Report No: 37/97A

WATER RESOURCES ASSESSMENT PROJECT
BARKLY/GULF REGION
NATIONAL LANDCARE PROGRAM

DRILLING, GEOPHYSICAL LOGGING AND TEST PUMPING REPORT, MAP STUDY REGIONS 1 AND 2

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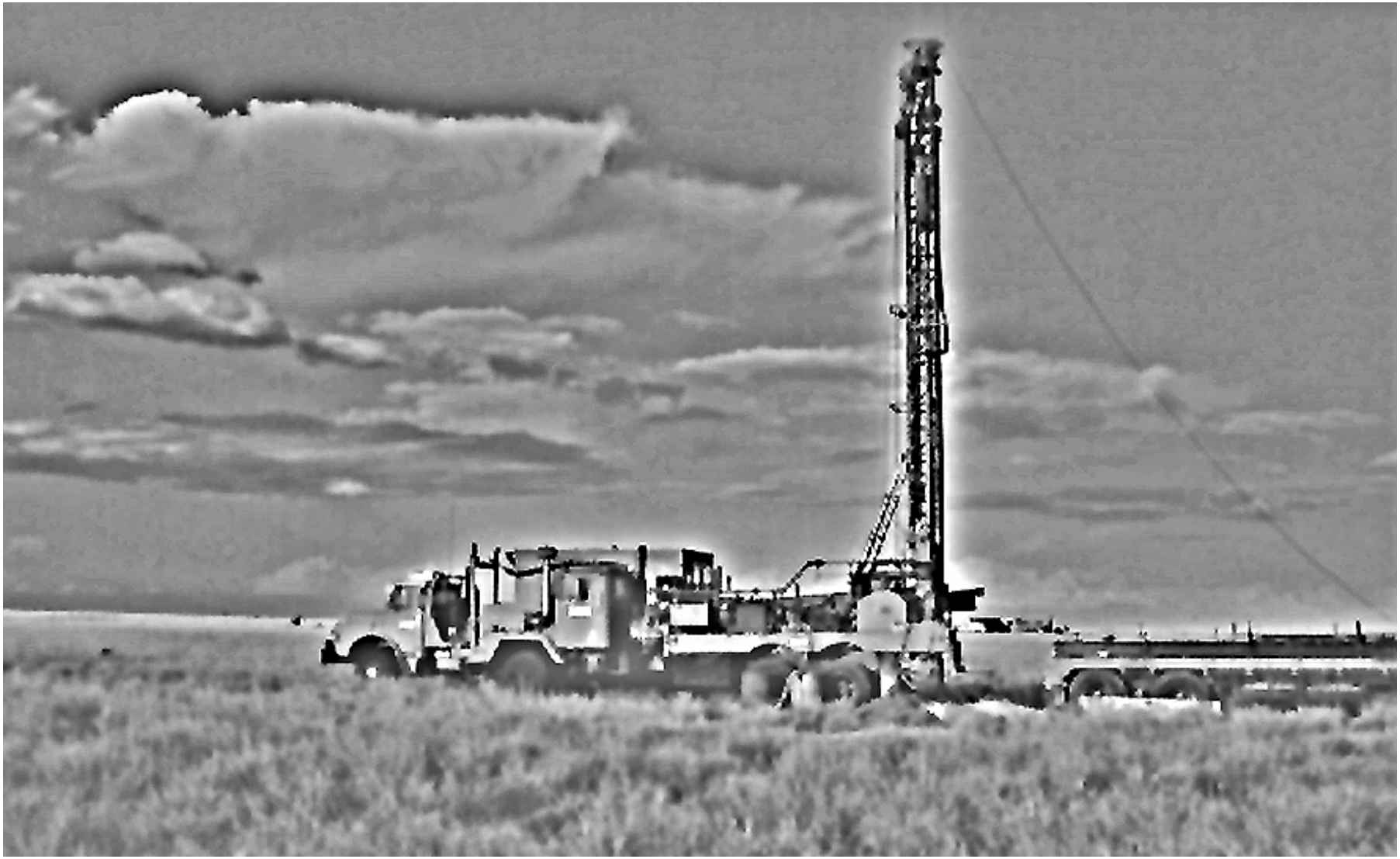
Frontispiece Drilling RN 30853 near the Dariel Gate, NT/QLD border, Rocklands Station



SYNOPSIS

Two major field investigations were undertaken in late 1996 and 1997 ("Stage 1" and "Stage 2" investigation, respectively) on the pastoral stations of Alexandria, Alroy Downs, Anthony Lagoon, Austral Downs, Mittiebah and Rocklands. Field operations consisted of drilling investigation bores, water sampling and geophysically logging and test pumping them. Some abandoned and temporarily disused stock bores were geophysically logged, and selected stock/domestic bores were test pumped.

Most of the field work was conducted within the Middle Cambrian Georgina Basin suite of rocks. Ten bores were drilled into the Camooweal Dolomite, Burton Beds and the Anthony Lagoon Beds. The drilling penetrated limestone, dolomitized limestone and calcareous sandstone aquifers. Differences in strata were noted from holes nominally drilled into the same rock formations as described in literature. In places, geological logging indicated that rock types differed from the published descriptions given of those rock formations; (notably and contrary to expectations; the domination of limestone within the 'Camooweal Dolomite').

Three bores, sited on Mittiebah Station, were drilled into Proterozoic sedimentary and volcanic rocks of the South Nicholson Basin.

Selected rock-chip samples from the drilling were sent for chemical analysis to ascertain the degree of dolomitization and silicification of the limestones. The few fossils found in the samples were sent for palaeontological identification to assist with verification of the age of these rock formations.

Large yields of water were attained from limestones and calcareous sandstones. The calcareous sandstone was a more uniformly productive aquifer, whilst two of the bores, drilled into limestone (namely the Camooweal Dolomite and the Burton Beds, respectively) each yielded less than 1 L/s in tight, un-fractured rocks.

Airlift yields varied from 1 L/s to more than 10 L/s. Apart from RN 16887, aquifers encountered in the drilling investigation were mostly fractured and cavity controlled. An aquifer intersected by RN 16887 occupied a disconformity between Tertiary and Cambrian-aged rocks.

Pump testing proved that yields of over 10 L/s are available from a large proportion of the study region. High yielding bores (more than 20 L/s) should be able to be constructed in selected areas.

Step discharge and a more limited series of constant rate tests were analysed and values of transmissivity and, where possible, storage coefficients have been presented.

Water quality was variable, ranging from potable to only suitable for stock and occasionally saline. The quality varied between the formations, spatially within the formations and with depth in individual bores.

A correlation of the regional stratigraphy has been attempted using transects of natural gamma geophysical logs. With future studies this may assist to elucidate the regional hydrogeology.

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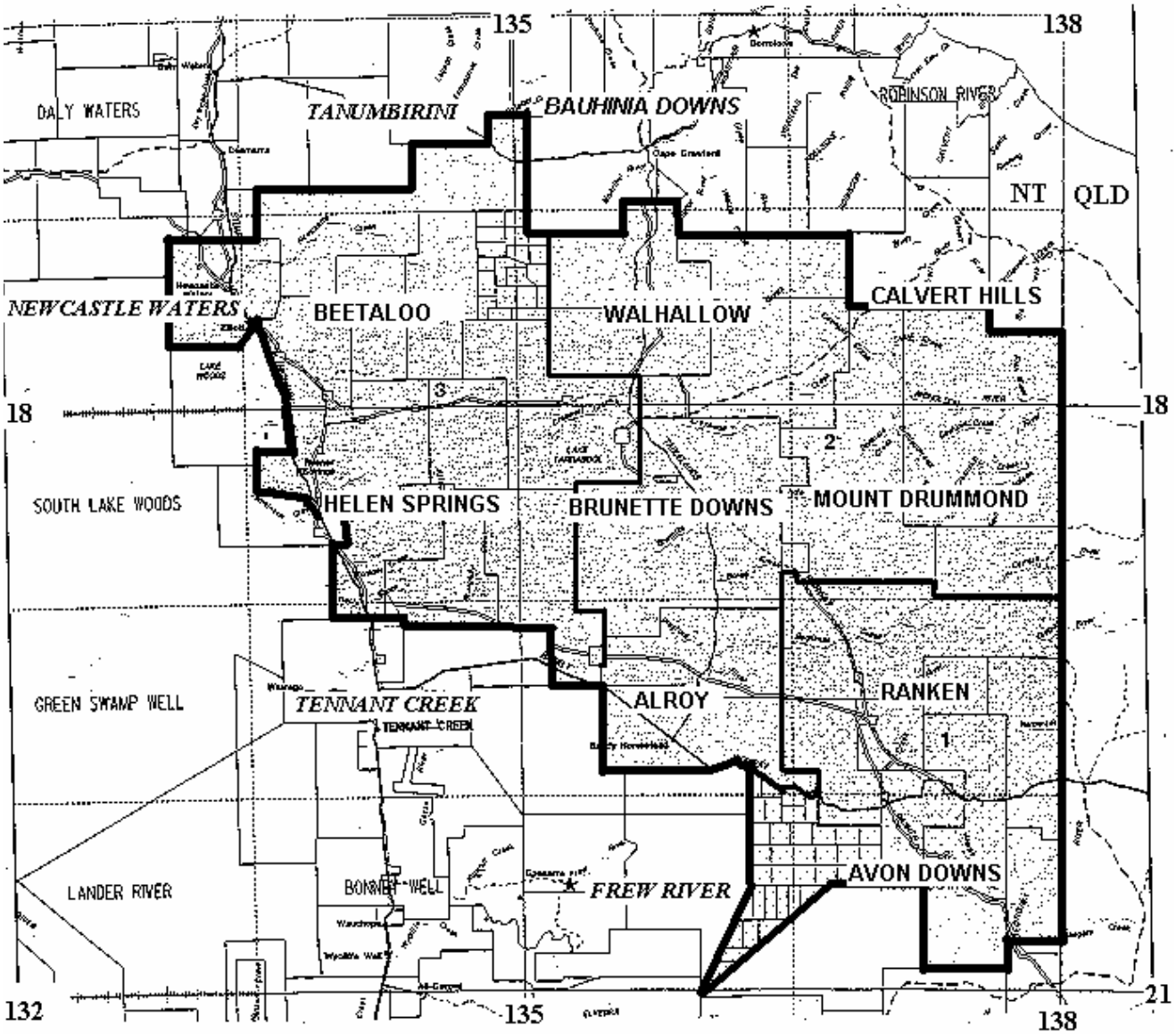
ABBREVIATIONS

AMG	Australian Map Grid
bgl	below ground level
cps	counts per second
EC	electrical conductivity (a measure of salinity - EC x 0.65 = TDS in mg/L)
g	grammes weight
GWP	galvanised water pipe
ID	inside diameter
L/s	litres per second
km	kilometres
m	metres
mg/L	milligrams per litre
mm	millimetres
m/min	metres per minute
NB	nominal bore (average diameter)
OD	outside diameter
PVC	polyvinylchloride
RN	registered number
ROP	rate of drill-bit penetration
SWL	standing water level
TD	total depth
TDS	total dissolved solids (mg/L)
µS/cm	microSiemens per centimetre; *the units used to measure EC*

1.0 INTRODUCTION

A set of three 'Water Resources Maps" (scale 1:500,000) have been produced as the major output of a water resources study of the Barkly / Gulf region of the Northern Territory. The geographical limits of these three maps, labelled '1', '2' and '3', respectively over the study region are given in Figure 1. Figure 1 also indicates the 1:250,000 topographical and geological map sheets covering the study region.

Figure 1 Location Map of the Study Region

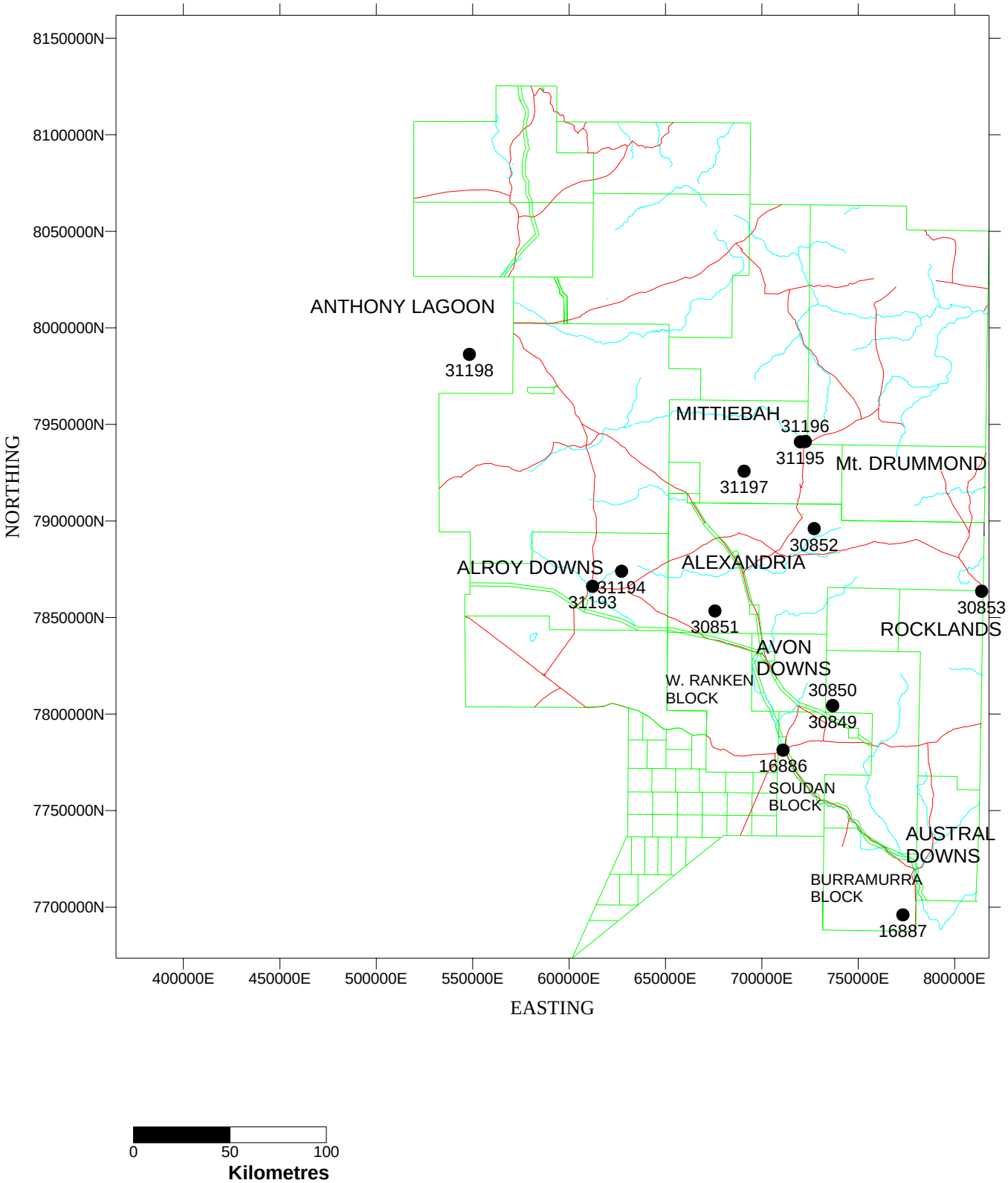


As an integral part of compiling these maps, two major field investigations were completed within the study region. The report emanating from these investigations forms part of a National Heritage Trust (Landcare) funded study.

The investigations took place in the latter half of 1996 and 1997 ("Stage 1" and "Stage 2", respectively) and included the drilling of a total of 13 investigation holes, test pumping of 14 bores and the geophysical logging of 45 bores (including the investigation holes and some existing stock/domestic bores). Figures 2 and 3 show the location of those bores drilled and those bores geophysically logged and test pumped, respectively.

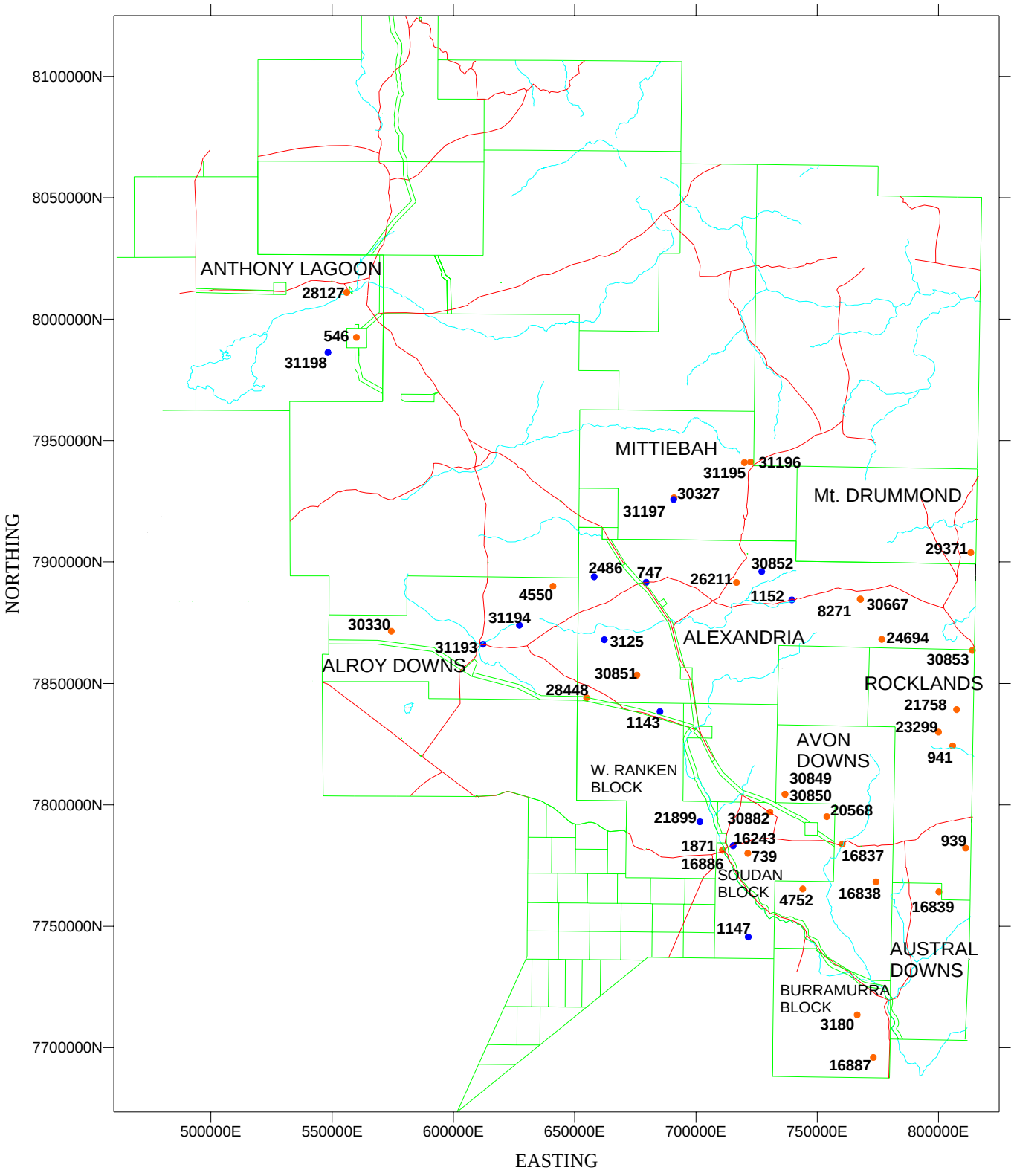
Territory Groundwater Services was engaged to provide a hydrogeologist to collate and compile the drilling data, and to assist with production of a technical report to summarise and interpret this data. Subsequently, Australian Groundwater Technologies Pty Ltd has interpreted and reported upon the geophysically logging and test pumping of the bores.

Figure 2 Location Map showing Investigation Bores



747 - REGISTERED NUMBER (RN) OF BORE

Figure 3 Location Map showing Bores Geophysically Logged and Test Pumped



2.0 HYDROGEOLOGY

The greater part of the field investigation area is occupied by Middle Cambrian rocks of the Georgina Basin. Some Proterozoic rocks crop out in the north-eastern part of the area while, in the central, southern and western parts, Mesozoic and Tertiary rocks overlie the Cambrian sedimentary rocks in patches.

The Proterozoic rock formations consist of sedimentary, volcanic and igneous rocks. They generally have variable groundwater prospects, usually inferior to that of the surrounding Cambrian sedimentary rocks. However, there are notable exceptions in the form of good quality, locally and regionally significant, sandstone aquifers. The Mesozoic and Tertiary sedimentary rocks can be good aquifers but are often thin and above the regional water table.

The Georgina Basin sedimentary rocks consist of limestone, dolomite, dolomitic limestone, calcareous sandstone, chert, and some sandstone and siltstone. These rocks generally have good secondary porosity and are permeable. A huge volume of groundwater of variable chemical quality is stored in the Georgina Basin.

Scientific reviews summarising the geology and hydrogeology of the Georgina Basin are available in Smith (1972) and Randal (1967) respectively.

