, pale pink
22.00	
	Mudstone, pale reddish brown
28.00	
	Mudstone, greyish orange
34.00	
	Mudstone, light brownish grey, laminated
35.00	
	Mudstone, greyish orange
37.00	
	Mudstone, pale red purple
39.00	
	Gneiss, weathered, pinkish grey
50.00	
	Gneiss, fresh, medium grey, medium-grained; alternating with Gneiss, reddish, leucocratic, medium-grained
60.00	
	End of hole.

NOTES

1) Dry borehole; Haly Fault intersected at 39 m

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 11/06/2002
DATE PROFILED :

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

GROUND LEVEL :
X-COORD : 22 43' 00.3"
Y-COORD : 29 06' 18.1"

HOLE No: Haly 53

017

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Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: Haly 54
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:500

0.00	Soil, pinkish with Calcrete nodules
3.00	Mudstone, moderate reddish orange; occasionally mottled
19.00	
20.00	Mudstone, silty, pale red
25.00	Mudstone, greyish red
30.00	Mudstone, pale red, bluish grey and very light grey; thin intercalations of Sandstone, very light grey, medium-grained
35.00	Mudstone, medium grey to bluish grey
42.00	Gneiss, slightly weathered, dark grey, medium-grained; with intercalations of Gneiss, leucocratic, reddish
52.00	Gneiss, slightly weathered, brownish grey and pale greenish grey, medium-grained
60.00	Gneiss, fresh, grey with a reddish tinge; medium-grained
	End of hole.

NOTES

1) Dry borehole; Haly Fault intersected at 35 m

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 11/06/2002
DATE PROFILED :

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

GROUND LEVEL :
X-COORD : 22 42' 59.3"
Y-COORD : 29 06' 17.1"

HOLE No: Haly 54

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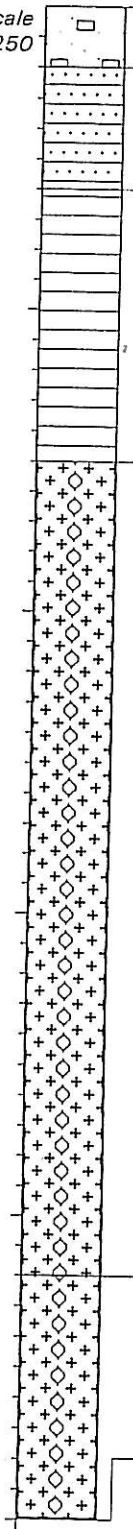
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: Haly 55
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:250



0.00	Soil, pinkish grey, with Calcrete nodules
2.00	Sandstone, slightly weathered, purplish grey, brownish grey and greyish white with minute pyrite specks; medium-grained
6.00	Mudstone, light grey to light bluish grey
15.00	Gneiss, weathered, brownish grey and medium light grey; medium-grained
42.00	Gneiss, fresh, medium light grey with a slight areddish tinge; medium-grained
50.00	End of hole.

NOTES

1) Dry borehole; Haly Fault intersected at 15 m

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 12/06/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 42' 58.7"
Y-COORD : 29 06' 16.1"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