3.0 DRILLING AND GEOPHYSICAL LOGGING

3.1 Introduction

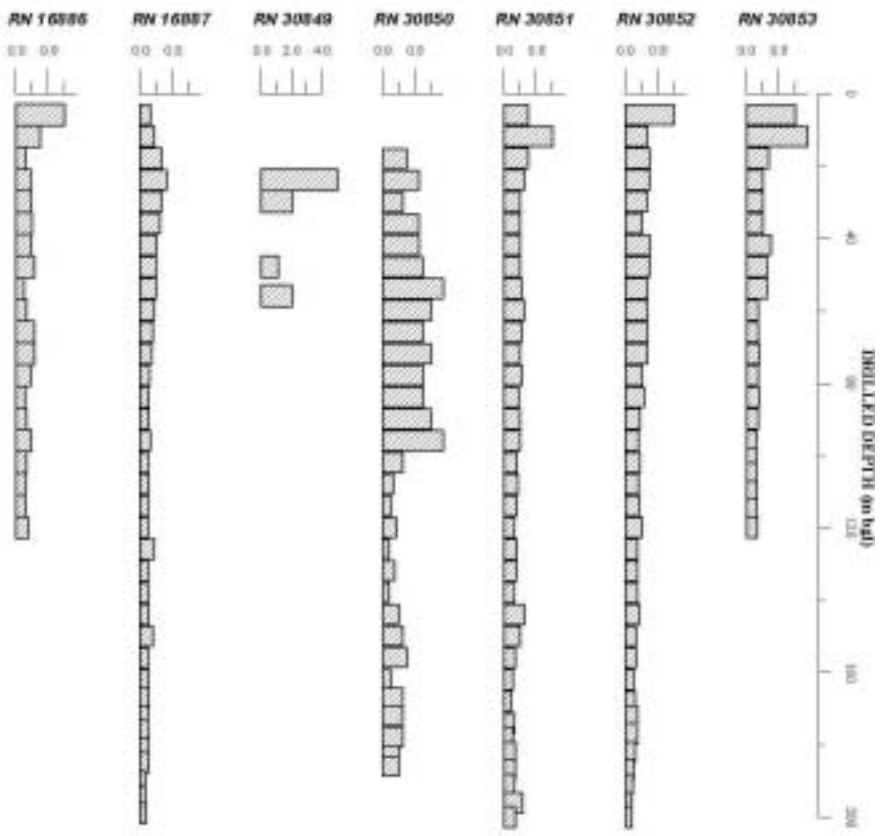
Seven holes were drilled from 15th October to 12th November 1996 ("Stage 1" Drilling Program) using Water Resources Branch drilling rig '21' (a Portadrill table-drive model). A further six holes were drilled from 27th August to 9th October 1997 using the same rig.

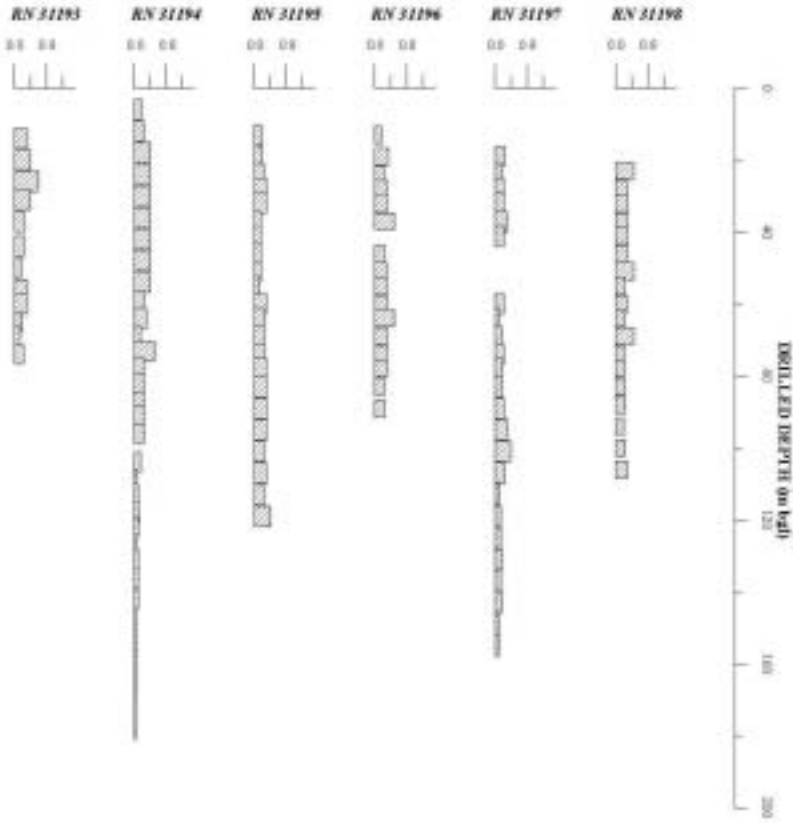
Drilling commenced in the south of the study area and progressed in a generally north-west direction. All holes were drilled using conventional rotary / hammer percussion with a combination of air and foam injection. Holes attained maximum depths of 200 m.

Composite logs for all 13 investigation bores (and four production bores drilled by Gorey and Cole in 1997; which complement the investigation) are provided as Appendix A. Detailed rock cutting descriptions as interpreted by the study's field hydrogeologist are presented in Appendix A.

Drill penetration rates (ROP) were recorded for all holes and are presented graphically as Figure 4.

Figure 4 Rate of Drill Penetration Logs





Rock-chip samples (40-50 g per sample) were taken from bulk samples recovered at the surface from various depths for six of the holes drilled. They were delivered to Amdel Laboratory, Adelaide, via the Northern Territory Geological Survey, Alice Springs. Amdel did whole rock analyses on the samples (known as an "IC4 test"). The results are shown in Table 1; a description of the test and a sample list is given as Appendix B. These analyses indicate the bulk percentage of limestone, dolomite, silica and phosphate (amongst other mineral types) present in individual rock samples. The results indicate the degree of dolomitisation and silicification; important for determining the impact of this lithification on aquifer permeability.

Table 1 Whole Rock Analyses

RN	SAMPLE	$A1_20_3$	CaO	Fe_20_3	K_20	MgO	MnO	Na_20	P_20_5	S_10_2	TiO_2	LOI
	Depth (m bgl)	percentages										
16886	108-111	1.53	36.8	0.96	0.50	2.01	0.04	0.04	1.66	26.2	0.130	30.2
16886	117-120	1.31	26.5	3.94	0.42	1.80	0.08	0.05	1.97	41.6	0.110	22.1
16887	138-144	1.31	25.5	0.53	0.50	17.9	0.01	0.03	0.02	14.3	0.080	40.1
16887	159-165	4.42	20.9	1.67	0.42	15.1	0.01	0.03	<0.01	19.9	0.280	36.5
16887	195-200	2.31	25.6	1.07	0.26	18.2	0.02	0.03	0.01	11.4	0.140	41.7
30852	108-114	2.86	32.1	1.31	1.28	7.73	0.22	0.05	0.18	20.4	0.200	33.6
30852	129-135	0.17	48.8	0.30	0.06	5.65	0.09	0.02	0.08	1.19	0.020	44.2
30852	156-162	2.58	29.5	1.41	0.86	5.43	0.11	0.05	0.24	31.4	0.160	28.3
30853	108-111	4.20	22.8	1.83	1.88	9.59	0.23	0.07	0.30	31.0	0.305	27.9
30853	117-120	0.71	29.2	0.99	0.09	20.4	0.04	0.02	0.01	3.85	0.040	45.1
31194	69- 75	0.36	30.7	0.39	0.09	20.9	0.03	0.08	0.05	1.86	0.025	46.3
31194	114-120	3.28	33.9	1.64	1.35	4.59	0.04	0.09	0.26	23.8	0.240	30.6
31194	153-159	0.94	42.1	0.60	0.37	3.17	0.01	0.05	0.46	17.1	0.055	35.6
31194	174-178	2.25	32.9	1.18	1.06	3.21	0.02	0.07	0.55	29.1	0.140	29.3
31198	75- 81	1.57	25.6	1.79	0.65	16.6	0.03	0.04	0.02	14.8	0.080	39.2
31198	105-107	2.79	19.3	1.41	1.44	11.8	0.03	0.07	0.02	34.9	0.165	28.7

Fossils were collected, where observed in drill chip samples, and were identified by Dr. P.D. Kruse, palaeontologist, Northern Territory Geological Survey, Darwin. A short description and age of these fossils is given as Appendix C.

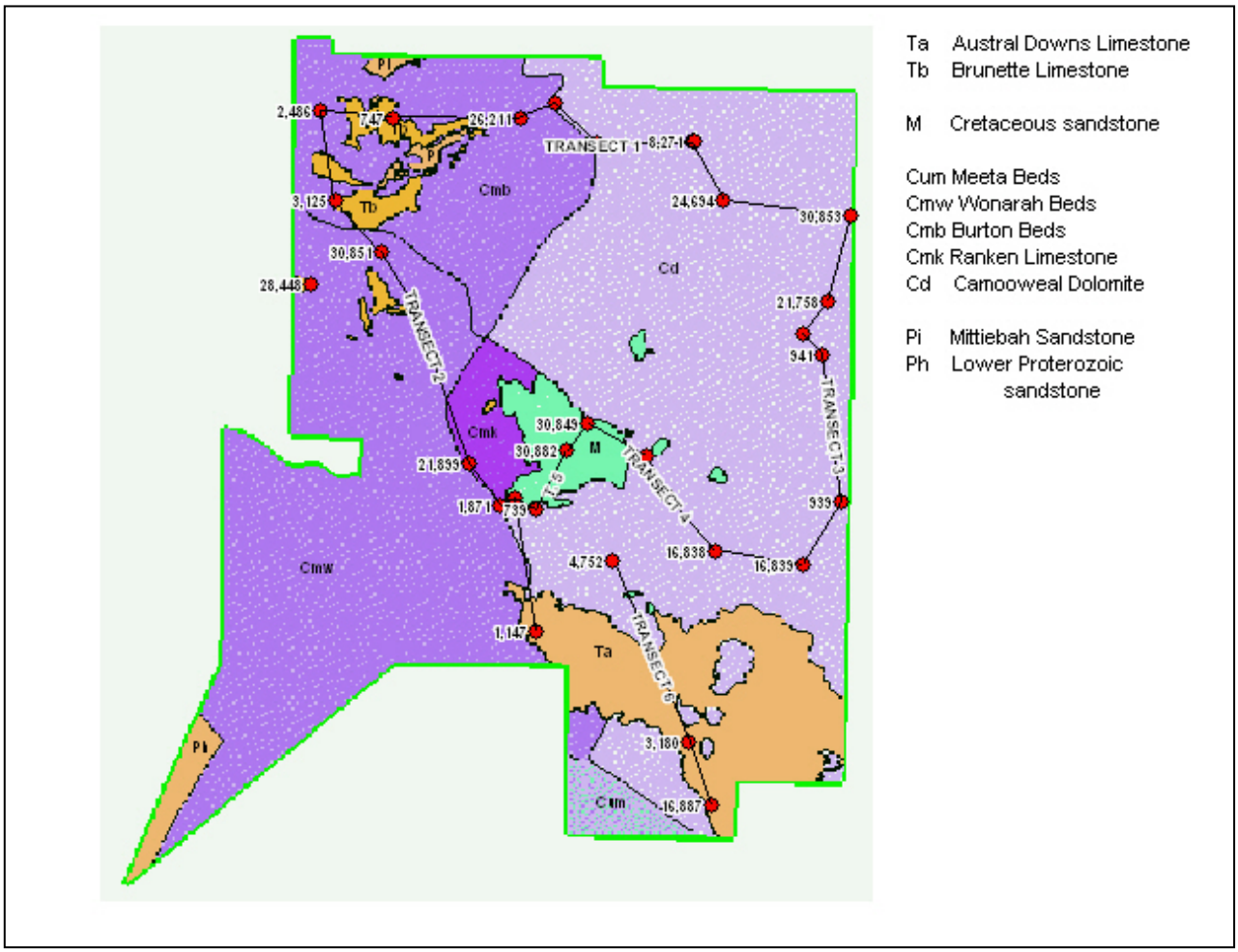
The composite logs (Appendix A) show field values of electrical conductivity (EC); a simple measurement used to gain knowledge of total dissolved solids (TDS) of the water. A tabulation of chemical water quality (laboratory - analysed) results, including those holes sampled as part of the drilling investigation, is given in Appendix D.

Down-hole ("wire-line") geophysical logging of these holes was done after drilling completion, prior to casing or backfilling them. A list of bores geophysically logged and their details, including those logged as part of the investigation, is given in Table 2. Individual geophysical logs are presented in Appendix E. These consist of caliper logs, transects 'Nos. 1 – 5' based on natural gamma logs and composite geophysical logs. Figure 5 shows the location of these transects.

Table 2 Details of Bores Geophysically Logged

RN	BORE NAME	EASTING	NORTHING	COMPLETION DATE	TD DRILLED (m)	TD LOGGED (m)	PUMPED DISCHARGE (L/s)	SWL (m bgl)	SWL 1996/1997 (m bgl)	TEMPERATURE 1996 (Celsius)	pH 1996/7	EC 1996 (uS/cm)	SAMPLE No.	ORIGINAL STATUS	STATUS - 1996	PUMP TYPE	CALIPER	GAMMA	ELECTRIC	TEMPERATURE	FLUID RESISTIVITY
546	WENDY, B.S.R.	560000	7992500	01-Jan-42	76.8	72.8	1.5	49.4						EQUIPPED	ABANDONED		*	*			
739	NO 5 SOUDAN HOMESTEAD	721346	7780050	01-Jan-01	96.6	58.8	3.8	67.4	DRY					EQUIP	ABANDONED			*			
747	NO 12 (HOMESTEAD NO.1)	679450	7891650	01-Jan-13	137.5	75.7	3.9	77.7	55.3					EQUIP	ABANDONED			*			
939	NO 5 WESTERN CREEK	811182	7782168		81.1	71.4	3.8		68.5					EQUIP	ABANDONED		*	*			
941	NO 10 REDFORD	805797	7824276		91.4	80.7	3.9	74.6	77.1					EQUIP	EQUIPPED	PUMP PULLED	*	*			
1143	NO 29	685142	7838397	19-Sep-49	118.5	105.5	2.6	61.0	60.2	27.4	7.1	3500.0	A29	EQUIPPED	EQUIPPED	S/CROSS		*			
1147	NO 35	721537	7745587		121.0	107.2	2.5	57.9	51.0					CAPPED	EQUIPPED	MONO	*	*			
1152	NO 26	739531	7884399	11-Oct-48	122.5	114.0	3.1	84.7	83.1	29.4	7.2	770.0	ADA26	EQUIP	EQUIPPED	MONO	*	*			
1871	HOMESTEAD	710919	7781410		122.1	100.0	0.4	63.3	54.1					CAPPED	ABANDONED			*			
2486	NO.49	658012	7893912	07-Nov-60	74.7	69.1	3.0	56.4	61.5	27.7	6.9	1570.0	A49	EQUIP	EQUIPPED	MONO		*			
3125	NO 50	662200	7868000		62.1	61.1	2.6	48.7	48.5	25.2	7.2	1440.0	A50	EQUIP	EQUIPPED	S/CROSS		*			
3180	OLD NO 18	766464	7713498		94.5	94.3		53.9	38.0					EQUIP	ABANDONED		*	*			
4550	NO A18 REPLACEMENT	641050	7890000	07-Nov-64	61.5	51.8	3.1	47.5						CAPPED	ABANDONED		*	*			
4752	REPLACEMENT NO 25	744006	7765362	19-May-65	128.0	116.1	3.0	50.2						CAPPED	ABANDONED		*	*			
8271	No. 77	767679	7884750	22-Oct-73	141.7	104.9	1.4	88.0	85.5					EQUIP	ABANDONED		*	*			
16243	A2/80 (No 86)	715316	7783129	24-Jun-80	197.4	121.8	3.0	77.0	69.9	34.0	1840.0	6.8	QU40, SO86	CAPPED	EQUIPPED	MONO		*			
16837	GARDEN IRRIG. POLICE ST.	774207	7768296		90.0	89.3	2.0		57.7						CAPPED			*			
16838	NO 3 DUPLICATE	774207	7768296		77.3	68.9	1.5		60.6			1930.0			CAPPED		*	*	*	*	
16839		800154	7764177		90.0	87.8	4.0		58.8			1220.0			CAPPED		*	*	*	*	
16886	MONITORING S	710954	7781308		120.6	120.6	5	54.3	38.4			1614			CAPPED		*	*	*	*	
16887		773118	7696004		199.4	196.3	14		33.7			1114			ABANDONED		*	*	*	*	
20568	NO 82	753951	7795152	09-Nov-74	104.0	100.9	0.8	75.0	74.8					CAPPED	ABANDONED		*	*			
21758	NO19 MIKADO REPLACEMENT	807449	7839222	07-Oct-81	129.0	120.7	0.9	90.0	85.0					CAPPED	EQUIPPED	PUMP PULLED	*	*			
21899	DUPLICATE NO.18	701608	7793009	22-Oct-82	152.0	144.7	3.8	68.0	67.6					CAPPED	EQUIPPED	MONO		*			
23299	NO 46	799968	7829954	28-Jul-84	122.0	120.7	1.3		87.0					CAPPED	EQUIPPED	PUMP PULLED	*	*			
24694	STATION NO.112 (NO.1)	776584	7868137	14-Aug-86	143.0	90.7	0.0	93.0	DRY					CAPPED	ABANDONED			*			
26211	SITE NO.74	716739	7891584	12-Sep-73	137.0	132.6	1.0	104.0	71.3					CAPPED	ABANDONED			*			
28127	HOMESTEAD REPLACEMENT	556000	8011000	09-Aug-92	83.0	80.0	1.5	54.5						CAPPED	CAPPED		*	*			
28448	NO.66	654884	7844100		91.4	92.8	2.5		64.3					CAPPED	ABANDONED			*			
29371	WILFRED CK. BORE	813308	7903895	06-Sep-94	102.0	97.2	2.0	87	70	34.0	6.6	826.0	QW 51	EQUIPPED	EQUIPPED	GR'FOS SUB	*	*			
30327	BLACKFELLA	690942	7926516	10-Nov-95	77.0	75.5	0.8	29.3	23.0					CAPPED	ABANDONED		*	*			
30330	NO 9 REPLACEMENT	574384	7871505	19-Apr-97	59.3	57.8	1.5		33.1					CAPPED	CAPPED		*	*	*	*	
30667	NO. 77 GALLIPOLI (NEW)	767832	7884645	01-Jan-81	136.2	146.0			85.6	29.6	7.0	1730.0	QU44, GA77E	EQUIPPED	EQUIPPED	MONO	*	*			
30849		736688	7804360		48.8	47.7	0.0		DRY						ABANDONED		*	*			
30850		736704	7804365		186.3	178.7	1		76.8			2180			ABANDONED		*	*	*		
30851		675630	7853387		200.7	200.1	1		53.3			2240			CAPPED		*	*	*		
30852	BAGPIPE	727112	7896026		200.4	198.5	1		78.2			700			CAPPED		*	*	*	*	
30853		813945	7863600		119.5	117.5	1.6		76.9			528			CAPPED		*	*	*	*	
30882	ROAD BORE	730499	7797019		150	102.3			78.6					CAPPED	CAPPED			*			
31193	MONITORING A	612201	7866140	1-Sep-97	76	73	>3.3		36.8		8.0	2370	QI26	MONITOR	MONITOR		*	*	*	*	*
31194		627222	7873950	3-Oct-97	178.4	177.6	6.2		41.1		8.2	8000	QI04, QP44	ABANDONED	ABANDONED		*	*	*	*	*
31195		719958	7940956	10-Sep-97	120.0	117.0	0.3		8.7		8.3	784.0	QC65	MONITOR	MONITOR		*	*	*	*	*
31196		722538	7941179	10-Sep-97	88.9	87.9	0.0		79.0					ABANDONED	ABANDONED		*	*	*	*	*
31197		690776	7925773	16-Sep-97	156.0	155.1	9.0		26.4		8.2	800.0	QN04, QL28	CAPPED	CAPPED		*	*	*	*	*
31198		548280	7986290	09-Oct-97	106.9	105.6	13.0		50.6		8.1	4400.0	QR97, QM69	CAPPED	CAPPED		*	*	*	*	

Figure 5 Location Map of Geophysically Logged Bores and Transects in relation to Simplified Geology of 'Study Region 1'



3.2 Stage 1 Drilling Program

- Bore RN 16886 was sited adjacent to Soudan Homestead (between the front entrance and the Barkly Highway) just west of the Ranken River Bridge.

It was drilled to 120 m and cased with 100 mm ID PVC (1 mm slot size) for use as a monitoring bore. See Appendix A for the composite log.

The bore penetrated siltstone and chert of Mesozoic age until 18 m below which calcareous sandstone and limestone with minor sandstone ("Ranken Limestone") was encountered to TD. Two rock-chip samples were analysed - one of dolomitic (?) limestone and the second a micritic limestone (refer Table 1).

About 1 L/s was attained at 70 m while the main supply (9 L/s) was struck in fractured calcareous sandstone, limestone and sandstone from 114 m to 120 m. The water quality in the deeper aquifer was significantly better than that of the first supply (1600 µS/cm versus 2500 µS/cm).

Geophysical logging indicated two, thin, discrete aquifer zones (bedding planes?) at approximately 71 m and 116 m, respectively. A higher gamma trace was attained in the calcareous sandstone than the limestone. The geophysical log completed on RN 16886 is shown in Appendix E.

- Bore RN 16887 was sited 38 km south-south-west of Austral Downs Homestead, 6 km west of the Barkly Highway / Sandover Highway feeder road via Austral Downs on Burramurra Block, on the edge of the "desert country". It was sited to investigate a narrow palaeochannel, evident on satellite images but invisible in the field, which connected with the Ranken River approximately 15 km upstream of its confluence with the Georgina River.

RN 16887 was drilled to 199 m, cased with 6 m of surface casing, and left open hole thereafter. After geophysical logging this had bridged back to 43 m, and later, infilled to the level of the water table (33 m). Refer Appendix A for a composite log.

Vughy, cherty and silicified limestone of the Tertiary - aged "Austral Downs Limestone" was encountered to 33 m; (from 33 m to 62 m is possibly the Austral Downs Limestone, too, with disconformities at 51 m and 62 m). Cambrian - aged limestone of the "Camooweal Dolomite" was struck below 62 m to TD, with some areas being dolomitized and/or micro-vughy. The limestone from this hole showed more evidence of dolomitization than the other holes drilled for this project. Three rock-chip samples were analysed; nominally a limestone, dolomitized limestone and a dolomite; (Table 1).

The first water was struck at 60 m with a final airlift of 13 L/s. The water quality remained consistently good throughout.

A distinct lack of fracturing is evident on the caliper geophysical log (see Appendix E) below the first water strike. Combined with a steady increase in temperature and decrease in penetration rate as depth increased (refer Figure 4) indicates that the Camooweal Dolomite is tight and non-water bearing below 80 m in this locality. Most of the water emanates from a vughy chert between 60 and 62 m (at the disconformity between the Cambrian and Tertiary formations).

- Bore RN 30849 was drilled on Avon Downs Station, 36 km north-west of the homestead, 9 km north of the Ranken Road ("dog-leg" of the old Barkly Highway alignment).

Circulation was lost from approximately 24 m to TD at 48 m. Because of drilling difficulties, the hole was abandoned above the aquifer and backfilled. See Appendix A for composite log. The penetration rate was high with an average for the hole of over 1 m/min (see Figure 4).

Drilling encountered clayey silt, mudstone and chert to 24 m before entering medium grained, firm, and brittle sandstone with moderate visible porosity, below which no samples returned to the surface. The rocks from 0 to 24 m are considered to be of Mesozoic age whilst, below 24 m, Camooweal Dolomite is present.

A distinct decrease in the gamma geophysical log at 24 m suggested that either limestone or calcareous sandstone was encountered at the zone of lost circulation to TD.

- Bore RN 30850, was drilled alongside RN 30849, and as a replacement investigation hole for it.

RN 30850 was left with 6 m of 203 mm ID surface casing capped initially for monitoring purposes, and for the station to hire a drilling contractor to ream it later as a stock bore if desired. Circulation was lost at 25 m before some returns were regained from 38 m and 219 mm casing inserted to 32 m. Drilling then continued to 138 m before circulation was lost again. The hole was terminated at 186 m. (Appendix A). Penetration rate averaged over 1 m/min until 96 m and about 0.5 m/min thereafter (Figure 4).

Limestone was encountered from 38 m until about 70 m, and then interbedded sandstone and siltstone to 114 m. Calcareous sandstone and interbedded chert and sandstone then continued until the bottom zone of lost circulation. The drillers log noted firm drilling to 153 m, fractures to 156 m, a few soft bands around 159 m, fractures from 162 m to 176 m, then a few metres of soft drilling before a hard, fractured and cavernous area was struck for the last few metres. The caliper log confirms this interpretation (refer Appendix E).

Because of lost circulation, no airlift yields were available and the bore was bailed to attain a representative sample, suitable for chemical analysis.

Prior to removing the 219 mm casing string, the hole was geophysically logged and a slug test was undertaken by the drill crew with 600 L of water poured down the drill pipe. The following readings were attained:

Time (min)	*Slug Depth (m)*
1.0	0.02
1.5	0.02
2.0	0.01
3.5	0.01

5.0	0.01	
8.0	0.01	
10.0	0.00	water head dissipated (i.e. "fully recovered" to SWL)
15.0	0.00	

- Bore RN 30851 was sited 38 km west by south of Alexandria Homestead, 21 km west of the (Barkly Stock Route's (Ranken Road) "Ranken Plain Bore" on Alexandria Block.

It was drilled to 200 m TD and completed at 120 m as a production bore for stock use (see Appendix A). The penetration rate was significantly lower than previous drilling with rates generally from 0.2 - 0.4 m/min (see Figure 4).

The bore encountered various limestones from 9 m to TD. The limestone was interbedded white, grey and brown varieties, hard and massive, rarely oolitic (30 - 36 m) and occasionally micritic.

From 0 to 9 m calcareous mudstone and siltstone occurs which is gradually superseded by sparry and vughy silicified limestone to 18 m. Limestone and silicified limestone predominates from 18 m to 30 m. This is probably an outlier of "Brunette Downs Limestone" of Tertiary age. Below 30 m to TD the geological log (and the sudden decrease in the gamma log) indicates "cleaner limestones. This interval is assigned to the "Wonarah Beds" of Cambrian age supported by fossils of primitive corals – *Archaeocyathids*? or possibly sponges observed in rock-chips; whilst bivalves were found in the strata above 30 m.

The initial water strike occurred from 95 m to 101 m and yielded 1.6 L/s in a vughy dolomitized limestone. A little more water may have been struck at 138 m in a re-crystallized oolitic limestone. A second aquifer occurred between 190 m and 200 m where the yield increased substantially from 4 L/s to 12 L/s in a differentially weathered horizon with hard, minor fractured and interbedded residual limestone (silt); (evident in the strata sample, in the penetration rate and the caliper log). The water quality deteriorated from an EC of 2090 µS/cm at the first water strike (95 m) to 3060 µS/cm at TD.

The gamma count remained low and smooth for all except the top 30 m of hole with an average of 5 cps (Appendix E).

- Bore RN 30852 was sited on Alexandria Station, about 45 km east of the Homestead and 5 km south-east of the Playford River.

It was drilled to 200 m and completed as a production bore for stock use (see Appendix A). The penetration rate (Figure 4) was regular (with values similar to RN 30851) emphasising the uniformly massive, tight nature of the strata.

This bore struck limestone throughout apart from a small section of cherty calcareous sandstone, sandstone and silicified limestone between about 23 m and 33 m. The limestone was oolitic from 90 m to 102 m and 114 m to 126 m and appeared to have good visible porosity in places. Before circulation was lost at 162 m, the limestone was hard, thinly bedded and micritic. The drilling remained firm to hard with no fracturing to TD. Three samples were sent for major element analysis – the first a hard, micritic limestone above the aquifer zone, a sample from the aquifer zone and a third from just above the zone of lost circulation (Table 1).

It is difficult to assign the strata encountered in this hole to a formation. It is tentatively assigned to the Camooweal Dolomite, although it could equally be designated as belonging to the "Burton Beds" (based upon a slightly higher gamma count). Surficial deposits to 33 m could be of a younger age than Cambrian; however mapping indicates Camooweal Dolomite sub crop; this is supported by the similar gamma log profile of the hole and lack of washout zones at sub-surface on the caliper log (apart from the calcareous sandstone described previously).
Seepage occurred at 114 m (supply of less than 0.8 L/s) increasing to 1 L/s at 134 m, although no fracturing was evident on either the drillers log or caliper log. The water quality was good with an EC of 700 µS/cm.
The low yield is surprising considering that some of the rock-chips, especially the section of oolitic limestone, appeared to have moderate visible porosity. Apparently the porosity is not inter-connected (the ooliths being spherical, well-packed, with a matrix cement), thus rendering the rock with low permeability.
The spike evident on the temperature log (and corresponding ones on the electric and SP logs) suggests a thin, discrete aquifer; possibly a closed joint or bedding plane. Refer to Appendix E for the geophysical logs.

- Bore RN 30853 was drilled on Rocklands Station, about 60 km north of the Homestead, adjacent to the Queensland border (nearly 2 km south-south-west of the "Dariel Gate"). It was the most easterly of the bores drilled in the study area.

It was drilled to a TD of 120 m and completed at 116.5 m as a production bore for stock use (Appendix A). The penetration rate (Figure 4) was similar to RN 30853 both in its rate and regular nature.
"Clean" limestone was struck from about 54 m to TD with some sections micritic and minor intervals weakly dolomitized and silicified. Strata samples from the aquifer zone and the bottom of the hole were sent for analysis (Table 1).
Below 36 m the strata is assigned to the Camooweal Dolomite with its characteristically low gamma count; (the interval 36 m to 54 m has been subject to sub-aerial weathering indicated by wash-outs in residual limestones and minor mudstones and siltstones). The upper 36 m is more problematic to assign a formation and age to; surface mapping indicates that Camooweal Dolomite sub-crops below the thin veneer of "black soil". Rock-chips logged indicate strata consist of calcareous siltstone, mudstone and residual cherty limestone. It could well be assigned to the Camooweal Dolomite, but could equally be assigned to a younger Tertiary-aged formation? with its predominance of argillaceous sedimentary rocks. There is some evidence of intermittent fault gouge especially between 33 m and 36 m.
Most of the in-flow was concentrated from 103 - 110 m from a zone of minor fracturing in a cherty limestone and a limestone breccia, (evident from strata samples and the caliper log). There was a very low gamma response below 36 m, with minor spikes similar to that attained in RN 16887 (Appendix E).
A yield capable of supporting stock (1.6 L/s) of good quality water (EC 600 µS/cm) was attained.

3.3 Stage 2 Drilling Program

- Bore RN 31193 was sited between Alroy Downs' Homestead and the Playford River, adjacent to the south bank of the river.

It was drilled to 76 m TD and finished with 100 mm ID PVC for use as a monitoring bore (see Appendix A).

Clay, claystone and siltstone was struck to a depth of 44 m. Pale yellow and brown calcareous sandstone with good visible porosity then continued until loss of circulation at 54 m. Washed out zones are evident on the caliper log from 54 - 59 m before a change to a harder calcareous sandstone or limestone as indicated by the slower penetration rate (Figure 4) and 'smoother' caliper log.

A flow of 3.3 L/s of fair to brackish water quality (EC 2,370 µS/cm) was encountered at 44 m (contact between the siltstone and calcareous sandstone) but no final airlift yields were possible due to loss of circulation[1]. Circulation was originally lost at 134 m, and not regained until 162 m with an estimated 50% returns. Drilling then finished for the day and circulation could not be restored in the morning. Cavities were encountered from 54 - 54.9 m and 58.4 - 59.7 m with the surrounding material being broken before becoming hard at 65 m and very hard from 70 m. No major changes in drilling conditions were noted from 140 m to TD. The drillers log notes that from 29 m to 31 m were heavily fractured and from 31 to 33 m there was a cavity, where perhaps the returns were being lost into this top cavernous zone. Circulation was lost even though the material drilled was firm, hard and unfractured. The limestone was not fractured with minimal porosity and a low yield.

A low gamma response was noted through the calcareous sandstone and until the drilling became hard at about 70 m. (The strata and gamma log results from RN 31194 suggest that the harder material from about 70 m was limestone). See Appendix E for the suite of geophysical logs completed on RN 31193.

- Bore RN 31194 was sited 17 km north-east of Alroy Homestead on the south side of the Playford River and north of No. 10 Bore (RN 728).

It was drilled to 178 m TD, cased to 69 m with open hole below this depth (Appendix A). Circulation was lost from 43 - 69 m. The penetration rate (Figure 4) below 100 m was very slow (> 0.1 m/min) with the slower drilling rate coinciding with hard, micritic limestone.

Fine-grained calcareous sandstone with good visible porosity was encountered above and below the lost circulation zone, down to 93 m. A mix of hard, micritic limestone and fine-grained calcareous sandstone were struck to TD. Four samples were sent for whole rock analysis - the first a calcareous sandstone from the bottom of the zone of lost circulation, two from zones of dolomitized (?) limestone and the last from the bottom of the hole (micritic limestone); refer Table 1.

The final airlift yield was 7 L/s. A fluid conductivity test was run and combined with the results from bore RN 31193; it appears that three different water qualities exist at different depths. Water with an EC less than 5000 µS/cm is available from the calcareous sandstone in the upper part of the

[1] *Once below the regional water table, lost circulation, whilst drilling the limestones of this region, indicates a probability of considerable amounts of groundwater available once a bore is constructed (cased) and pumped. Lost circulation is indicative of extensive fracturing and cavities within the rock mass.*

zone of lost circulation. The water quality then deteriorates to more than 10 000 µS/cm by the calcareous sandstone / limestone contact around 100 m. According to the fluid conductivity log, at the bottom of the hole, the EC had diminished to 3000 µS/cm.
The calcareous sandstone and limestone had distinctly different gamma log responses (average of 5cps versus 15cps respectively). Two temperature logs were run; one and 11 days, after the completion of drilling and responses are in some ways different. The curves are similar in shape but it appears that the change in temperature near the aquifer zones is very much muted on the latter run (presumably because the temperature differential associated with the aquifer zones had decreased by mixing). See Appendix E for the geophysical logs.
Low yielding bores could be constructed near the top of the zone of lost circulation while higher yielding bores would need to seal off the poorer quality water from 50 m to 120 m.

- Bore RN 31195 was sited 22 km north of Mittiebah Homestead, 5 km west of north of Mitchiebo Waterhole and 4 km west-north-west of the gate near the corner of Mittiebah / Waanyi ALT boundary's fence line.

It was drilled to 120 m and constructed with 100 mm ID PVC for use as a monitoring bore (see Appendix A).
Trachyte(?) and basalt was struck to 57 m with red and brown siltstone continuing to TD.
A small supply (0.25 L/s) of good quality water (EC 780 µS/cm) was struck at the contact between the two rock types. A uniformly fast drilling rate was achieved (see Figure 4).
A marked jump in gamma response and electrical resistivity occurred on the geophysical log (Appendix E) at 57 m on passing from the volcanic suite of rocks into siltstone below. A spike on the temperature log at 55 m indicates the inflow zone, probably situated at a weathered disconformity at the base of the basalt.

- Bore RN 31196 was sited approximately 2.5 km east of RN 31195; that is towards the boundary fence line, on Mittiebah Station.

It encountered sandstone to 15 m and siltstone to about 60 m and sandstone to TD of 89 m thereafter.
The bore was dry (minor seepage only) and was abandoned and backfilled (Appendix A).
The increased gamma response was very similar to that described in RN 31195, except that it occurred at a shallower depth of 15 m (Appendix E).

- Bore RN 31197 was sited about 30 km west-north-west of Mittiebah Homestead, approximately 100 m south-west of Blackfella Bore (RN 30327) and south of Peaker Piker Creek.

It was drilled to 156 m, cased to 58 m and left open hole thereafter (Appendix A).
The hole was drilled through trachyte (?) to 26 m and then layers and interbeds of siltstone and sandstone to TD. The ROP was uniformly high; however siltstone beds tended to be harder (silicified) around the 100 m depth zone (Figure 4).
The final airlift yield was 9 L/s with the water coming from the uppermost sandstone layer between 53 m and 99 m. Water quality was consistently good throughout the hole (EC = 800 µS/cm).

Minor fractures (bedding planes?) are evident in the caliper log in the upper sandstone while the temperature log suggests significant inflow below about 75 m (Appendix E).

- Bore RN 31198 was sited 27 km south-south-west of Anthony Lagoon Homestead, 4 km south of No. 7 Bore, along the road to Rockhampton Downs Homestead.

It was drilled to 107 m and constructed as a stock bore with casing to 81 m and open hole thereafter (Appendix A).

Interbedded sandstone, minor conglomerate and mudstone were penetrated to 21 m. Below 21 m calcareous sandstone predominated with some limestone and minor mudstone interbeds. From 81 m to 87 m a layer of siltstone was encountered, proceeded by calcareous sandstone, sandstone and minor siltstone interbeds to TD. Two samples of calcareous sandstone were sent for whole rock analysis - the first from the aquifer zone and a second from the bottom of the hole (Table 1). The ROP log indicated harder beds of sandstone at 20 m and calcareous sandstone at 50 m and 70 m (Figure 4).

A supply of 6 L/s was struck from 75 - 79 m in thinly bedded and fractured calcareous sandstone with no further increase until fractured, porous sandstone at 105 m yielded an additional 7 L/s. The EC deteriorated from 3400 µS/cm to 4300 µS/cm after the second water strike.

The gamma response of the calcareous sandstone was generally higher, with larger spikes than the other bores; a reflection of the mudstone and siltstone interbeds. Major fractures were observed on the caliper logs at 77 m and 100 m. The temperature log indicated that most inflow occurred from the 77 m fracture and inflow from depth (Appendix E).

4.0 TEST PUMPING

4.1 Introduction

A total of nine pumping tests were carried out on existing stock bores including two domestic bore ("Homestead Bore" RN 1142 and No. 86 Soudan RN 16243) from 25th May to 27th July 1996 ('Stage 1 Test Pumping'). This included eight step tests, and one constant rate test where two observation wells were available (RN 1142 - pumped bore). A further five pumping tests were conducted from 26th June to the 20th October 1997 ('Stage 2 Test Pumping'); (one step, two constant rate and two step and constant rate tests, respectively).

The step tests normally consisted of four steps, each of 100 minutes' duration, often with an extended last step. Constant rate tests were generally each of 480 minutes' duration. Monitoring of the recovery rate after cessation of pumping was undertaken for up to 150 minutes, depending on the individual bore.

Two tests utilised existing bore pumps belonging to the station, whilst Water Resources Branch equipment was used for the rest. WRB equipment consisted of a diesel powered, shaft driven Mono 640A or Mono 820 pump on 80 mm column. [The Mono 640A has a maximum rate of 4.2 L/s at 80 m head and is suitable for bores constructed with a minimum 100 mm ID casing (pump OD of 80 mm). The Mono 820 has a maximum rate of 13.3 L/s at 80 m head and is suitable for bores constructed with a minimum 145 mm ID casing (pump OD of 130 mm)].

At a number of locations, fuel, oil and grease were found around bore heads, which themselves were often in bad condition. Quantities of fuel and oil were also bailed from some of these bores. This may allow infiltration of hydrocarbon products into the aquifers and soil/rock profiles, thereby contaminating the aquifer, albeit locally. Attention is drawn to the station owners/managers to be aware of these problems. They are encouraged to make modifications to the bore head equipment to prevent further problems of this nature.

Table 3..Summary of Settings for Test Pumping

BORE NAME	RN	DATE OF TEST	PUMP TYPE USED	TYPE OF TEST	PUMP SETTING (m bgl)	STATIC WATER LEVEL (m bgl)	AVAIL DRAW DOWN (m)	PUMP RATE (L/s)	TOTAL DURA-TION (mins.)	MAX. DRAW DOWN (m)	RECO-VERY (m after mins.)
No. 32 Home-stead	1142 / 747[2]	26.6.96	Southern Cross PDG; 66 mm column[3]	Constant Rate with 2 Observation Bores[4]	85.2	51.1	34.1	1.5	480	?[5]	0.9 after 60
No. 29	1143	31.5.96	Mono 640; 80 mm column	Extended Step	94.1	60.1	34.0	0.5; 1.5; 2; 2.5	720	27.2[6]	0.6 after 70
No. 35	1147	17.7.96	Mono 640; 80 mm column	Extended Step	87.8	51.0	36.8	0.4; 1; 2	1020	25.3	fully after 10
No. 26	1152	27.7.96	Mono 820; 80 mm column	Extended Step	94.5	83.1	11.4	7; 10; 14	1210	4.0[7]	fully after 15
No. 49	2486	24.5.96	Mono 620; 50 mm column[8]	Extended Step	66.2	61.5	4.7	1; 2; 3; 5	720	3.9	0.8 after 60
No. 50	3125	27.5.96	Mono 820; 80 mm column	Extended Step	57.7	48.6	9.1	2; 4; 6; 8; 10	720	5.8	0.2 after 720
No. 86	16243 / 1871[9]	19.7.96	Mono 640; 80 mm column	Extended Step	100.2	69.9	30.3	0.5; 1.5; 3	1260	22.7	0.2 after 60
No. 18	21899	13.7.96	Mono 820; 80 mm column	Extended Step	82.3	67.7	14.6	5; 10; 12	480	3.4	fully after 1
No. 77	30667	24.7.96	Mono 820; 80 mm column	Extended Step	106.8	87.6	19.2	3; 6; 1.6; 4	450	18.8[10]	0.1 120
-	30852	9.10.97	Mono 640; 80 mm column	Step	107.7	77.8	29.9	0.6; 0.8; 1	380	29.5	
-	31193	17.9.97	Mono 640; 50 mm column	Constant Rate	51.9	37.2	14.7	5	480	0.23	
-	31194	19.7.97	Mono 820; 80 mm	Constant Rate	58.8	41.3	3.8	15	360	0.09	0.01 after 3

[2] WRB recorded the bore pumped as RN 747; it was actually an adjacent bore, RN 1142
[3] Station pump and column was used
[4] Max. drawdown in Obs. Bores: RN 747 3.7 m and RN 9817 4.6 m
[5] Water level probe obstructed below 60 m (8.9 m drawdown after 4 minutes)
[6] Rate reduced to 1.4 L/s after 400 minutes for a final drawdown of 10.9 m
[7] Rate reduced to 8.8 L/s after 400 minutes (left pumping overnight) for a final drawdown of 1.9 m
[8] Station pump and column was used
[9] WRB recorded the bore pumped as RN 1871; it was actually an adjacent bore, RN 16243
[10] During 2nd step (at 6 L/s after 160 minutes)

			column								
-	31197	23.9.97	Mono 820; 80 mm column	Constant Rate	46.2	26.4	20.03	6	480	7.9	
-	31198	21.10.97	Mono 820; 80	Constant Rate	71.2	50.2	21.0	12	420	13.3	

Drawdown graphs of the bores' reaction to pumping comprise Appendix F (nine step rate and five constant rate drawdown tests). Test reports are available for all 14 tested bores as Appendix G; these reports recommend individual pump settings and pumping discharge rates for each bore based on the predicted drawdown graphs.

The step tests were analysed using the Starpoint software package, "Stepmaster" and also the modified Lennox method (from Hazel, 1975). The constant rate tests were analysed manually utilising a modified Theis method. Hydraulic parameters calculated from the above-mentioned test-pumping program have been summarised in Table 4.

Table 4 Hydraulic Parameters calculated from the Suite of Test-Pumping and Recommended Long-Term Pumping Rates

	STEP TESTS	CONSTANT RATE TESTS			
RN	TRANSMIS-SIVITY (m^2/d)	TRANSMIS-SIVITY (m^2/d)	STORAGE CO-EFFICIENT	MAX. RATE FOR 2 YEARS CONT. PUMPING (L/s)	BORE EFFICIENCY (%)
1142		26			
1143	11			2.2	76
1147	46			2.1	28
1152	1,160			> 25	
2486	79			5.4	91
3125	294			12.0	91
16243	65			3.3	4
21899	290			> 15	45
30667	66			5.4	85
30852	3			0.6	74
31193		3,290		> 25	
31194		5,650		> 25	
31197		95		9.0	
31198		107		12.0	

4.2 Stage 1 Test Pumping

Six of the nine established bores had yields of less than 5 L/s while the other three were over 10 L/s. All bores were designed for low yield stock or domestic use and, at most of the locations, different bore construction would most likely have resulted in higher yields. For some of these bores neither strata nor construction details are known.

A number of these bores exhibit drawdown characteristics of fractured aquifers (RN 1143 in particular) although some of this could be due to poor bore construction. Transmissivities ranged from 11 - 1200 m^2/day with bore efficiencies ranging from 4% to 90%.

A constant rate test was undertaken on RN 1142 with the nearby bores RN's 747 and 9817 being monitored. The test was conducted with the station pump and the probe would not go past 60 m. This gave a measurable drawdown of 8.85 m that the pumping water level exceeded in less than 4 minutes. The test was conducted at 1.5 L/s and this has been recommended as the maximum continuous pumping rate as the drawdown within the bore could not be measured. The transmissivity was calculated at 27 m^2/day.

4.3 Stage 2 Test Pumping

All bores except RN 30852 have maximum continuous recommended yields of more than 5 L/s. The transmissivity of RN 30852 was 3 m^2/day while those of RNs 31197 and 31198 were around 100 m^2/day and the two high yielding bores, viz. RNs 31193 and 31194, respectively were 3300 m^2/day and 5600 m^2/day.