HOLE No: Haly 55

017

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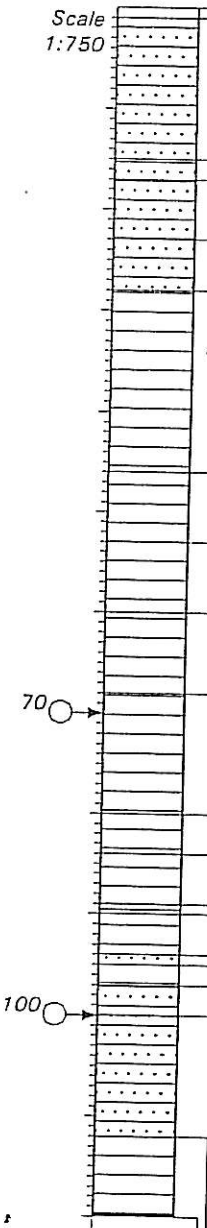
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: Haly 56
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 1.00	Soil, light brown
1.00 – 15.00	Sandstone, argillaceous; moderate reddish orange, in places pale red; slightly mottled; fine-grained (Red Rocks Member)
15.00 – 17.00	Sandstone, quartzitic, light brownish grey, fine-grained
17.00 – 23.00	Sandstone, argillaceous, moderate reddish orange, fine-grained
23.00 – 28.00	Sandstone, argillaceous, greyish pink, fine-grained
28.00 – 46.00	Mudstone, moderate red to pale reddish brown
46.00 – 53.00	Mudstone, pinkish grey and light brownish grey; laminated in places
53.00 – 60.00	Mudstone, pale reddish brown to pale red, scattered quartz grains; thin beds of Sandstone, argillaceous, light grey and brownish grey, medium-grained in upper part
60.00 – 68.00	Mudstone, bluish white to very light grey; silty between 64-65 m
68.00 – 80.00	Mudstone, pale reddish brown; in places mottled
80.00 – 84.00	Mudstone, silty, greenish grey
84.00 – 89.00	Mudstone, pale red, in places mottled; scattered quartz grains between 87-88 m
89.00 – 90.00	Sandstone, argillaceous, grey and brown, medium-grained
90.00 – 94.00	Mudstone, pale red and bluish grey
94.00 – 95.00	Sandstone, argillaceous, pale red, medium-grained
95.00 – 97.00	Mudstone, pale red and light grey; scattered quartz grains
97.00 – 100.00	Sandstone, very light grey to pinkish grey, medium-grained
100.00 – 112.00	Sandstone, feldspathic, light grey, medium-grained; with intercalated Mudstone, pale red , light greenish grey and light brownish grey laminated (Klopperfontein Formation)
112.00 – 120.00	Mudstone, medium grey; thin intercalations of Mudstone, moderate red
120.00	End of hole.

NOTES

1) Water strikes at 70 m (2.2 l/s) and 100 m (5.5 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 12/06/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 43' 03.2"
Y-COORD : 29 06' 16.7"

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:51
TEXT : a:\BRAND4DO.TXT

HOLE No: Haly 56

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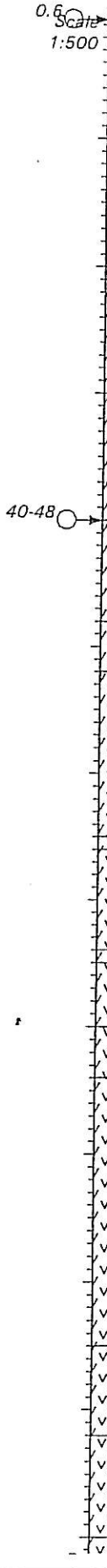
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: MS 57
Sheet 1 of 2

JOB NUMBER: 000

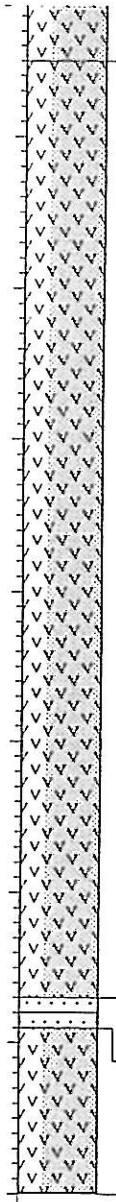


0.00	Soil, dark brown, turfy
1.00	Soil, light grey, with Calcrete nodules
2.00	Basalt, severely weathered, yellowish brown, medium-grained; calcite vein between 11-15 m
15.00	Basalt, weathered, medium light grey, medium-grained
20.00	Basalt, slightly weathered, dark greenish grey, medium-grained
21.00	Basalt, weathered, greyish red
30.00	Basalt, slightly weathered, greyish with a slight greenish or areddish tinge; medium-grained; amygdaloidal between 35-36 m
40.00	Basalt, fresh, medium dark grey with a greenish tinge; medium-grained; tiny sulphide specks (possible dyke?)
48.00	Basalt, slightly weathered, greyish red, medium-grained; lots of greenish amygdales
52.00	Basalt, fresh, medium dark grey to dark grey, medium-grained; slightly amygdaloidal
65.00	Basalt, slightly weathered, pale reddish grey, medium-grained; amygdaloidal
66.00	Basalt, fresh, dark grey, medium-grained
74.00	Basalt, slightly weathered, pale red, medium-grained; lots of greenish amygdales
75.00	Basalt, fresh, dark grey, medium-grained
80.00	Basalt, pale reddish grey with a greenish tinge; medium-grained
84.00	Basalt, medium dark grey, medium-grained
105.00	Basalt, slightly weathered; greyish red, becoming reddish grey towards bottom; lots of greenish amygdales
112.00	Basalt, dark grey, medium-grained
120.00	

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: MS 57
Sheet 2 of 2

JOB NUMBER: 000



Basalt, slightly weathered, greyish red; lots of greenish amygdales

125.00

Basalt, dark grey, medium-grained; slightly amygdaloidal

187.00

Sandstone, very light grey, fine-grained (fine powder)

189.00

Basalt, dark grey to blackish grey, medium-grained

200.00

End of hole.