Bores RN's 31193 and 31194 could probably sustain higher yield (perhaps 20 L/s plus) but further testing at higher rates would be required to confirm this.

5.0 WATER QUALITY

5.1 Test Pumping

Table 5 summarises field measurements taken to measure physical and chemical attributes of the groundwater being pumped.

Table 5 Summary of Water Quality measurements taken whilst Test Pumping

RN	BORE NAME	DATE OF TEST	TEMPERATURE (° C)	pH	EC (µS/cm)	DISSOLVED OXYGEN	MINOR IONS SAMPLED	ISOTOPE SAMPLE	COMMENTS
1142	No. 32 Home-stead	26.6.96	28.9	6.58 to 7.01	792	-	F; Br; I; Li; Sr; Mn	Oxygen; Carbon 14	Discharge clean & clear
1143	No. 29	31.5.96	27.4	7.34 to 7.07	3300 to 3500	-	F; Br; I; Li; Sr; Mn		
1147	No. 35	17.7.96	29.5 to 30.4	7.04 to 6.99	1550	-	F; Br; I; Li; Sr; Mn	Oxygen; Carbon 14	Discharge occluded becoming clear
1152	No. 26	27.7.96	29.4	7.01 to 7.28	771 to 742	-	_	_	Discharge some rust & sdst chips & clear
2486	No. 49	24.5.96	27.7	6.33 to 6.92	1860 to 1572	-	F; Br; I; Li; Sr; Mn	–	Some brown discolouration
3125	No. 50	27.5.96	25.2	7.40 to 7.17	1425	-	F; Br; I; Li; Sr; Mn	Oxygen; Carbon 14	Became clean & clear
16243	No . 86	19.7.96	32.8 to 34.2	6.65 to 6.79	2510 to 2090	-	_	–	Becoming clean with rust fines
21899	No. 18	13.7.96	31.5	7.09 to 6.89	2010 to 1971	-	_	–	Becoming clean with rust flakes
30667	No. 77	24.7.96	29.6	6.64 to 6.99	1658 to 1731	-	_	_	Hazy, oily discharge; few sand grains
30852		9.10.97	27.5	7.03 to 6.93	491 to 691	4.29 to 3.21	-	-	~ discoloured with a little fine sand
31193		16.9.97	29.0	6.49 to 6.54	2700 to 2660	4.04 to 4.62	F; Br; I; Li; Sr; Mn	Oxygen; Carbon 14	Discoloured with fine sand
31194		19.9.97	26.0	6.47 to 6.73	5720 to 5640	4.20 to 5.88	F; Br; I; Li; Sr; Mn	Oxygen; Carbon 14	Became clean & clear
31197		23.9.97	30.0	6.74 to 6.65	850 to 833	3.94 to 4.67	F; Br; I; Li; Sr; Mn		Became clean & clear
31198		21.9.97	31.5	6.67 to 6.65	3310 to 3570	2.41 to 2.10	F; Br; I; Li; Sr; Mn	Oxygen; Carbon 14	Became clean & clear

6.0 DISCUSSION

6.1 Georgina Basin

Bores RN's 16887 and 30853 both penetrated the Camooweal Dolomite, with RN 16887 commencing in the overlying Tertiary Austral Downs Limestone. The strata in both bores were logged as limestone with some dolomitized limestone. RN 16887 was the most dolomitic. This was unexpected as the Camooweal Dolomite is generally regarded as being dominated by dolomite. Five chip samples were sent for analysis to determine the degree of dolomitization.

Bore RN 16887 struck water at 63 m in vughy limestone and the supply gradually increased during drilling to the final airlift yield of 13 L/s, with very little to no fracturing evident. In contrast bore RN 30853, attained only a small supply, from a discrete, fracture controlled zone. RN 16887 appears to be the only carbonate bore drilled during this program in which the aquifer characteristics were not strongly fracture controlled.

According to the geological map sheet, RN 16886 should also penetrate the Camooweal Dolomite. The strata are different to the above-mentioned bores and are dominated by calcareous sandstone with some limestone. The gamma log is different to the above-mentioned bores, with a much higher average count. The limestone has a lower gamma response than the calcareous sandstone. Further to the west RN 31193 and 31194, drilled into the Wonarah beds and also penetrating limestone and calcareous sandstone has the opposite response with a lower count for the calcareous sandstone than the limestone. As such it is most likely that bore RN 16886 is drilled into the Camooweal Dolomite despite the lithological and gamma log variations compared to bores RN 16887 and RN 30852 as well as the geological description of the unit.

Bore RN 30849 / 50 commenced in Mesozoic sediments that persisted for about 25 m before passing into a sequence of limestone, sandstone and calcareous sandstone. It cannot be determined which unit this bore penetrates as no similar sandstone or siltstone sequences exist in any of the five other investigation bores which surround RN 30850. The bore was not pump tested, but a high yield can be inferred from the zone of lost circulation and by the results of the slug test.

Both RN 30851 and 30852 probably penetrate the Middle Cambrian Burton Beds. They were drilled into hard limestone, with minor oolitic and fossiliferous limestone. However the aquifer characteristics and down-hole geophysical logging proved quite different. The main supply (approximately 10 L/s) for RN 30851 was attained from fractures between 190 m and 200 m while RN 30852 did not strike appreciable fracturing (or cavities below the water-table) and yielded only 1.0 L/s. The gamma trace for RN 30852 is appreciably higher and spikier than RN 30851, which more closely resembles that attained from the Camooweal Dolomite than RN 30852. The EC of RN 30852 finished at 3000 µS/cm while that for 30852 was only 700 µS/cm.

Bore RN 31198 was drilled into calcareous sandstone, sandstone and limestone of the Anthony Lagoon Beds and airlifted 13 L/s from two distinct areas of fractured calcareous sandstone.

6.2 South Nicholson Basin

Bores RN's 31195, 31196 and 31197 were drilled into sandstones and siltstones of the Proterozoic South Nicholson Group; the former two penetrated the Mullera Formation (aquitard), the latter one the Mittiebah Sandstone along the axis of an anticline. This structural feature probably allowed fractured supplies (otherwise the Mittiebah Sandstone is not as aquifer).

The units that the bores were interpreted as being drilled are summarised as follows:

RN	*UNIT*
16886	Camooweal Dolomite?
16887	Tertiary/Camooweal Dolomite
30849	Mesozoic (above the water table)
30850	Unknown
30851	Burton Beds
30852	Burton Beds
31195	South Nicholson Group (Mullera Formation)
31196	South Nicholson Group (Mullera Formation)
31197	South Nicholson Group (Mittiebah Sandstone)
31198	Tertiary/Anthony Lagoon Beds

Some of these correlations are tentative and it appears that the commonly accepted descriptions of some units (the Camooweal Dolomite for example) may not adequately describe all rock types mapped as that unit.

There also appears to be variation of rock types and aquifer characteristics spatially within individual units. This is especially evident in RN's 16887 / 30850 and RN's 30851 / 30852. The first two bores varied in yield, water quality and aquifer type, while the second two had distinctly different yield and water quality.

Fractured calcareous sandstone seemed to be the most regular aquifer, especially where it was hard and thinly bedded. The fractured and cavernous limestone is also a good aquifer, but in at least two locations (RN's 30850 and 30852) fracturing was not encountered and yields were less than 1 L/s.

Water quality changes with depth are evident in a number of holes; RN 31194 has a three-layered system. The general trend is for poorer quality water toward the topographic low point of the area (to the west of this study's area towards Lake Sylvester and Lake Corella).

7.0 CONCLUSIONS

A total of 10 bores were drilled through carbonate sequences of the Georgina Basin, while three were drilled into older arenaceous units of the South Nicholson Group. A tentative correlation has been made between individual bores and rock units, but this is difficult in places due to the distance between data points and the apparent spatial changes (both vertical and horizontal) within the units. The study region is too large to allow a sufficient density of data points to enable a definitive description.

Apart from RN 16887, all successful bores yielded water from fracture and cavities, regardless of whether the bore was drilled into limestone, dolomitized limestone or calcareous sandstone. RN 16887 supplies a high yield from basically unfractured, hard but vughy limestone.

No dry holes were drilled in calcareous sandstone-dominated sequences, as the required degree of fracturing was present in all holes. In contrast, two bores with low yields were drilled in limestone sequences where insufficient fracturing or cavities were present to provide a usable water supply.

For most of the older bores in the region, the only information available is gamma logs. These logs are generally helpful in deciding on correlations between units and bores but may be misleading on occasions. In some of the investigation bores (where there is good strata control) the calcareous sandstone sequences have lower gamma responses than areas of limestone, yet in other bores the opposite is true.

The test pump results confirm that high yields are available over a large proportion of the study region. Some of the bores tested produced good results (especially the investigation bores) while others which were inadequately constructed and often did not penetrate far into the aquifer were less representative of the true characteristics of the aquifer, but still adequate for stock watering purposes. Some of the investigation and old stock/domestic bores have calculated maximum yields of more than 10 L/s with short term yields of probably over 20 L/s.

In certain areas, suitably constructed bores could be installed where the water quality would be sufficient for long term, high water use projects (more than 20 L/s per bore). Further drilling and longer-term testing would be required before reliable estimates of groundwater storage could be made. Studies of the rates of recharge would also have to be included at this stage of resource assessment if water use was expected to expand significantly. To this end water table monitoring equipment has been installed on RN 16686 and RN 31193 to complement river flow monitoring equipment on the Ranken and Playford Rivers respectively. And, water samples for isotope analyses have been taken.

Water quality was sometimes potable and generally suited for stock. Care will need to be taken predicting long-term water quality at certain locations, as there appears to be large variations between the units both spatially and with depth.
In summary it can be said that:

- there is significant strata variation within the rock units both spatially and with depth.
- the strata from certain units, most notably the Camooweal Dolomite do not closely conform to the published descriptions.
- fracturing was responsible for the majority of the yield available from all carbonate bores apart from RN 16887.
- significant aquifers were struck in all the carbonate bore holes except RN 30852 where there was insufficient fracturing resulting in yields of less than 1 L/s.
- the water quality was variable between the units, within the units spatially and with depth in individual bore holes.

8.0 FUTURE PROSPECTS

1. Bore yields of more than 10 L/s were attained during the test pumping program and higher yielding bores could be constructed in selected areas.
2. These same bore sites could be constructed in areas with water quality sufficient for long-term high water use projects.
3. More intensive drilling and testing would need to be undertaken if the current water use patterns expand.
4. Monitoring of the water table and river flows (notably the Ranken River at Soudan Block) should continue.

9.0 REFERENCES

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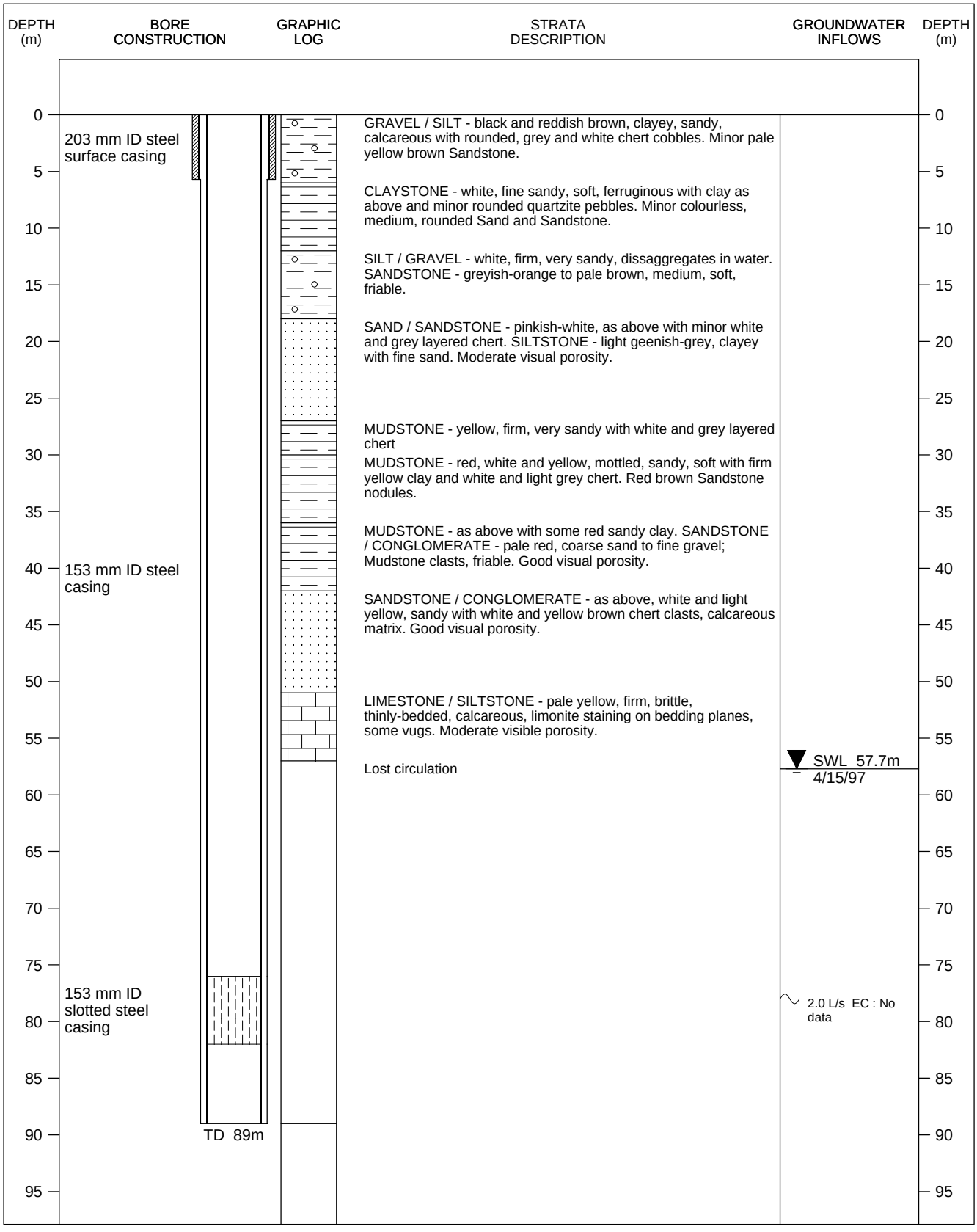
APPENDIX A