NOTES

1) Minor water strike 0.6 l/s; possible dyke at interval 40-48 m

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 14/06/2002
DATE PROFILED :

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

GROUND LEVEL :
X-COORD : 22 49' 19.8"
Y-COORD : 29 09' 33.2"

HOLE No: MS 57

017

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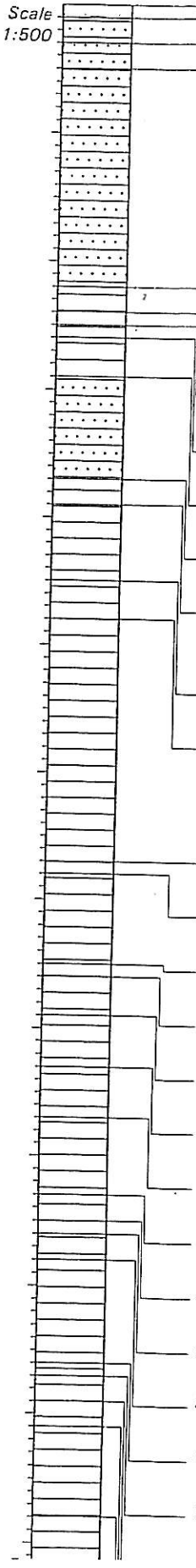
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: PC 58
Sheet 1 of 2

JOB NUMBER: 000

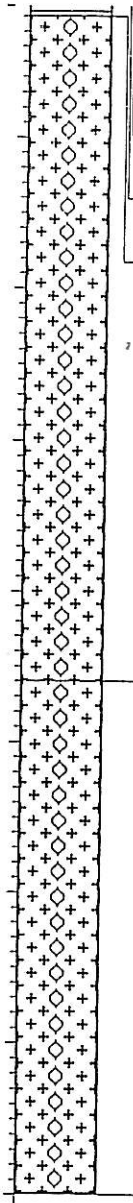


0.00	Soil, moderate yellowish brown, with Calcrete nodules, greyish white and light brown
1.00	Sandstone, very pale orange, medium- to fine-grained
3.00	Sandstone, light brown and moderate pink, medium-grained
5.00	Sandstone, greyish pink, fine- to medium-grained, with thin medium-grained pale red beds; minute pyrite grains at 9 m
22.00	Siltstone, medium grey
24.00	Mudstone, slightly silty, moderate reddish brown
25.00	Siltstone, pale yellowish orange
26.00	Siltstone, greyish orange pink
29.00	Sandstone, pale red, medium-grained (Fripp Formation)
37.00	Mudstone, grey and greyish pink; minute pyrite grains
39.00	Mudstone, medium grey and medium dark grey; minor pyrite grains between 39-40m
45.00	Mudstone, dark yellowish brown
48.00	Mudstone, medium grey, becoming slightly darker towards bottom
67.00	Mudstone, dark grey
68.00	Mudstone, medium dark grey
75.00	Mudstone, coaly, blackish grey
76.00	Mudstone, medium dark grey
79.00	Mudstone, coaly, dark grey
83.00	Mudstone, medium dark grey
87.00	Mudstone, coaly, dark grey
93.00	Mudstone, greyish black, with coal seamlets
95.00	Mudstone, dark gey
96.00	Mudstone, greyish black, with coal seamlets
98.00	Mudstone, medium dark grey to dark grey
106.00	Mudstone, coaly, greyish black
107.00	

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: PC 58
Sheet 2 of 2

JOB NUMBER: 000



Mudstone, medium dark grey

109.00

Mudstone, brownish grey, with a few scattered small quartz grains

111.00

Mudstone, slightly coaly, dark grey

118.00

Mudstone, light brownish grey; scattered quartz grains

122.00

Gneiss, slightly weathered, leucocratic, light grey

166.00

Biotite Gneiss, slightly weathered down to 170 m; light grey, with a greenish tinge in places; medium-grained (Alldays Gneiss)

200.00

End of hole.