COMPOSITE AND GEOLOGIST'S LOGS

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



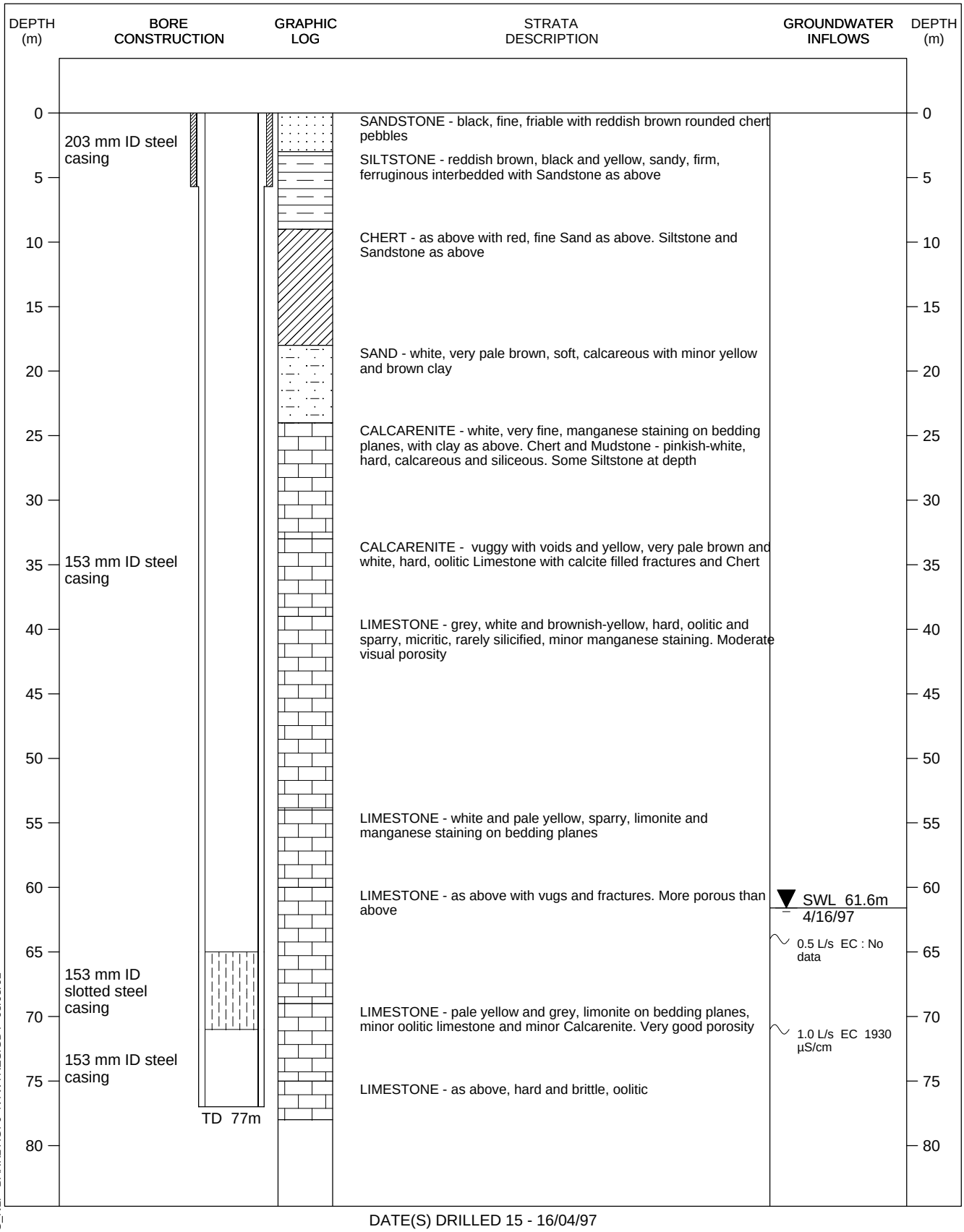
DATE(S) DRILLED 14 - 15 /04/97

BARKLY/GULF REGION RN16837

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



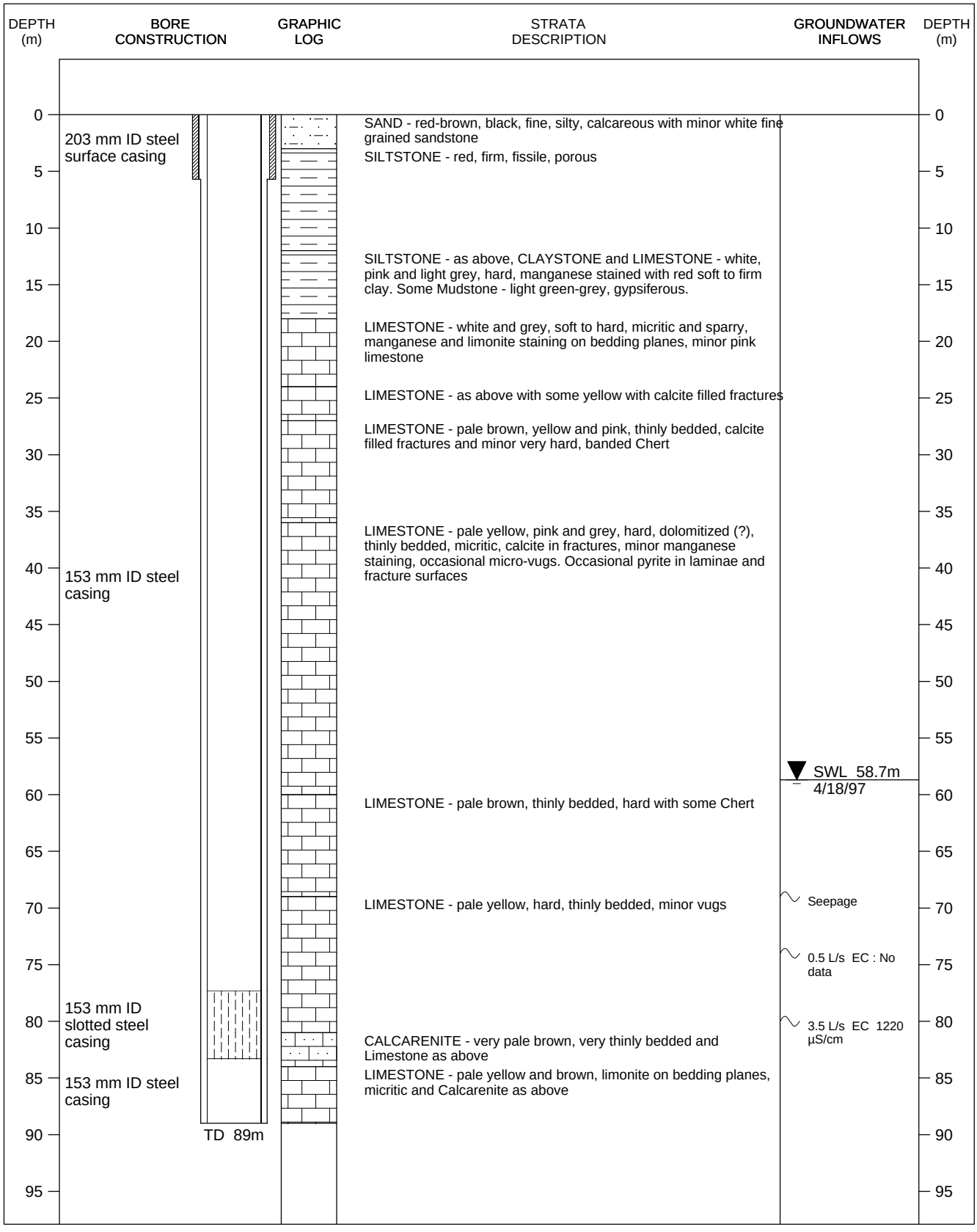
DATE(S) DRILLED 15 - 16/04/97

BARKLY/GULF REGION RN16838

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



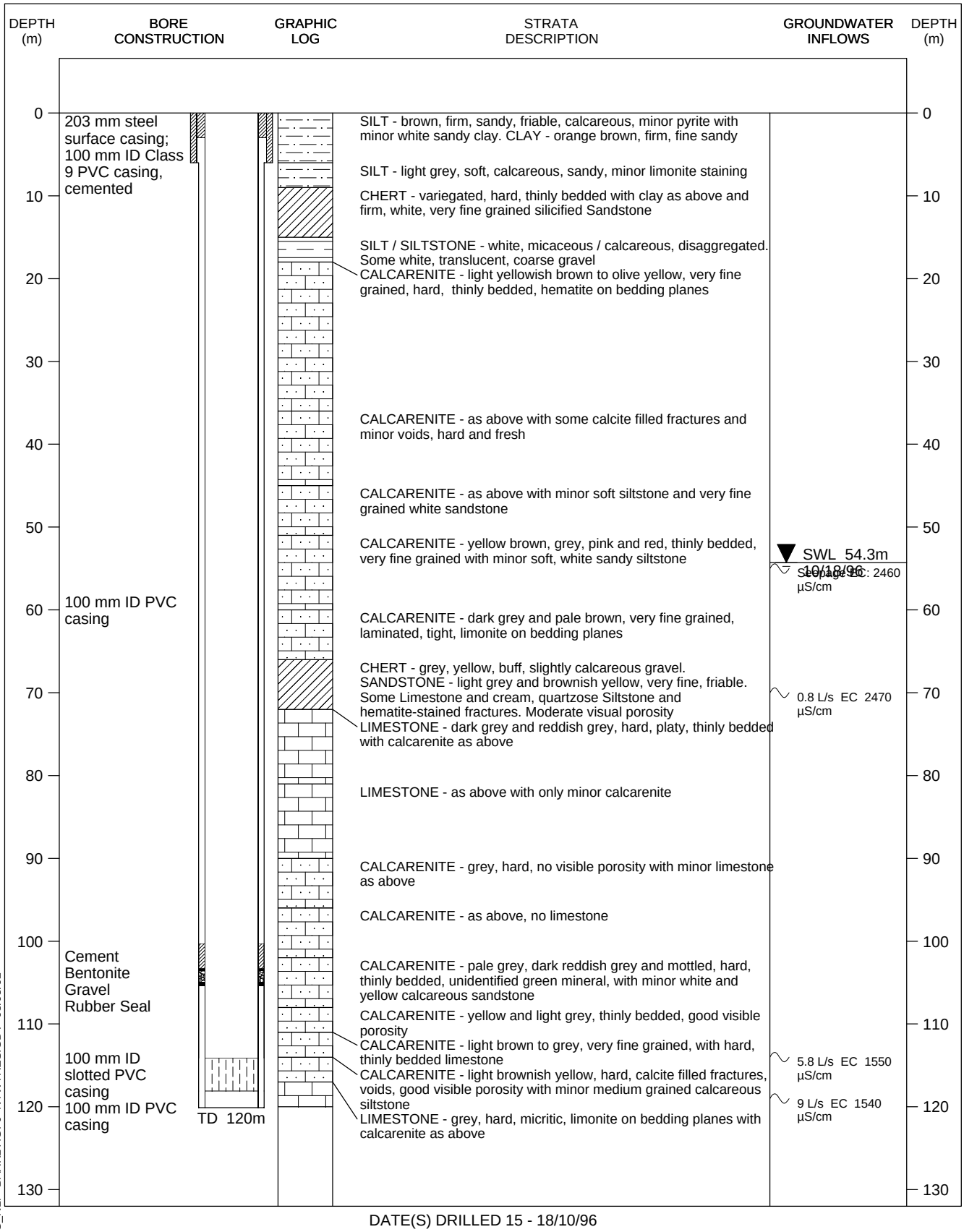
DATE(S) DRILLED 17 - 18/04/97

BARKLY/GULF REGION RN16839

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



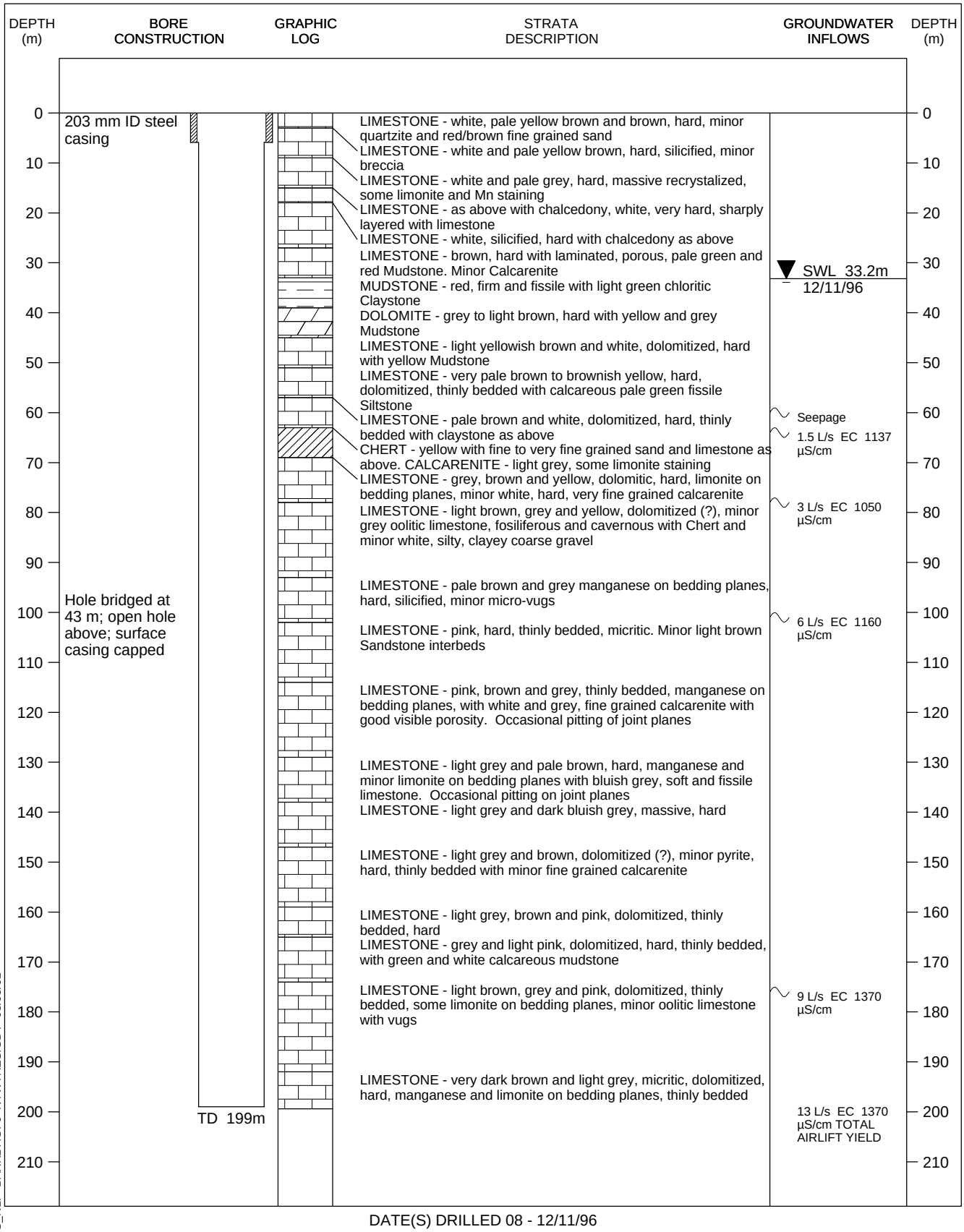
DATE(S) DRILLED 15 - 18/10/96

BARKLY/GULF REGION RN16886

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



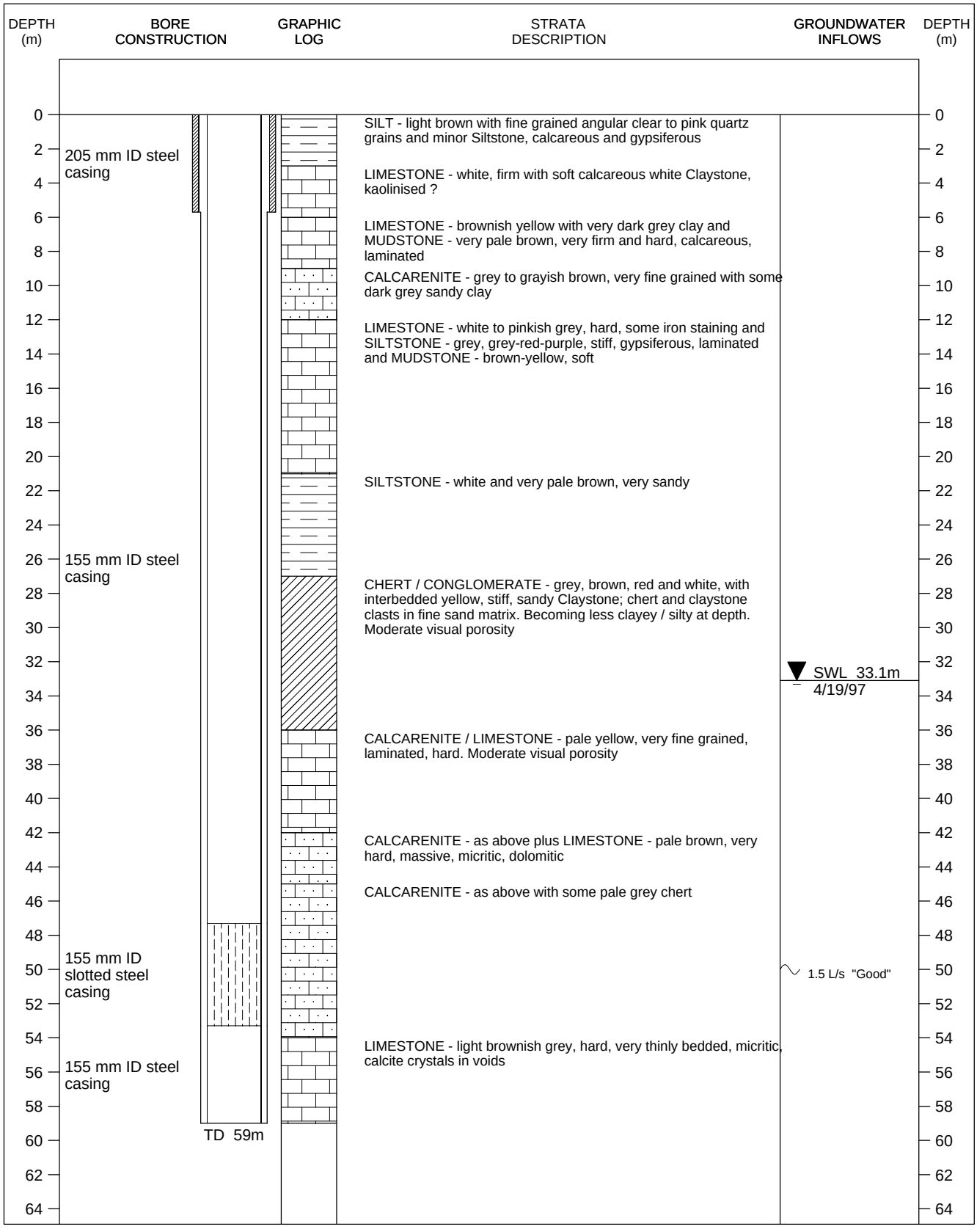
DATE(S) DRILLED 08 - 12/11/96

BARKLY/GULF REGION RN16887

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



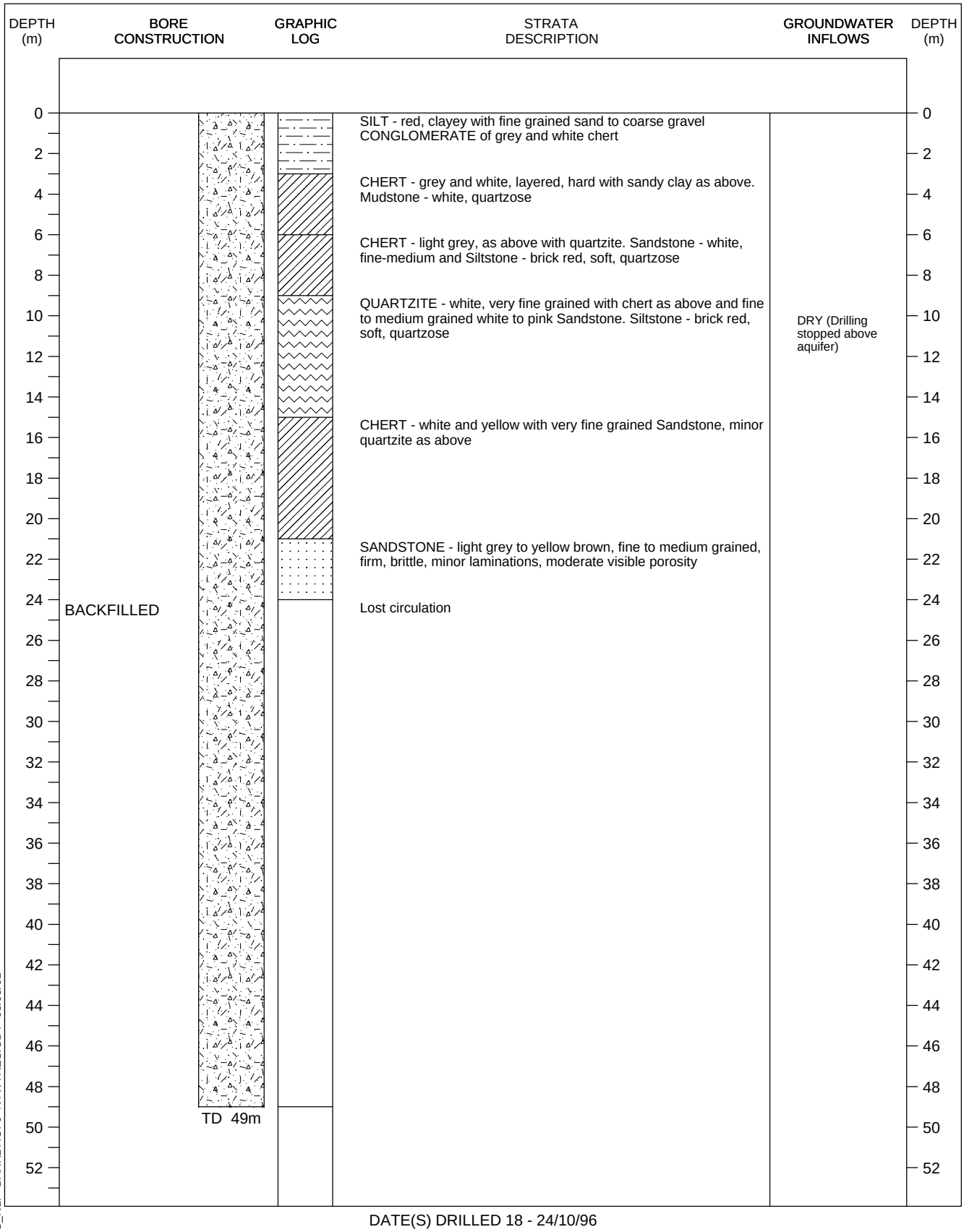
DATE(S) DRILLED 18 - 19/04/97

BARKLY/GULF REGION RN30330

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



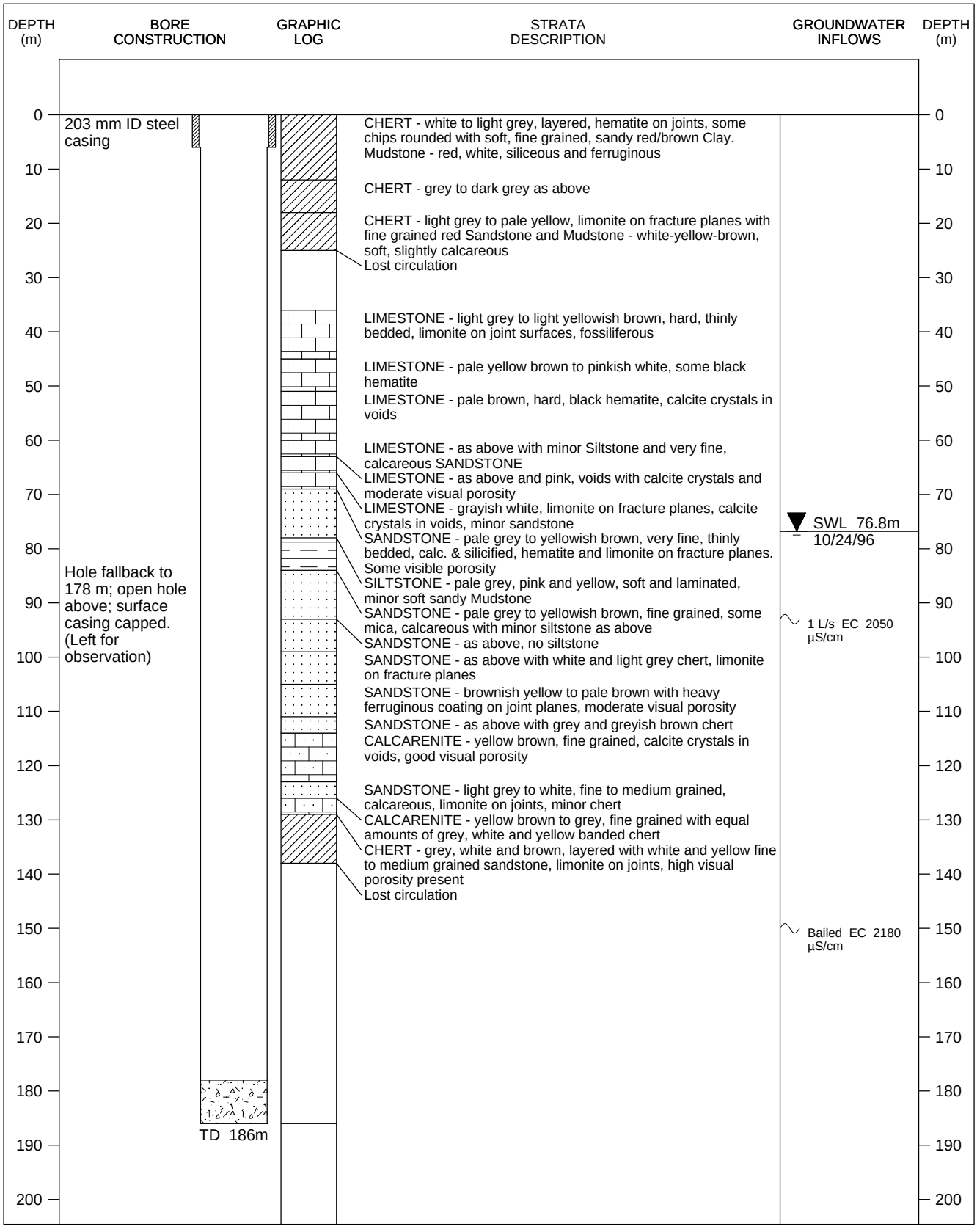
DATE(S) DRILLED 18 - 24/10/96

BARKLY/GULF REGION RN30849

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



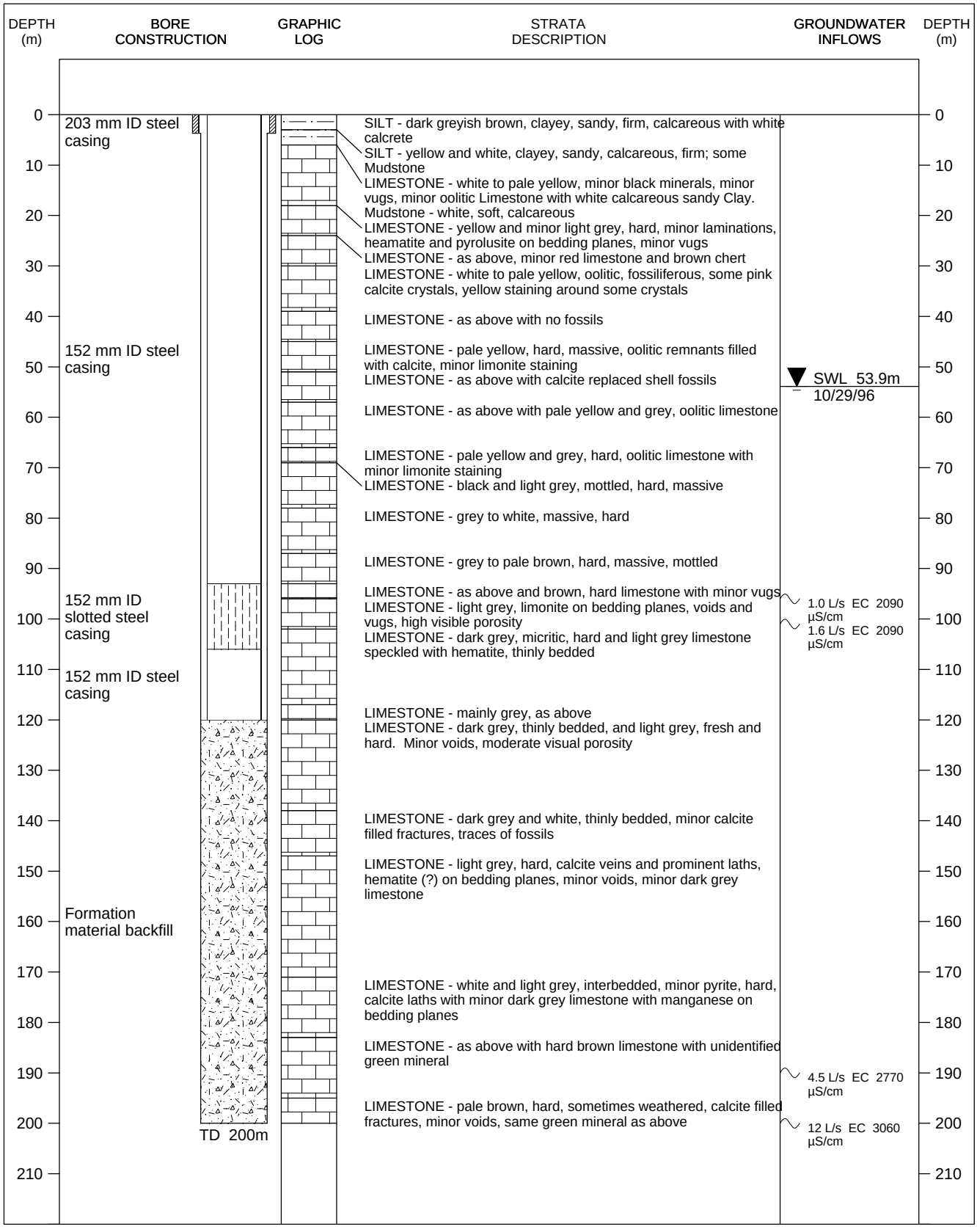
DATE(S) DRILLED 21 - 24/10/96

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

BARKLY/GULF REGION RN30850

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



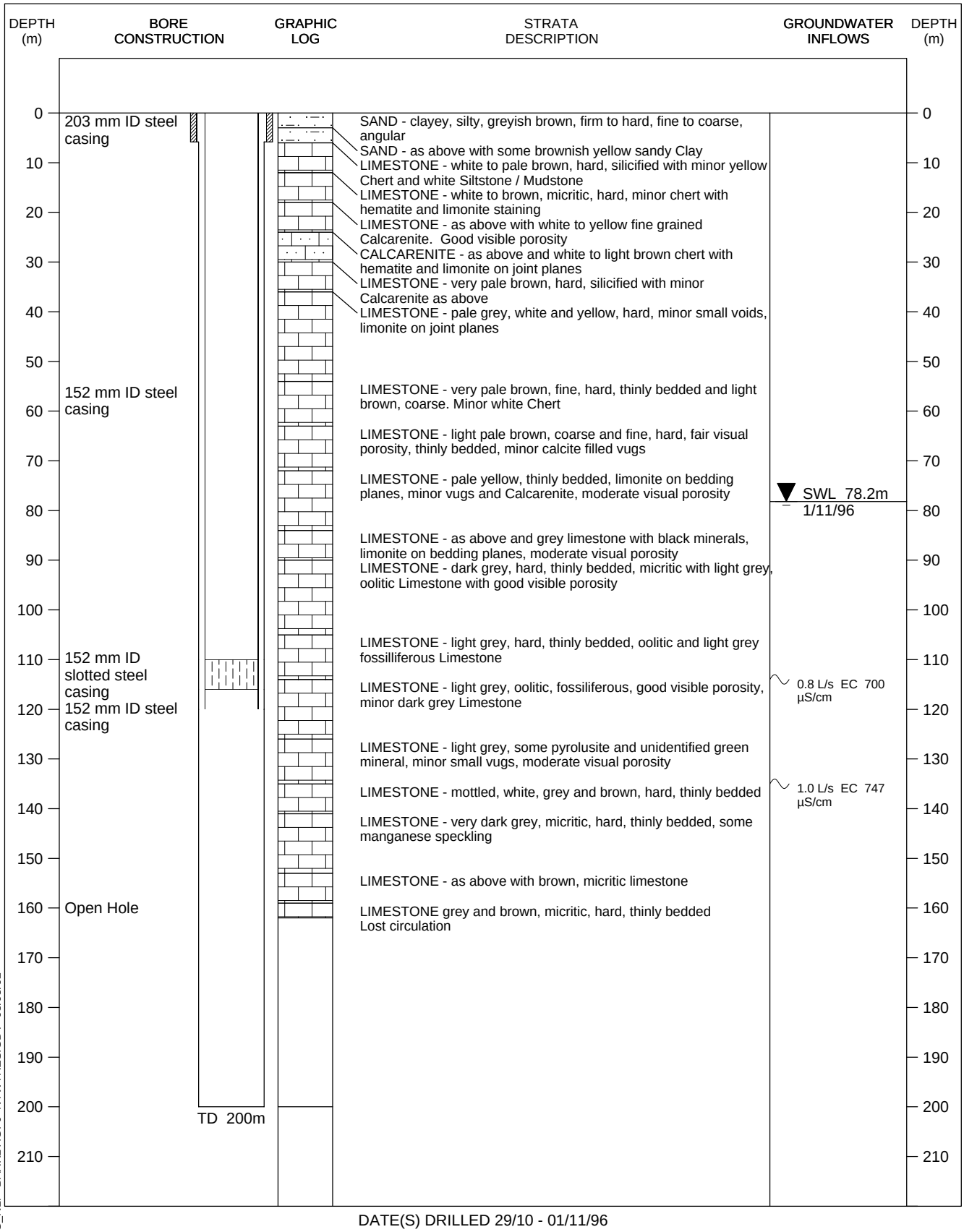
DATE(S) DRILLED 24 - 29/10/96

BARKLY/GULF REGION RN30851

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



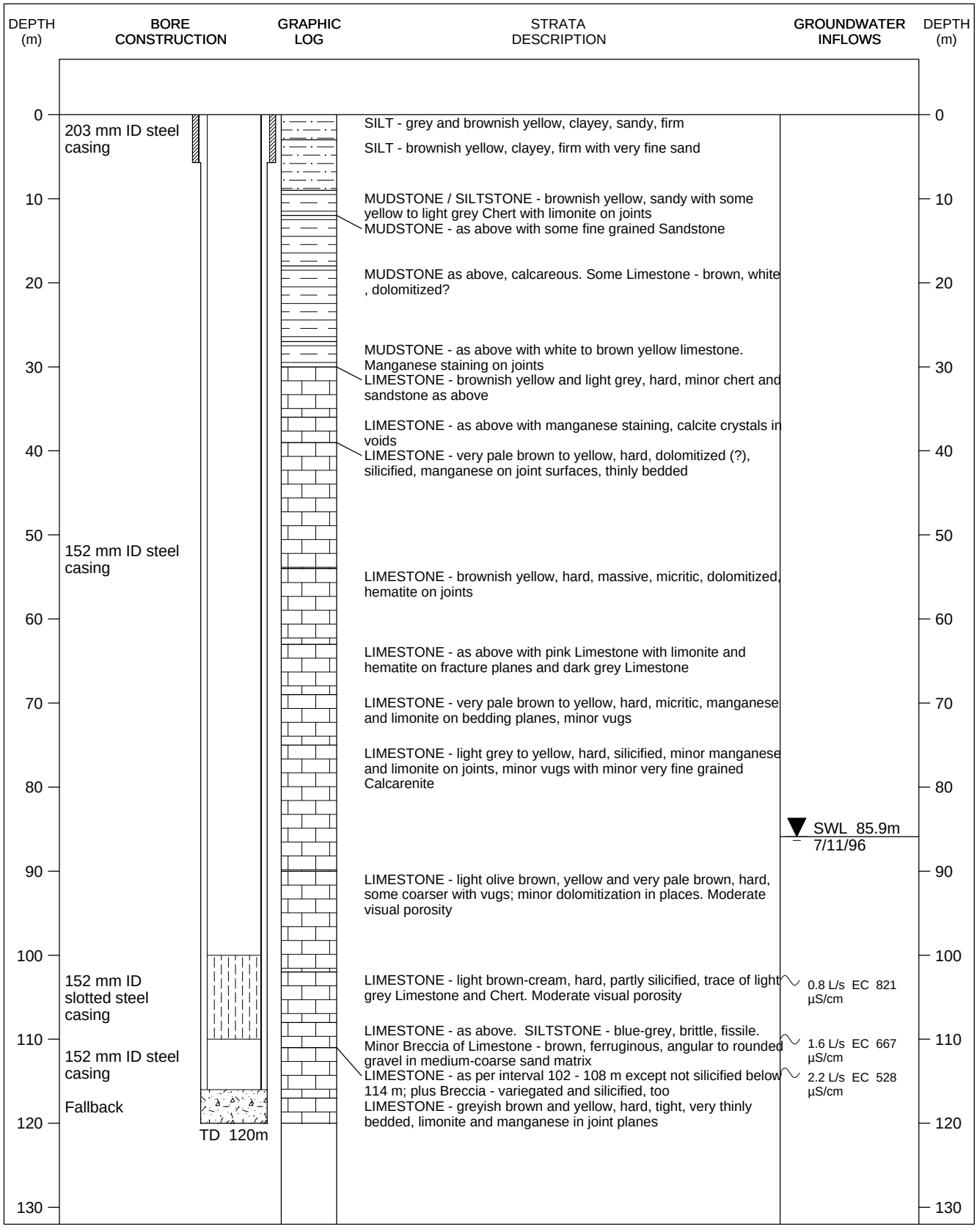
DATE(S) DRILLED 29/10 - 01/11/96

BARKLY/GULF REGION RN30852

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



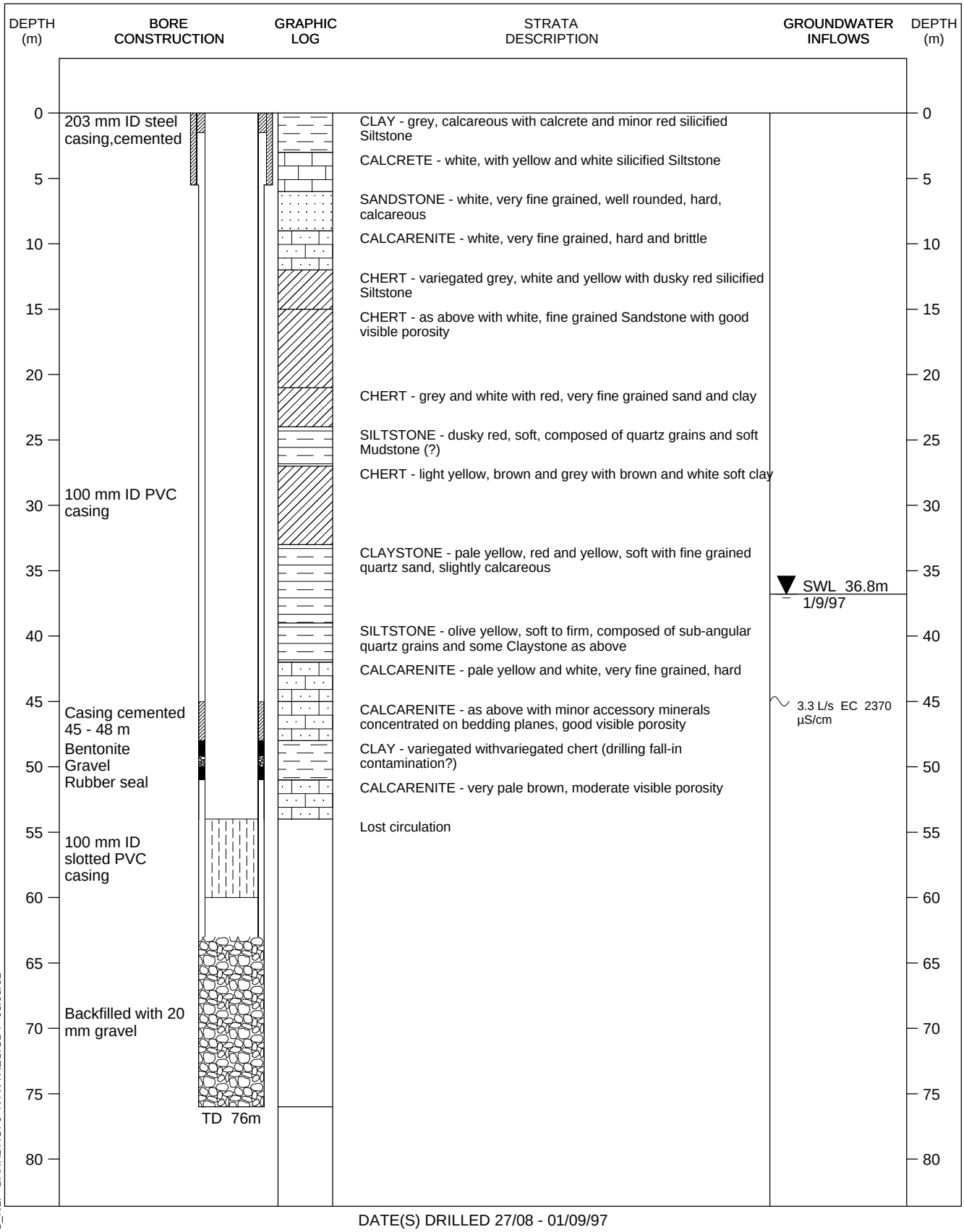
DATE(S) DRILLED 02 - 07/11/96

BARKLY/GULF REGION RN30853

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



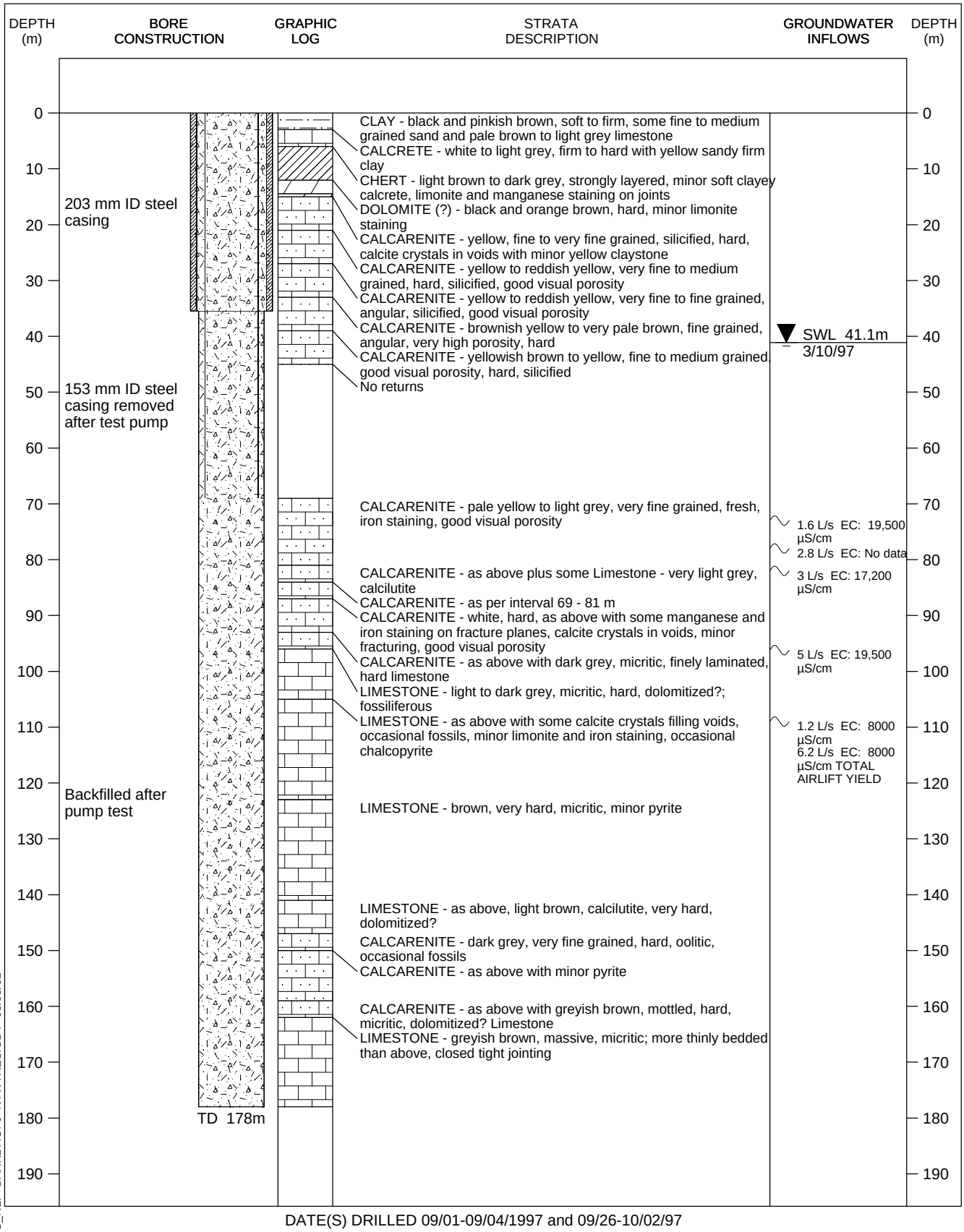
DATE(S) DRILLED 27/08 - 01/09/97

BARKLY/GULF REGION RN31193

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



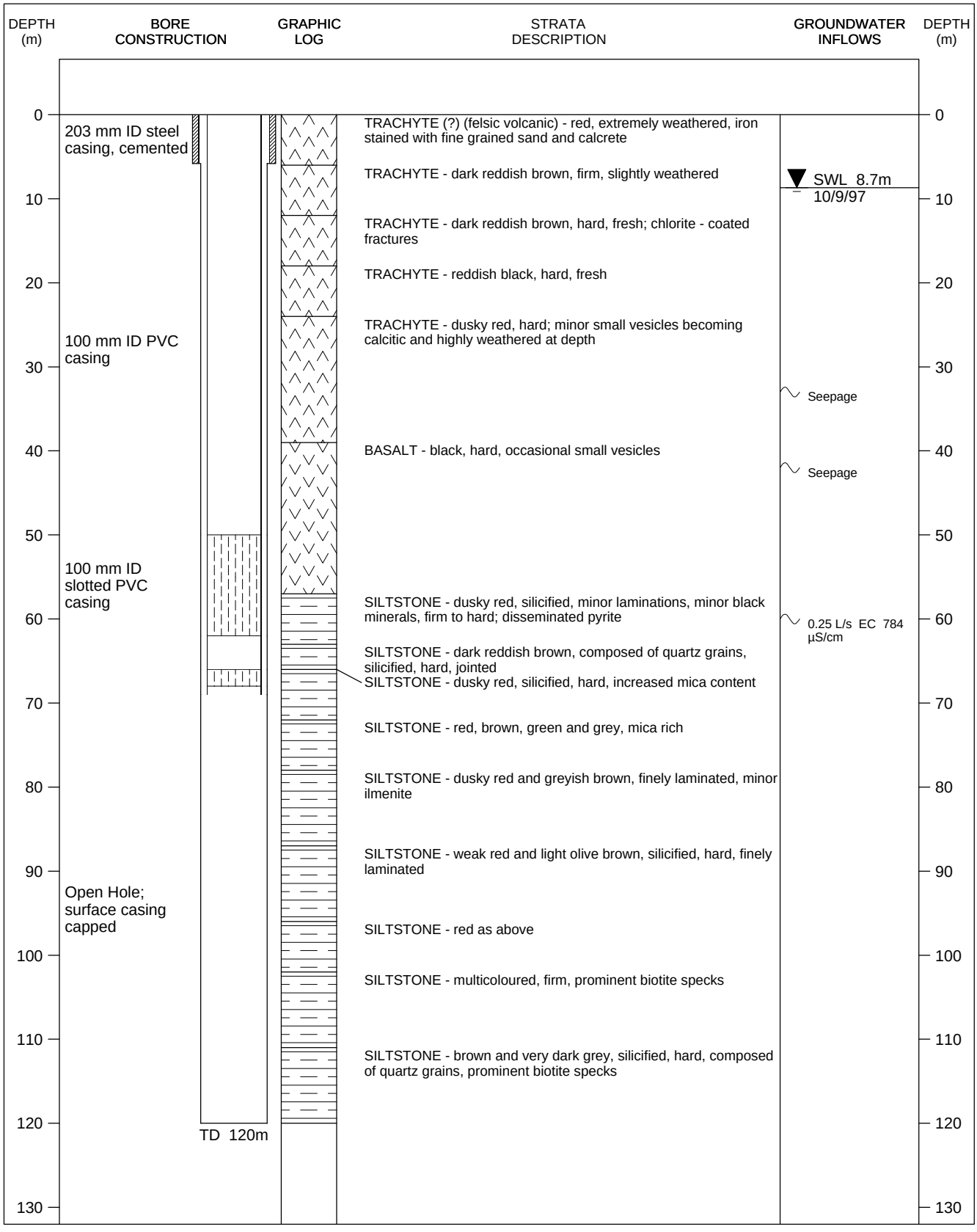
DATE(S) DRILLED 09/01-09/04/1997 and 09/26-10/02/97