NOTES

1) Muddy water

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 19/06/2002
DATE PROFILED :

DATE : 20/02/03 13:49
TEXT : a:\BRAND4DO.TXT

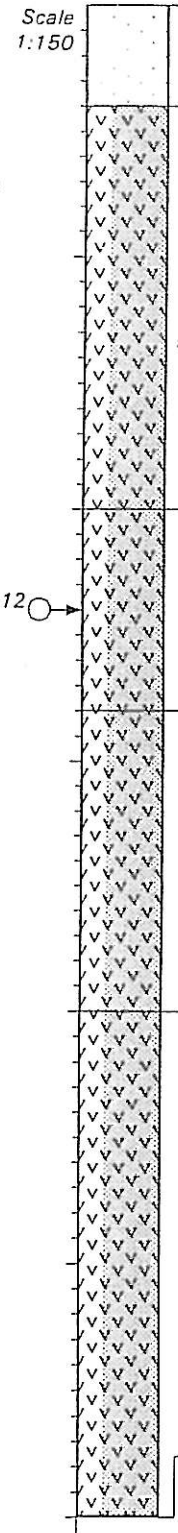
GROUND LEVEL :
X-COORD : 22 47' 03.1"
Y-COORD : 29 04' 36.6"

HOLE No: PC 58

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GF 59
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, pinkish grey, with grey Sandstone and Basalt fragments
2.00	Basalt, severely weathered, moderate yellowish brown, medium-grained
10.00	Basalt, severely weathered, pale red, medium-grained; strongly amygdaloidal
14.00	Basalt, weathered, dark grey, medium-grained
20.00	Basalt, weathered, medium grey, medium-grained
30.00	End of hole.

NOTES

1) Minor water strike at 12 m (0.08 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 20/06/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 48' 45.6"
Y-COORD : 29 01' 37.7"

HOLE No: GF 59

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:49
TEXT : a:\BRAND4DO.TXT

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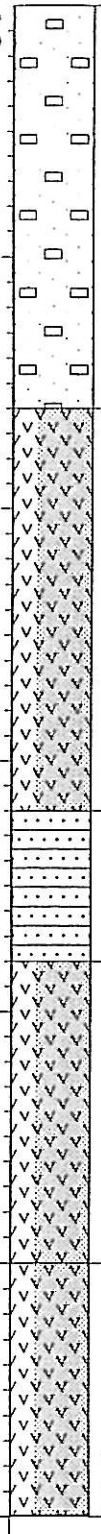
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GF 60
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:150



0.00	Soil, pale yellowish brown, with Calcrete nodules
8.00	Basalt, weathered, medium grey with a slight greenish tinge, medium-grained
16.00	Sandstone, possibly tuffaceous; greyish red, in places greenish red; medium-grained
19.00	Basalt, weathered, pale red, medium-grained; highly amygdaloidal (white, pink and green amygdales)
25.00	Basalt, slightly weathered, dark grey, medium-grained; occasionally amygdaloidal
30.00	End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 20/06/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 49' 12.4"
Y-COORD : 29 01' 33.6"

HOLE No: GF 60

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:49
TEXT : a:\BRAND4DO.TXT

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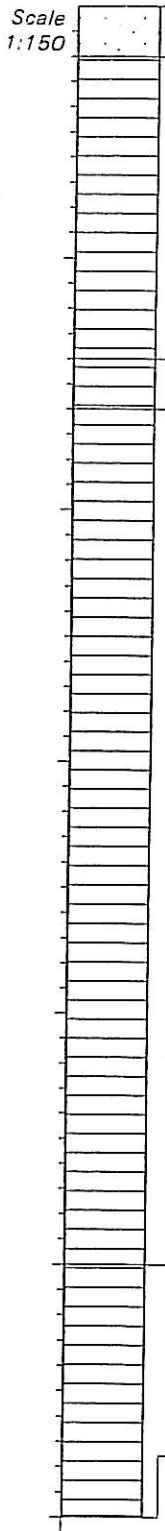
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GF 61
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, pinkish
1.00	Mudstone, weathered, light olive grey
7.00	Mudstone, weathered, pale red
8.00	Mudstone, weathered, light bluish grey to light olive grey
25.00	Mudstone, weathered, medium grey
30.00	End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 21/06/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 48' 36.5"
Y-COORD : 28 59' 42.4"