BARKLY/GULF REGION RN31194

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



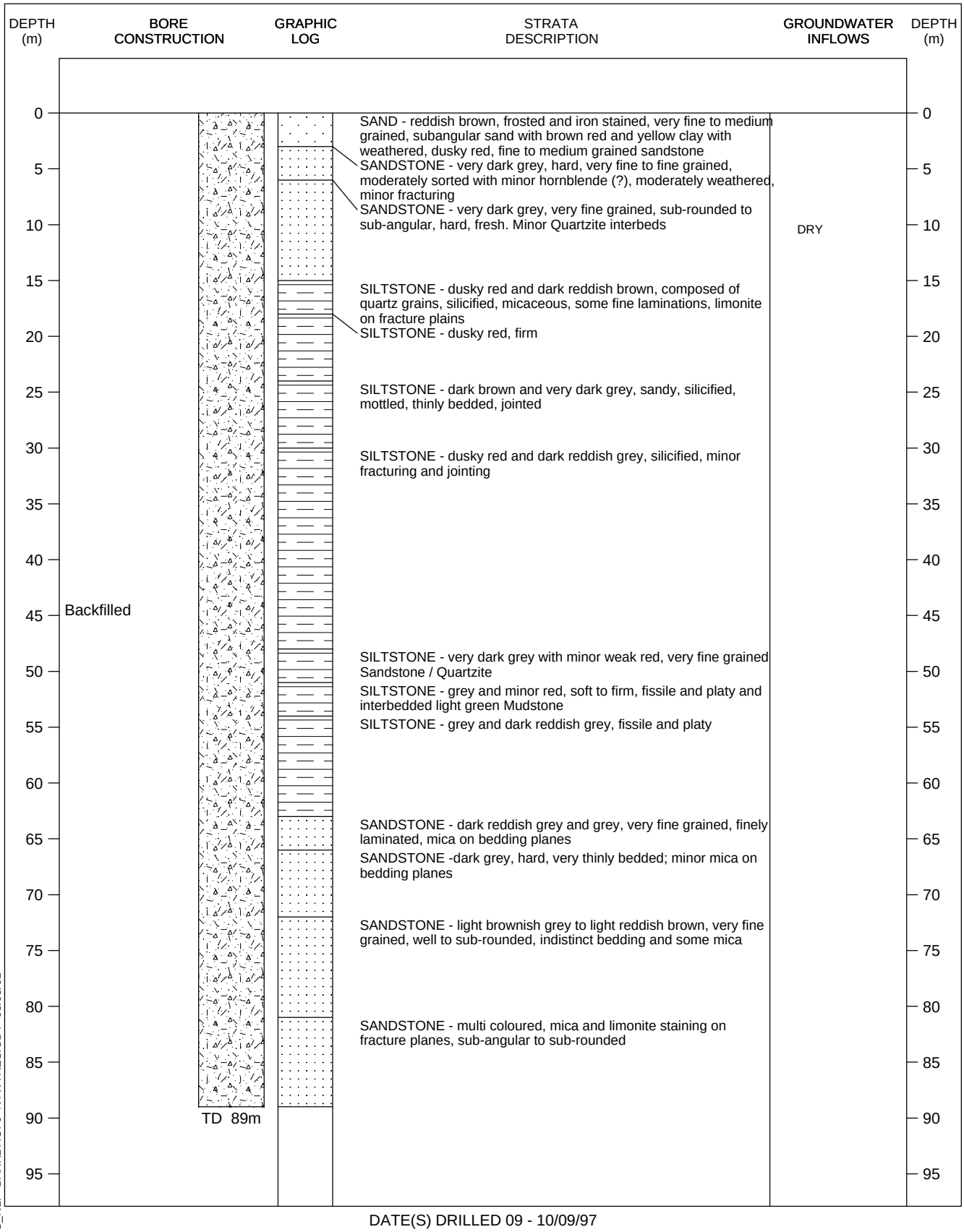
DATE(S) DRILLED 05 - 10/09/97

BARKLY/GULF REGION RN31195

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



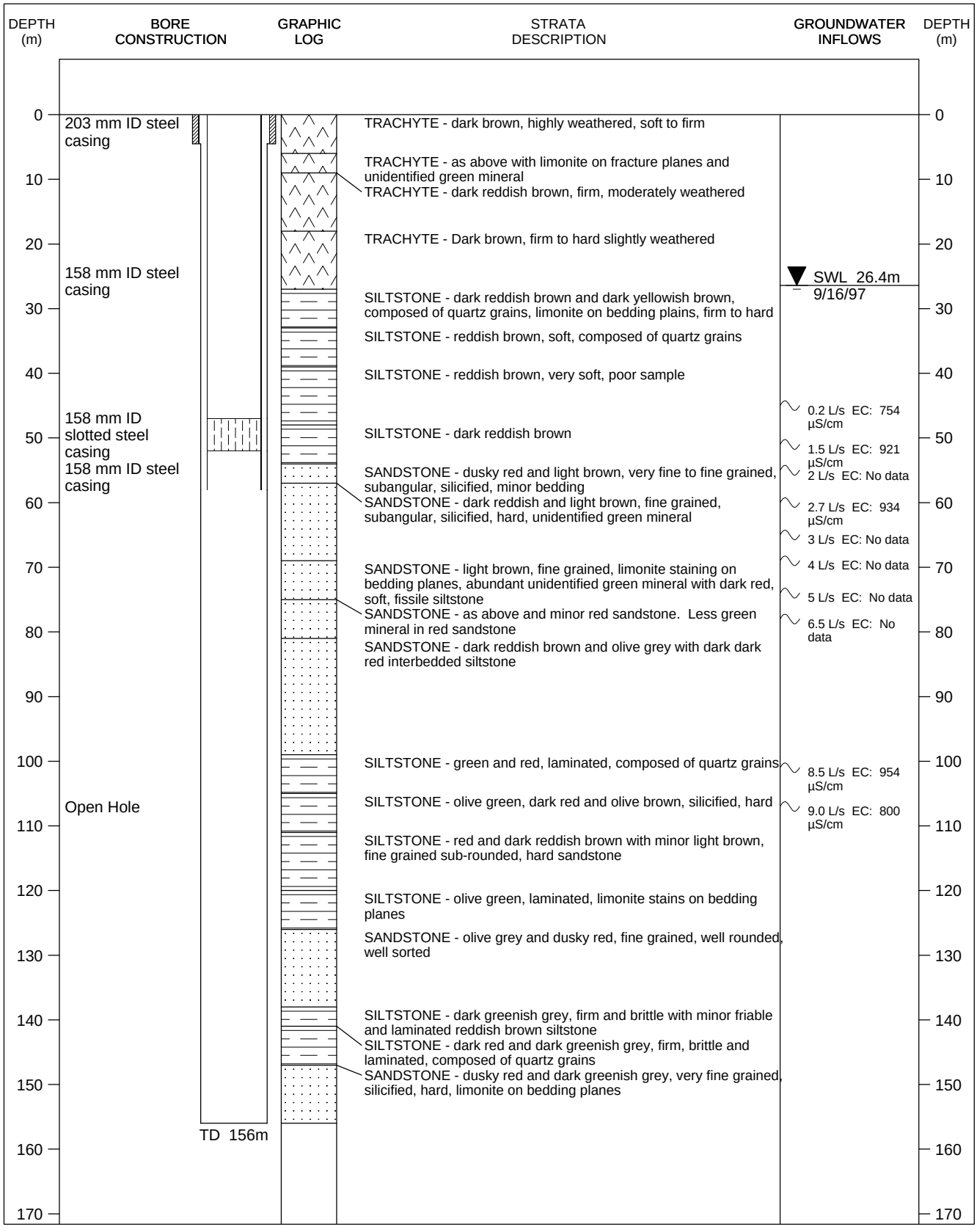
DATE(S) DRILLED 09 - 10/09/97

BARKLY/GULF REGION RN31196

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



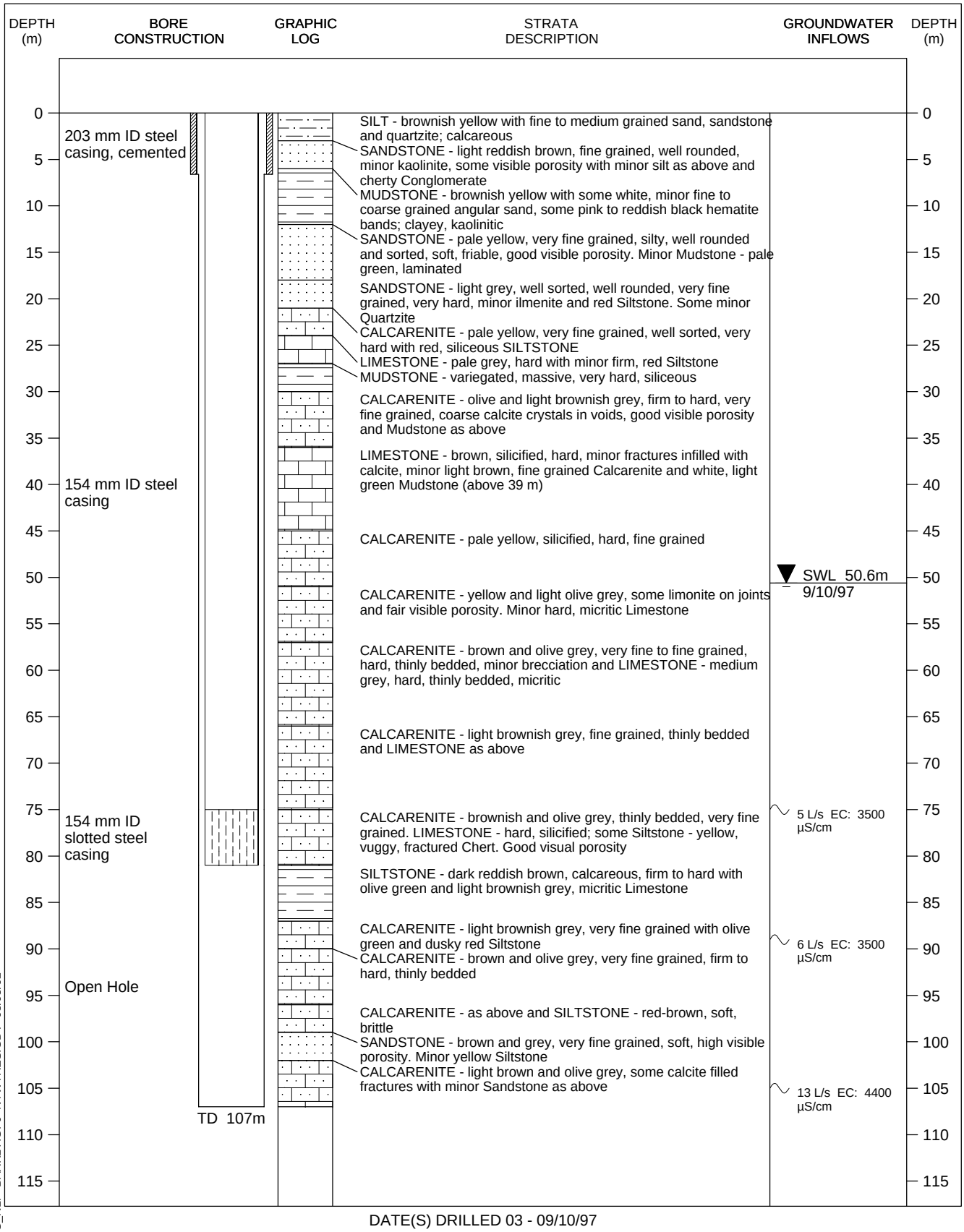
DATE(S) DRILLED 11 - 16/09/97

BARKLY/GULF REGION RN31197

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

NATIONAL LANDCARE PROGRAM

NATURAL RESOURCES
COMPOSITE LOG OF BORE



DATE(S) DRILLED 03 - 09/10/97

BARKLY/GULF REGION

RN31198

COMP_LOG_NLP BARKLY.GPJ NTWTRES.GDT 08/03/02

GEOLOGIST'S LOG – RN16886, SOUDAN HOMESTEAD

0-3 m SILTSTONE -calcareous; brown, firm to soft, friable, cracked, greasy lustre
3-6 m SILTSTONE -As above. Lighter brown to white ; with patches of mottled orange/brown clay; hard. Quartz fine sand; matrix supported; pyrite specks.

6-9 m SILTSTONE - calcareous; off- white; soft, EW; conchoidal fracturing & disaggregates. Some silt coated limonite-stained chert.
9-12 m SILTSTONE - As above and CHERT; variegated pinkish white/ black, yellow, red; and siltstone/ sandstone; white, *silicified*
12-15 m CHERT - and SILTSTONE; As Above *Bedded contact chert with very fine sandstone*
15-18 m SILT - off-white - yellow and SILTSTONE - white, micaceous/ calcareous; disaggregated. Some CHERT- white - translucent/ opaque, large pebbles.

18-21 m CALCAREOUS SANDSTONE - yellow/ brick red, MW to EW; *lateritised*; and siltstone - off-white - brown, silt - coated. *Relict bedding seen*.

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21 - 27 m CALCAREOUS SANDSTONE - light buff, fine-grained, SW, hard; slightly limonite stained; matrix supported angular, quartz and mica. *Some pinkish haematite/ chalcopyrite specks and laminae - darker bands - haematite - rich.*
27-36 m As above; no laminae..

36-42 m As above but fresh and hard.
42-45 m As above; light brown/ buff with rare chalcopyrite specks. *More porous*
45-48 m As above; but white, medium-grained and angular, with SILTSTONE/ mudstone. *Haematite veins in HW yellow calcareous sandstone and siltstone quite porous; calcareous sandstone very porous.*
48-51 m As above - 60% CALCAREOUS SANDSTONE v.f. sand to silt sized; 40% SILTSTONE variegated, plus minor sandstone; fine grained, v. Thin bands, haematitic. *Pyrolusite veining and speckling plus one radial crystal ingrowth of millerite (?) NiS. Quite porous.*

51-57 m As above - 70% CALCAREOUS SANDSTONE laminated by grain size and weathering off-white / pinkish rust. Mn veins, v. Thin and parallel to bedding planes. 30% SILTSTONE - white some yellow/ ochre EW soft; speckled with Mn. More calcareous than above.
57-60 m - As above cream - brown too.

60-63 m CALCAREOUS SANDSTONE -fine grained, light grey, calcareous; fresh-SW, laminated. Orange goethite staining inc. Veins and golden min. Specks. *No porosity*
63-66 m As above but steel grey, well-sorted angular grains; fresh-MW, fissile to v. Thinly-bedded, brittle and hard. Moderate primary porosity parallel to bedding planes.

66-69 m CHERT- pebbles, banded, slight grey/ yellow buff cream; slightly calcareous. Goethite specks and limonite stained. SANDSTONE - v.f. grained, light grey/ yellow banded, HW, friable. Some limestone fragments and micro-nodular goethite / quartz rich cream siltstone all in cream brown, quartzose, silty, friable matrix. Some dolomitisation. Haematite fracture plane observed. *Quite porous; primary porosity along bedding planes.*
69-72 m As above. Contact of chert with sandstone observed. No dolomitisation. *Fracture zone at 72 m*

72-75 m 50% CALCAREOUS SANDSTONE - fined grained, medium grey, fresh, fissile and flaggy bedded. *No porosity*. 50% LIMESTONE - buff; hairline fractured. Minor siltstone; white, yellow goethite stained v. Thin bands and sandstone; v. Fine grained; *latter is porous. Rare calcite bands and laterisation.*
75-78 m 70% CALCAREOUS SANDSTONE and 30% LIMESTONE - as above but less variegated plus rare chert pebbles; translucent brown coated by silt; light yellow, calcareous. Sandstone; light yellow, very fine grained, calcareous with rare tubercle moulds. *Negligible porosity*.
78-81 m As above but less limestone.

81-84 m As above but less silty, plus rare Sandstone; white & mauve, Calcareous sandstone has rare tiny cubic crystals of chalcopyrite (?).
84-87 m As above Limestone is cream yellow with conchoidal fracture system and rare dolomite.
90-96 m CALCAREOUS SANDSTONE - fine grained, medium grey, fresh, fissile and flaggy. *No porosity.* Some limestone; light grey, fresh; contact with calcareous sandstone observed.
96-102 m As above but without limestone.

102-108 m CALCAREOUS SANDSTONE - Highly calcareous, fine grained, fresh, flaggy, grey becoming variegated pinkish medium grey; v.f., white, orange-stained (*very porous*) and medium - coarse, light grey/ white. Rare sandstone; fine, yellow/ orange, HW, lateritised and v.f., buff (102-105 m). *Free calcite crystal growth and rare bottle green , glassy, unidentified mineral (form of calcite?). and golden arsenopyrite (?). Some silicification.*

108-111 m CALCAREOUS SANDSTONE - variegated, yellow/ light grey, SW, thinly bedded, flaggy; some pebble intraclasts (?); some dark grey/ black v.f. to fine; v. Calcareous (*very porous*). Calcareous sandstone, coarse, translucent/ white; chertified. Minor DOLOMITE; mauve brown/ translucent grey, banded.
111-114 m DOLOMITE - cream light grey, HW-SW, hard, brittle, micro-fractured and banded. Yellowish on thin bedding planes. *Mn flower-like crystalline specks and orange haematite/ goethite inclusions*.
CALCAREOUS SANDSTONE - v.f., mauve/ v. Light grey, SW, competent.
114-117 m CALCAREOUS SANDSTONE and SANDSTONE - yellow buff, fine -medium grained, well-sorted; with medium-grained, dark brown goethite inclusions , friable (v. Porous). Some angular fragments coarse sandstone with platy calcite and angular quartz in calcareous sandy matrix (*extremely porous*). Spicules of carbonaceous/ haematitic material. SILTSTONE - yellow, EW, fissile with conchoidal fractures. Rare rust, lateritic sandstone with tiny root tubule moulds. Rare cream slightly calcareous marl/ mudstone with Mn (?) speckling; forms white fissile caps to sandstones.
117-120 m EOH. LIMESTONE - medium grey, micritic with black carbonaceous inclusions.
CALCAREOUS SANDSTONE - fine, light yellow/ buff, v. Thinly-bedded and banded; some cherty, translucent with large rounded flat (parallel to bedding planes) pebbles; some pinkish weathered surfaces, others angular. Cream, limonitic medium sandstone in cherty calcite and fine, yellow, HW, limonitic calcareous sandstone. Rare root tubule mould (sea grass?) normal to bedding 1 cm long; limonite-stained.

DRILLER'S LOG – RN16886

0-1 m Hammer plus 10.75" button bit.
1-6.5 m 10" blade & reamer
6.52 m 8 5/8" casing
6.5-EOH Hammer plus 7 7/8" button bit.
0-0.3 m GRAVEL & CHERT
0.3-4.5 m CLAY; grey/black.
4.5-12.6 m CLAY; white/grey & CLAYSTONE.
12.6-19.6 m CLAY; light brown becoming dark brown with depth and CHERT
19.6-42.6 m SANDSTONE; light brown/grey; fractured 36-36.6 m.
42.6-54.3 m SANDSTONE; light brown to brown/grey; fractured & weathered; fractured 43.6-44.2 m; some "quartzite" bands.
54.3-54.7 m "QUARTZITE"; hard - SEEPAGE
54.7-66.7 m SANDSTONE; light brown & grey with band of light/dark grey SANDSTONE; fractured & weathered; cavities 63.6-66.7 m.
66.7-72.8 m As above plus CHERT; bands, grey; fracture zone 69.6-71.7 m. SUPPLY 0.8 L/S, EC 2470, pH 8.4, SAMPLE NO. QT48, SWL = 38.96 BTOC (measured next morning). SWL = 38.44 m BGL at 73 m BGL (Wed AM).
72.8-90.7 m SANDSTONE; light brown & grey; fractured plus CHERT bands.
90.7-96.7 m SANDSTONE; light & dark grey; fractured.
96.7-102.7 m As above plus SANDSTONE; light brown & SILTSTONE & CHERT bands; grey.
102.7-108.7 m As above with "QUARTZITE & GRANITE"; fresh. SAMPLE NO. QU23.
108.7-114.7 m SANDSTONE; light brown/brown & light grey/grey; fractured; fracture zone 114.2-114.7 m. SUPPLY INCREASE 6 L/S, EC = 1553, pH 8.2, SAMPLE NO. QK71.
(114.2-116 m fracture zone & at 117 m & 119 m; drill string sticking).

114.7-120.7 m SANDSTONE; as above; weathered; hard below 117 m.
EOH SUPPLY = 9 L/S, EC = 1542, pH 8.12, SAMPLE NOS. QU96 & QT38

CONSTRUCTION DETAILS – RN 16886

100 mm NB Class 9 PVC pipe.
2 m blank - sump at EOH.
4 m slotted
114 m blank plus 0.21 m with cap AGL.
top of rubber packer at 104.9 m BGL.
TD PVC = 120.1 m BGL; slotted 114.1 - 118.1 m BGL.
SWL = 56.50 m BGL on 17/10/96 after casing.
40 L gravel into annulus back to 103.4 m.
5 L bentonite pellets into annulus back to 103.2 m.
Run ¾" GWP in annulus to 101 m & tremie OP cement (2 bags in 48 L water); 100.2 - 103.2 m.
Cement annulus GL - 3 m BGL between 8" MS & 100 mm PVC casing.
Cement pad placed around top of bore.
SWL = 54.31 m BGL on 18/10/96 after cementing.
Airlift yield = 5 L/s (through ¾" GWP from 106 m BGL for 45 mins.); EC = 1590, pH 8.06, temperature = 31 C SAMPLES QT37 & QU42.
LE NO. QT48, SWL = 38.96 BTOC (measured next morning).
72.8-90.7 m

GEOLOGIST'S LOG – RN 16887, AUSTRAL DOWNS STATION

0-.3 m SAND, f., red.
.3- 3 m LIMESTONE - c., mottled, off-white/cream, red/brown, hard; re-crystallised with colourless calcite veinlets. Gravel -large, sub-rounded, slightly quartzitic, red/ yellow impure limestone fragments. Sand - m.-c., sub- to angular, quartzitic in calcitic red ferruginous silt matrix; Mn inclusions. A little red, clayey silt (EW limestone).

3- 6 m LIMESTONE - dolomitic(?), off-white/ cream, SW-fresh, v. hard; dolomite rhombs(?); calcite partially infilling micro-vugs. Some siliceous limestone breccia.
6- 9 m LIMESTONE - dolomitic, c., off-white/ fawn, fresh, v. hard; v. thinly bedded, re-crystallized; silicified; some Mn speckling; low porosity. Rare rounded granules of SW, yellow limestone covered with Mn dendrites (snow-flake-like patterns) plus white calcite oolith-like grains in colourless calcite matrix. At 7m band of light grey, soft siltstone, and at 7.7 m, 1 m thick band of quartz.
9- 15 m LIMESTONE - dolomitised, fawn/ light brown, fresh, v. hard, massive, re-crystallized; calcite veinlets and minor Mn staining; rarely partially silicified; low porosity.

15- 18 m 80% LIMESTONE - partially silicified, white/ colourless, re-crystallized; limonite stained micro-vugs; moderate secondary porosity. 20% CHALCEDONY - off-white/ translucent, extremely hard; conchoidal "bottle" fracturing; (re-crystallized mudstone?). Sharp contacts observed between silica and siliceous limestone. Fault breccia - yellow/ orange stained, pitted surface with fresh silicified limestone below.

18- 21 m As above with micro-vugs; plus Mudstone - siliceous, fawn, v. hard; goethite fragments. Rare mudstone - calcareous, brick red/ brown, HW, brittle; v. finely laminated; slakes and swells.
21- 26 m As above. Bit jarring.

26- 30 m MICRITE - dolomitic, cream, fresh, v. hard. Mudstone - dolomitised, hard, conchoidal & jagged fractures; v. porous. At 26 m DOLOMITE - buff, v. hard; much less siliceous. Some thin bands of orange/ brown siltstone.
30- 33 m LIMESTONE - silicified, light brown/ fawn/ white, fresh, v. hard; variable low to moderate porosity. MUDSTONE - pale green. Rare white calcareous sandstone(?).