HOLE No: GF 61

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:49
TEXT : a:\BRAND4DO.TXT

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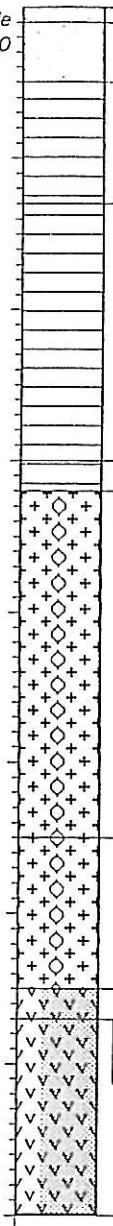
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GF 62
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Soil, reddish brown
1.00	
	Soil, greyish orange pink, coarse
5.00	
	Mudstone, weathered, pale brown to pale yellowish brown
13.00	
	Mudstone, weathered; greyish purple, becoming darker towards bottom;
30.00	
	Mudstone, carbonaceous, greyish black
32.00	
	Gneiss, severely weathered, pinkish grey, medium-grained
55.00	
	Gneiss, relatively fresh, moderate pink, medium-grained
65.00	
	Basaltic rock, dolerite dyke, chilled zone, medium dark grey, very fine-grained
67.00	
	Basaltic rock, dolerite dyke, medium dark grey, medium-grained
80.00	
	End of hole.

NOTES

1) Dry borehole; dolerite dyke from 65 m to bottom.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 21/06/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 47' 44.1"
Y-COORD : 28 59' 28.1"

HOLE No: GF 62

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:49
TEXT : a:\BRAND4DO.TXT

017

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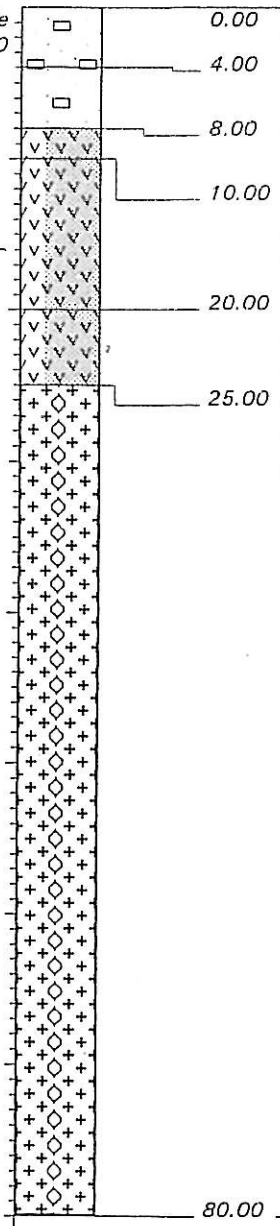
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GF 63
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 4.00	Soil, pinkish grey, with Calcrete nodules
4.00 – 8.00	Soil, yellowish brown, with Calcrete nodules
8.00 – 10.00	Basaltic rock (dyke ?), severely weathered, light olive grey
10.00 – 20.00	Basaltic rock, fresh, medium dark grey with a greenish tinge, medium-grained
20.00 – 25.00	Basaltic rock, medium light grey, medium- to fine-grained (chilled phase?); some Biotite
25.00 – 80.00	Gneiss, leucocratic, probably Biotite-carrying; moderate red with a greenish tinge, medium-grained
80.00	End of hole.

NOTES

1) Dry borehole; possible dyke between 8-25 m

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 24/06/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 47' 15.3"
Y-COORD : 28 59' 29.8"

HOLE No: GF 63

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:49
TEXT : a:\BRAND4DO.TXT

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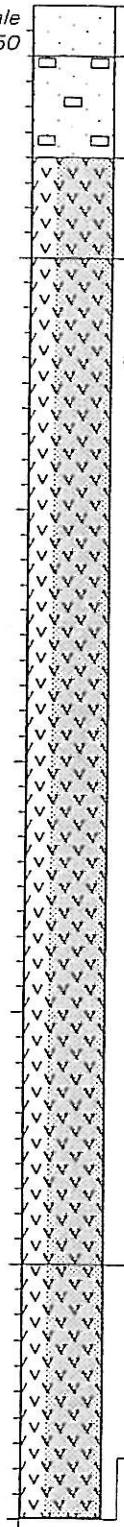
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GF 64
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, light brown
1.00	Soil, greyish orange pink, with Calcrete nodules
3.00	Basaltic rock, dyke, severely weathered, dusky yellow
5.00	Basaltic rock, dyke, weathered, dusky yellow and light olive brown, medium-grained
25.00	Basaltic rock, dyke, fairly fresh, medium dark grey to blackish grey, medium-grained
30.00	End of hole.

NOTES

1) Dolerite dyke; Muddy water

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 15/07/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 48' 44.0"
Y-COORD : 29 00' 45.7"

HOLE No: GF 64

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:49
TEXT : a:\BRAND4DO.TXT

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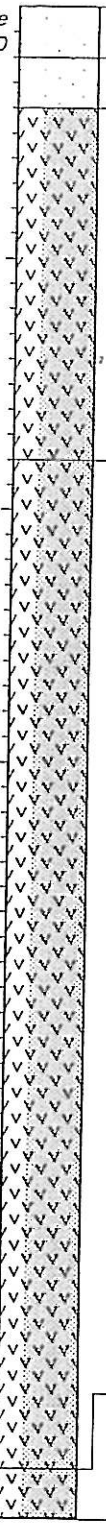
Geohydrology

HOLE No: GF 65
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, reddish brown
1.00	Soil, greyish orange pink
2.00	Basaltic rock, dyke, weathered, honey brown
9.00	Basaltic rock, dyke, fresh, medium dark grey, medium-grained; carries some Biotite
29.00	Basaltic rock, dyke, medium dark grey, fine-grained
30.00	End of hole.

NOTES

1) "Syfer water"; dolerite dyke

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 15/7/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 48' 45.7"
Y-COORD : 29 00' 27.8"

HOLE No: GF 65

TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

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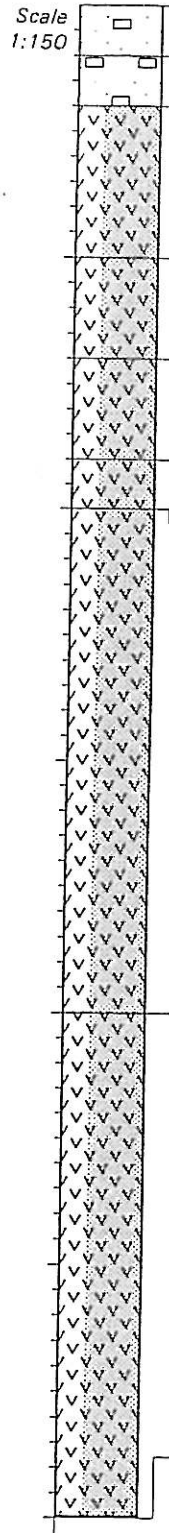
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GF 66
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, pale brown, with small Calcrete nodules
1.00	Soil, greyish orange pink, with small Calcrete nodules
2.00	Basalt, weathered, light brownish, medium-grained
5.00	Basalt, fresh, medium dark grey, medium-grained
7.00	Basalt, weathered, light brown, medium-grained
9.00	Basalt, fresh, medium dark grey, medium-grained
10.00	Basalt, weathered, pale yellowish brown to moderate yellowish brown; medium-grained
20.00	Basalt, fresh, medium dark grey, medium-grained
30.00	End of hole.

NOTES

1) "Syfer water; rock is not amygdaloidal.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 16/07/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 48' 48.1"
Y-COORD : 29 00' 18.4"

HOLE No: GF 66

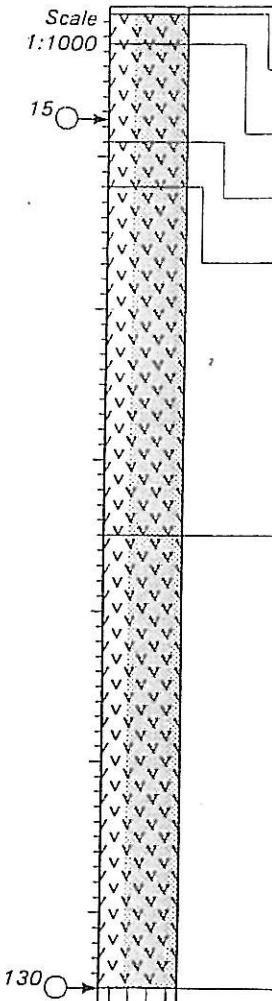
TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: GF 67
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 1.00	Soil, greyish red
1.00 – 5.00	Basalt, slightly weathered, dark grey, medium-grained
5.00 – 18.00	Basalt, severely weathered, dark yellowish brown, medium-grained
18.00 – 24.00	Basalt, weathered, medium grey, medium-grained
24.00 – 70.00	Basalt, slightly weathered, medium dark grey with a slight greenish or reddish tinge; medium-grained, occasionally amygdaloidal
70.00 – 130.00	Basalt, fresh, medium dark grey, medium-grained; between 105-130 m strongly amygdaloidal
130.00 – 195.00	Siltstone, very light grey, fine-grained; powder only
195.00	End of hole.

NOTES

1) Water strikes at 15 m (0.67 l/s) and at 130 m (5.59 l/s); deep weathering zone; Sandstone at

2) top not indurated.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 19/07/2002
DATE PROFILED :

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

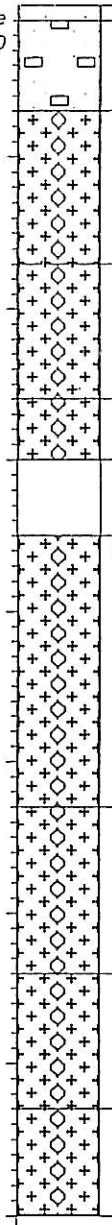
GROUND LEVEL :
X-COORD : 22 50' 20.9"
Y-COORD : 29 00' 12.8"

HOLE No: GF 67

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: RO 68
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, reddish brown
1.00	Soil, pale greyish orange, with Calcrete nodules
7.00	Gneiss, severely weathered, light olive grey; at 11-16 m interval: larger fragments of an acid rock, greyish red, fine-grained
17.00	Gneiss, weathered, pinkish red, medium-grained
26.00	Gneiss, slightly weathered, bluish grey, Biotite-rich; alternating with Gneiss, leucocratic, pinkish, Biotite-bearing, medium-grained
30.00	Marble, very light grey with a slight greenish tinge; medium-grained
35.00	Biotite Gneiss, leucocratic, moderate red, medium-grained; thin bands of Gneiss, leucocratic, whitish and greyish
53.00	Biotite Gneiss, reddish grey, medium-grained
64.00	Biotite Gneiss, leucocratic, whitish and pinkish, medium-grained
73.00	Biotite Gneiss, reddish grey, medium-grained
80.00	End of hole.

NOTES

1) Dry borehole

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 22/07/2002
DATE PROFILED :

GROUND LEVEL :
X-COORD : 22 48' 05.2"
Y-COORD : 28 56' 57.0"

HOLE No: RO 68

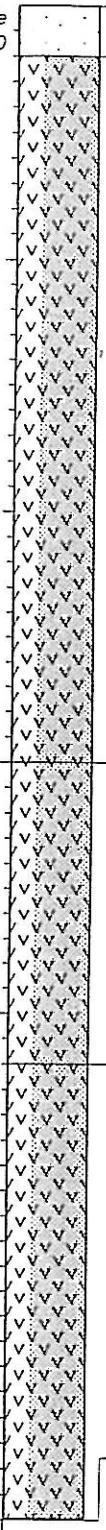
TYPE SET BY :
SETUP FILE : STANDARD.SET

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: RO 69
Sheet 1 of 1

JOB NUMBER: 000



0.00 Soil, turfy, dark brown

1.00 Basaltic rock, dyke, weathered, brownish grey, medium-grained

15.00 Basaltic rock, dyke, fresh, dark grey, medium-grained; lots of a micaceous mineral

21.00 Basaltic rock, dyke, fresh, dark grey, fine-grained; chilled contact

30.00 End of hole.

NOTES

1) Dry borehole; dolerite dyke (Louisiana dyke swarm?).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 23/07/2002
DATE PROFILED :

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

GROUND LEVEL :
X-COORD : 22 48' 07.4"
Y-COORD : 28 56' 55.8"

HOLE No: RO 69

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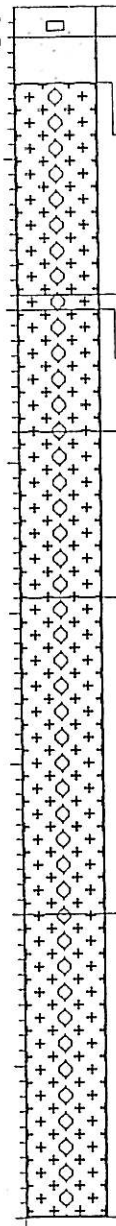
Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: RO 70
Sheet 1 of 1

JOB NUMBER: 000



0.00	Soil, light brown, with Calcrete nodules
2.00	
	Soil, pale brown
5.00	
	Biotite Gneiss, severely weathered, reddish grey
19.00	
	Gneiss, fresh, leucocratic, moderate orange pink, medium-grained
20.00	
	Biotite Gneiss, severely weathered, reddish grey, medium-grained
28.00	
	Gneiss, fresh, leucocratic; pink and whitish, in places medium grey; medium-grained
39.00	
	Biotite Gneiss; light to medium grey, in places moderate ornage pink and whitish; medium-grained; occasionally very Biotite-rich (Alldays Gneiss?)
60.00	
	Gneiss, leucocratic, Biotite-poor, moderate orange pink, medium-grained
80.00	
	End of hole.

NOTES

1) Seepage.

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl
TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 23/07/2002
DATE PROFILED :
DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

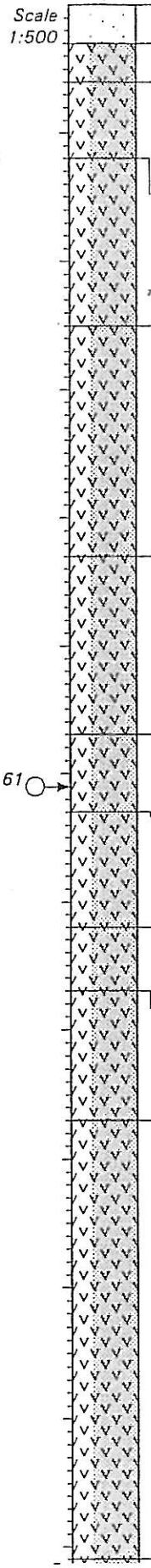
GROUND LEVEL :
X-COORD : 22 48' 10.6"
Y-COORD : 28 56' 54.1"

HOLE No: RO 70

Dept. for Water Affairs and Forestry;
Geohydrology

HOLE No: PAX 71
Sheet 1 of 2

JOB NUMBER: 000



0.00	Soil, moderate reddish brown
3.00	Basalt, weathered, dark yellowish brown, medium-grained
6.00	Basalt, weathered, medium light grey, medium-grained; slightly amygdaloidal
12.00	Basalt, weathered, light brownish grey, medium-grained; amygdaloidal
25.00	Basalt, weathered; greenish grey, in places medium light grey; medium-grained
43.00	Basalt, slightly weathered, medium dark grey, medium-grained; fine-grained greenish material between 49-50 m
57.00	Basalt, weathered, greyish red, medium-grained; strongly amygdaloidal
63.00	Basalt, slightly weathered, medium light grey, medium-grained; amygdaloidal
72.00	Basalt, weathered, light brownish grey with a green tinge, medium-grained; strongly amygdaloidal
77.00	Basalt, fresh, medium dark grey with a greenish tinge, medium-grained; indication of a quartzite, greenish grey, fine-grained between 84-85 m
87.00	Basalt, dark grey, occasionally a slight greenish tinge, medium-grained; slightly amygdaloidal; indication of a greyish quartzite and jaspery material between 119-120m
121.00	

Dept. for Water Affairs and Forestry;
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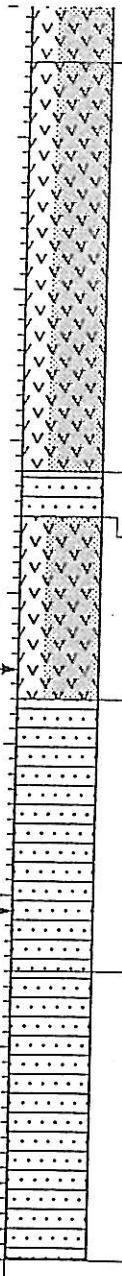
HOLE No: PAX 71
Sheet 2 of 2

JOB NUMBER: 000



Basalt, slightly weathered, greyish red, medium-grained; strongly amygdaloidal

125.00

Basalt, fresh, dark grey, medium-grained; slightly amygdaloidal; some brownish jaspery material between 125-127m, and some grey quartzite and Siltstone between 135-136m

152.00

Sandstone; greyish orange pink, fine-grained; powder only

155.00

Basalt, dark grey, medium-grained; slightly amygdaloidal

165

167.00

Sandstone, greyish orange pink, fine-grained; powder only

181

185.00

Sandstone, very light grey, fine-grained; powder only

204.00

End of hole.

NOTES

1) Water strikes at 61 m (0.53 l/s), 165 m (2.11 l/s) and 181 m (5.34 l/s).

CONTRACTOR :
MACHINE :
OPERATOR : Landman Bore
PROFILED BY : G. Brandl

TYPE SET BY :
SETUP FILE : STANDARD.SET

TRENCH LENGTH : VERTICAL
TRENCH WIDTH :
DATE EXCAVATED : 25/07/2002
DATE PROFILED :

DATE : 20/02/03 13:50
TEXT : a:\BRAND4DO.TXT

GROUND LEVEL :
X-COORD : 22 56' 48.0"
Y-COORD : 28 54' 53.2"

HOLE No: PAX 71