33- 36 MUDSTONE - chloritic, pale lime green, orange limonite mottling, SW-fresh, brittle. Rare mudstone - brick red with white haloes; conchoidally fractured; slightly calcareous. Mudstone - calcareous, fawn/ light brown, fresh. Silcified limestone (or mudstone?); low porosity.
36- 39 m As above; but HW mudstone- yellow/ orange, clayey, silty, sticky-firm; fissile; greasy lustre with c.-m., angular sand embedded. Bands of LIMESTONE - siliceous; fractured and vuggy. SILTSTONE - calcareous, cream, fresh, quite hard; some yellow SW joint surfaces. All interbedded?
39- 42 m GRAVEL - dolomitic, c., sub-angular, variegated, mottled white/ cream/ light brown; white, calcareous silt coated. SILTSTONE / MUDSTONE - yellow/ off-white, HW, stiff and sticky. Fault gouge?
42- 45 m As above; siltstone is slightly more plastic grading into DOLOMITE - light brown, v. hard.
45- 48 m LIMESTONE - dolomitic, variegated, light brownish yellow/ white, v. hard; slightly siliceous. At 48 m Quartzite - off-white, becoming brown with white calcareous silt coated fracture surfaces.
48- 51 m SILTSTONE - calcareous/ quartzose, clayey, yellow/ off-white, EW, stiff. GRAVEL - f., angular, calcite and quartz; earthy/ greasy lustre and sub-angular, translucent/ v. light brown, silicified Dolomite; v. hard. Rare rounded gravel of colourless quartzite; v. hard.
51- 54 m SILTSTONE - dolomitic/ calcareous, patchy pale green/ buff brown, SW-HW, soft, fissile; no porosity. DOLOMITIC LIMESTONE - white, hard, vuggy, silicified limestone and chert; v. porous.

54- 57 m As above, plus DOLOMITE - brown, fawn, light grey, fresh, hard; thinly bedded. All interbedded?
57- 60 m DOLOMITE - slightly silicified, green-buff, fresh, hard, v. thinly bedded; some re-crystallized fawn colour. Off-white, clayey siltstone and silty clay; EW enclosed by angular, c. sand - f. gravel of chert and haematite.
60- 63 m As above, except gravel is less angular and clay is firm and sticky. MUDSTONE - light grey interbedded with m., quartz SANDSTONE and CHALCEDONY ("Zebra stone") at depth. Seepage at 62

m; 1.5 L/s at 63.8 m. EC 1139 mg/L. Water is coming from a band of vuggy Chert - translucent/ white/ orange stained; fossiliferous?
63- 66 m SAND - silty, f.-m., variegated, yellow, white, orange; calcareous, EW; contains some v.f. quartz and small pebbles of angular quartz and green limestone; some silicified to chert. Silica/ calcite contact seen in a limestone fragment. MUDSTONE - slightly calcareous, v. pale green, fresh,; conchoidal fracture; earthy/ greasy lustre; slakes. Silt - white/ yellow, ochre, EW with angular calcitic sand. CALCAREOUS SANDSTONE - f., light grey; some limonite staining
66- 69 m LIMESTONE - dolomitic, c., mottled, cream, light brown, fawn, fresh, hard; re-crystallized; moderately porous. CALCAREOUS SANDSTONE - pink/ yellow limonite stained, ghost laminae.

69- 75m As above; grading into MICRITE - dolomitic, light grey; v. hard. DOLOMITE - dark grey; thinly bedded and interbedded with the micrite; SW sandy and rare red haematite veins and Mn stains on bedding planes. Some thin interbeds of Calcareous sandstone - white, hard and rounded f. sand quartz grains in a calcite matrix. Sandstone - f., pink, fresh, hard. At 72.5 m band of silicified, shelly, white/ translucent Limestone. No porosity.

75- 78 m. As above, plus CHERT - “ribbon stone”, rounded, ellipsoidal large pebbles; fossiliferous (replaced by silica). Rare white, silty Clay. Cavernous formation. 2.3 L/s; EC 1050.
78- 81 m LIMESTONE - micritic and dolomitic, medium grey, fresh, hard; rare haematite speckling; micro-fold observed in a fragment. Rare fawn chert. Hole at 39 m TD SWL 34 m BTOC.
81- 84 m DOLOMITIC LIMESTONE - cream, v. light brown, fresh, hard with light-medium grey interbeds; some Mn staining on bedding. No porosity.
84- 90 m As above; variegated, light-medium brown, fresh, hard; v. thinly bedded. Fluted bedding plane observed in light grey limestone with Mn speckling on surface coating of v.f. calcite. Rare maroon haematite stained bedding and joint planes; v. hard slow drilling; no porosity (84- 99 m).
90- 93 m LIMESTONE - light -medium brown, v. pale green tinge; rare partial silicification.
93- 96 m LIMESTONE - micritic, variegated, light brown predominant, fresh , hard; v. thinly bedded; rarely, replaced by silica; colourless, v. finely banded wavy parting lines; no porosity. Rare Mn wavy line between re-crystallized carbonate and calcite outlines the formers areas’.; micro-vuggy surfaces; slightly porous.
96- 99 m As above inc. rare partially calcite infilled micro-vugs in white re-crystallized limestone. Rare occurrences of 100% silicified limestone.
99- 102 m As per interval 93- 96 m, but alternating limestone beds of medium grey with v. pale brown variety. Rare bands of m., light golden brown Sandstone.
102- 105 m As above, but only the micritic limestone.
105- 108 m As per interval 102- 105 m except the limestone is mainly light grey.
108- 114 m LIMESTONE - micritic, white /light salmon pink, fresh, hard, v. thinly bedded; rare goethite specks
114- 126 m CALCAREOUS SANDSTONE - bluish steel grey, fresh, hard; v. thinly bedded. LIMESTONE - dolomitic, light brown, SW with brown veinlets of goethite(?) along laminae giving mottled appearance and MICRITE - v. light grey; becoming more jointed below 117 m; some joint surfaces pitted and red haematite stained. Back into un-fracture dolomitic limestone below 124 m. At 121 m TD, SWL 34.3 m BTOC. V. hard, slow drilling.
126- 129 m CALCAREOUS SANDSTONE(?) - medium grey, fresh, hard, brittle; fissile. LIMESTONE - dolomitic, white, light grey, fresh, hard; v. thinly bedded. Drilling v. hard, slow until 130 m.
129- 132 m LIMESTONE - dolomitic, light buff. Calcareous sandstone - f. gravel matrix with rounded, large gravel clasts, white, slightly yellowish, quite soft but competent; chalky; speckled with black carbonaceous (or ilmenite?) material.
132- 138 m LIMESTONE - dolomitic, light grey, fresh, hard; dendritic Mn stained bedding planes. Minor light brown/ white interbeds of Micrite. LIMESTONE - medium to bluish steel grey, soft; fissile, grades into calcareous SILTSTONE; slakes. No porosity.
138- 147 m LIMESTONE - medium grey; some blue steel grey. LIMESTONE - light brown/ pink; less massive. LIMESTONE - v.c., white/ light brown; re-crystallized with calcite ingrowths; rare pitting on joint planes. No porosity.
147- 159 m LIMESTONE - dolomitised, colourless; black, red haematite speckling on joint and bedding planes. Ferruginous laminae lining v. thin bedding planes. LIMESTONE - m., speckled, light/ medium grey. Rare Dolomite - light grey/ white/ brick red laminae, SW; v. finely laminated; quartz and chert inclusions - detrital as laminae are draped around them. No porosity.

159- 165 m DOLOMITE - variegated, light grey/ brown with Limestone interbeds, fresh-SW. Siltstone - calcareous, white.

----------162 m ----------

165- 168 m As above, plus MUDSTONE - slightly calcareous, v. pale green, SW, firm; conchoidal fractures with yellow limonite inclusions and black Mn speckling at 168 m.

168- 180 m DOLOMITIC LIMESTONE - v. light brown/ cream (lighter variety than above), fresh, v. hard; v. thinly bedded; re-crystallized in parts. Rare Limestone - c., white, SW; re-crystallized; micro-vuggy; some mauve/ pink, thin bands and rusty yellow goethite speckles in calcite partially-infilled micro-vugs and limonite stained joint planes; good porosity.

180- 192 m As above with DOLOMITIC LIMESTONE - 50% light buff/ cream, becoming 50% light pink, salmon with depth, fresh, v. hard; v. thinly bedded; plus rare ferruginous veinlets. Occasional Mudstone clasts - slightly calcareous, silty, off-white, SW. Low porosity.

192- 200 m EOH 90% DOLOMITE - cream/ light buff, fresh, hard; v. thinly bedded; 10% MICRITE - dolomitic, light pink. At 193.5 m SWL 33.75 m BTOC; 9 L/s; EC 1367; pH 8.24.

GEOLOGIST'S LOG – RN 30849, AVON DOWNS STATION

0-3 m CONGLOMERATE - lateritised, rust red; sub- to angular, v. large pebbles of chert in red, clayey silt matrix.

3-6 m CHERT - grey, brown, opaque; MUDSTONE - quartzose, white with black pyrolusite staining in rust-red silt. Some quartzite and v.f. sandstone. Rare quartzite fragments.

6-9 m CHERT - as above; QUARTZITE - cherty, light grey/ translucent; SANDSTONE - f.-m., white, pink-stained, angular to sub- rounded and well-sorted; porous; SILTSTONE - quartzose, brick red, HW, soft; some coating the chert; some sandstone - m., quartzose, white/ colourless, angular grains; porous.

9-12 m As above minus the m. sandstone.
12-15 m As above; banded by grain size.

15-18 m CHERT - grey, brown/ opaque, blue grey/ translucent, laminated; SANDSTONE - siliceous, f.-v.f., variegated, well-sorted, hard; SANDSTONE - quartzose, f., yellow, sub-rounded and well-sorted; grain-supported; SANDSTONE - quartzose, f., black/ pink, v. hard, ferruginous; moderately porous. QUARTZITE - in off-white, disaggregated silt matrix. Quartzite bedding contact observed with white v. thinly bedded siltstone grading into f., yellow sandstone. Sandstone - quartzose, v.f., yellow/ white, HW, earthy and Siltstone - orange, soft.
18- 21 m As above minus the minor sandstone and siltstone.

21- 24 m 30% CHERT - As above; 70% SANDSTONE (the first two-named above plus ferruginous sandstone - limonitic, haematitic - "pea-shot ironstone"; (moderately porous) and "banded ironstone"; slightly micaceous(?). Some m. sandstone with tiny perfect quartz crystals. All in a silty matrix.
24- 48.8 m EOH. No samples. *Lost circulation and no returns*.

GEOLOGIST'S LOG – RN 30850, AVON DOWNS STATION

0-3 m CLAY - red-brown; soft and CHERT - pebble to boulder size, rounded, variegated, concentrically banded translucent/ grey/ red. Limonite and haematite stained.
3-6 m As above plus mudstone- red, siliceous and ferruginous and v.f. sandstone. Rare quartzite fragments.
6-9 m As above plus mudstone - white, EW, residual. Haematite band observed.
9-12 m As above plus some chalcedony. *Earthier texture; haematite speckled - a silicified mudstone* ? limonite and v.f. sand-coated.
12-15 m As above. *Light grey, laminated chert replacement of a siltstone band observed.*
15-18 m As above. Black chert in pink/ white, chaotic silt to coarse gravel matrix; slightly calcareous.

18-25 m CHERT.- massive, translucent/ white, banded and limestone - tan to reddish brown, slightly calcareous, silicified and siltstone - red, siliceous. Rare sandstone - fine, brick-red. Black chert in MUDSTONE - slightly calcareous, white, yellow/ brown, EW residual, soft and sticky, conchoidal fractured; earthy to greasy lustre; swells; . Fine-medium, angular to rounded, quartz sand coats mudstone. Matrix siltier and pinker at top
25-36 m No samples. *Lost circulation and no returns*.
36-42 m LIMESTONE - white, mottled light grey/ brown, fresh- SW (stained on joint surfaces), hard and brittle; v. Thinly bedded. Rare micro-vugs. *Slightly porous*.
42-45 m As above; pink, micritic, HW, impure, more weathered and ferruginous. Fossiliferous (bivalves). Rare sub-rounded pebbles.
45-48 m As above but whiter with much black haematite and pyrolusite (?)speckling.
48-51 m As above plus crystalline ingrowths.
51-57 m As per sample interval 39-42 m.
57-60 m LIMESTONE - white, pink-stained, massive, SW, hard; *re-crystallised*.
60-63 m As above plus white siliceous limestone and SILTSTONE - grey/ yellowish brown, laminated and SANDSTONE - calcareous, v.f. grained; laminated and ferruginised along fractures. Dark laminae coarser
63-66m As above; 80% LIMESTONE; 20% SILTSTONE. Some v.f., reddish brown, ferruginous, impure limestone; haematite speckled. (Re-crystallised limestone low porosity, but some overgrowths impart high porosity).
66-69 m LIMESTONE - white, medium-coarse, impure and sandstone - calcareous, ferruginous in v.f. quartz matrix; coarse calcite crystal overgrowths. Rare mudstone - calcareous, silty, green grey, soft.
69-75 m SANDSTONE - calcareous, pinkish white, v.f., fresh with haematite inclusions; (moderately porous). SANDSTONE - silicified, calcareous; v. Thinly bedded; limonite stained joint planes.
75-78 m As per 78 -81 m without silt but with sandstone - slightly calcareous, fine-medium, angular, pink, fresh-MW; laminated by grain size and colour.
78-81 m SILTSTONE (calcareous, pink/ grey/ orange) MUDSTONE/ SANDSTONE - variegated, v.f., light grey/ brown , EW and rare sandstone - calcareous, v.f., white/ cream pink, laminated with some non-calcareous, greyish pink bands. V.f-f. Coarse, angular sand in yellow brown, swelling silt, EW matrix.
81-84 m As above but no calcareous siltstone.
84-87 m SANDSTONE - calcareous, fine, variegated, pink, cream/ light grey, SW, hard, red haematite stained and black speckling (*moderate porosity*). Some pyrite speckled calcareous sandstone and siltstone - bronze, EW, soft with brittle fracturing.
87-90 m SANDSTONE - calcareous, fine, yellow, SW, limonitic (*porous*). Some small - medium pebbles; sub-rounded, bi-modally sorted with some coarse sand, subangular quartz grains - PEBBLE BED ? All in buff/ fawn clayey silt matrix.
90-93 m 40% SANDSTONE - calcareous, v.f., yellow, white, re-crystallized (silicified?); haematite speckling. 10% SANDSTONE - ferruginous, fine-medium, brick red/ yellow; (*more porous than calc. Sandstone*), plus some calcareous sandstone - coarse, re-crystallized (silicified), (*very porous*). 50% SILTSTONE/ mudstone - ferruginous, yellow/ bronze, HW. Black ironstone large gravel.

93-96 m As above but less siltstone.
96-99 m As above but no mudstone.
99-102 m As above; 60% SANDSTONE plus 40% CHERT - translucent/ light grey. Rare rust/ black, ferruginous sandstone and mudstone - off-white, soft and earthy lustre.

102-105 m SILTSTONE - ferruginous, yellow, dark brown with medium, sub- to rounded pebbles of ironstone; SANDSTONE - calcareous, silicified, v.fine, white goethite-coated some cherty; SANDSTONE - calcareous, fine-coarse, angular, poorly-sorted, yellow; limonitic and dolomitic (?); *very porous.* Some translucent, light grey chert.
105-108 m SANDSTONE / SILTSTONE - siliceous, v.f., white, SW, hard and laminated with ferruginised (red haematite) joint coatings; SANDSTONE - calcareous/ ferruginous/ micaceous (?), v.f.- fine, dull brick red (*moderately porous*); haematite speckling with calcareous, vuggy ironstone *(extremely porous*).

----------*unconformity ?*----------

108-111 m As above but Sandstone is very ferruginised, only slightly calcareous, SW and haematite speckled; (very porous). Botryoidal goethite bands with some quartzite. CHERT - medium pebbles, brown - red, sub-rounded with polished faces.
111-114 m As per 102-105 m.

----------*unconformity ?*----------

114-117 m CALCAREOUS SANDSTONE - ferruginous, yellow/ orange, v.f.-f., sub- to angular with v. thin bands of reddish black botryoidal haematite. Fragments of haematitic, re-crystallized, vuggy calcareous sandstone and sandstone - calcareous, v.f., white, finely laminated and micro-vuggy. CALCAREOUS SANDSTONE - glauconitic, v.f., pink and variegated, re-cemented clasts of v.f. calcareous sandstone in v.f. matrix of calcareous, slightly micaceous quartz. (*Glauconite - fine grains, earthy black to green*). Sandstone - siliceous, ferruginous, coarse, platy and micro-vuggy (*extremely porous*).
117-120 m As per 114-117 m ; first sentence only.
120-123 m CALCAREOUS SANDSTONE - fine, pink to yellow/ brown (*moderately porous*); CALCAREOUS SANDSTONE - cream, yellow, micro-vuggy, angular; re-crystallized (?); goethite speckled; (*extremely porous*).
123-126 m DOLOMITIC SANDSTONE - medium, opaque, light grey, orange-stained, SW; colourless quartz - dolomite silicified (?) and goethite stained; (*very porous*). SANDSTONE - calcareous, quartzitic, fine, white, SW; yellow where iron-stained. Some black, haematitic calcareous sandstone and ironstone. Rare light grey chert.
126-129 m CHERT / QUARTZITE - variegated, banded; iron coated joint planes; CALCAREOUS SANDSTONE - yellow/ colourless, calcite crystal-cemented. Rare pebbles of sub-angular, fine ironstone and fawn sandstone (*porous*). CALCAREOUS SANDSTONE - ferruginous, medium, poorly sorted, angular, rust; limonite-cemented; (*v. porous*). *Some dolomite crystals and coarse platy quartz crystals replacing dolomite (?);* (*extremely porous*). Some banded ironstone and quartzite (*bedding plane porosity*).
129- 135 m 50% CHERT - variegated and 50% SANDSTONE - slightly calcareous, quartzitic, medium, cream-grey; *contact seen*; (*variable porosity*), plus QUARTZITE - cherty, opaque/ light grey, and calcareous sandstone - v.f. interbedded medium, white/ cream, yellow, iron-stained with goethite coating bedding planes, well-bedded; haematite speckled (*moderately porous*). Rare calcareous, quartzitic, micaceous, pink sandstone; haematite cemented; well-sorted; *(porous).*
138 m As above, but no chert.
138-186m EOH No samples. No returns - lost circulation.

DRILLER'S LOG – RN30850

0-38.6 m Hammer & 10 3/8" button bit. Hole dia. 264 mm
Run 8 5/8" MS Casing; would not pass below 31.7 m.
Clear hole with 7 7/8" button bit to 38.6 m & inject foam.
38.6-186.4 m EOH Hammer & 7 ½" button bit. Hole dia. 191 mm.
0-1.2 m CLAY; red/brown.
1.2-6.5 m CHERT.
6.5-18.5 m CHERT, LIMESTONE & CLAY; red/pink & white.
18.5-25.7 m CLAY; light brown to yellow and CHERT. Cavity 25.6-26.1 m and 30-30.6 fracture

GEOLOGIST'S LOG – RN 30851 ALEXANDRIA STATION

0-3 m SILT - clayey, sandy, medium brown; calcitic matrix and v.f. sub. -to angular quartz sand. Swells on wetting.

MUDSTONE - calcareous, slightly silicified, white, hard; pyrolusite speckled; calcrete-like.
3- 6 m SILT - calcareous, clayey, yellow, EW, stiff in matrix of c. quartz/ calcareous sand - f. gravel and relict white mudstone.. Ghost laminae; Mn staining. Swells on wetting.

6- 9 m SILTSTONE - calcareous, quartzose, white, fresh, hard; speckled with pyrolusite and fine disseminated pyrite. Mudstone - yellow, EW with quartz matrix. Chert - brown, angular granules coated with calcareous, white silt intergrowths within the siltstone; some limonite stained. Fossil - rugose bivalve (strongly ribbed)?
9- 12 m SILTSTONE and LIMESTONE - calcareous, slightly quartzose, white, SW. MUDSTONE - calcareous, off-white, fresh, soft,; conchoidal fracturing; swelling and orangish yellow, EW variety in matrix of sub- to angular calcite, quartz and chert c. sand. SPARRITE - quartzose, c., colourless in matrix of calcite; *v. porous*. Limestone - c., white/ translucent, vuggy; calcite lined vugs; *v. porous* and variegated chert - "ghost" silicified ooliths and fossil spicules.
12- 18 m As above, except vuggy limestone is absent.

18- 21 m LIMESTONE - v.f., 20% light grey/ 80% yellowish brown interbeds; SW, hard; impure; sugary texture and weakly laminated; some red haematite speckling and pyrolusite speckling on bedding planes; rare colourless calcite ingrowths and thin calcite veins; (*moderately porous*). Minor light grey chert (interbeds?). Rare siltstone - calcareous, off-white, Mn speckled.
21- 24 m As above, plus LIMESTONE - micritic, off-white; black "heavy' minerals concentrated along bedding planes. Some silicified limestone to variegated brown chert containing ooids (and fossil shells?); rare calcite infilling vugs in chert. (Bivalve fragment preserved in light grey limestone).
24- 27 m As per interval 18 -21 m.
27- 30 m As per interval 18- 21 m, except 50% light grey/ 50% yellowish brown limestone and siltstone absent.

30- 36 m OOLITIC LIMESTONE - cream, minor white/ grey and salmon pink tinged, fresh-SW; grain supported, partially re-crystallized; yellow goethite staining around crystals; some pink calcite rhombs. (*Mn nuclei observed in some ooliths*); *Fossiliferous; archaeocyathid (primitive coral-like fossil) observed in cross-section*. BIOSPARRITE - oolitic, white/ translucent; some iridescent black calcite; *archaeocyathids have been re-crystallized in this rock. Also a brachiopod mould observed.*
36- 39 m As above, calcite crystal twinning observed and replacing ooids *Archaeocyathid* preserved in calcitic spars and silt in limestone.
39- 45 m As above but no fossils observed.
45- 51 m LIMESTONE - v.c. white/ cream, some salmon pink, fresh-SW and massive; re-crystallized oolitic structure almost destroyed to calcite spars; limonite stained; some Mn speckled white silt. *Rare grains of green apatite observed*.
51- 54 m As above; slightly fossiliferous- *calcite replaced casts of shells observed in section*.
54 -57 m As above; but v.c., white, fresh limestone only.
57- 63 m LIMESTONE - oolitic, m.c., yellow, off-white/ translucent, SW; ooliths of white cryptocrystalline calcite, grain supported in calcite matrix; some v.c. re-crystallized, fresh and massive. SW fragments with f., grey sand coating limonite stained fracture surfaces; (*moderately porous*).
63- 66 m LIMESTONE - As above, plus slightly oolitic, light grey, SW, hard and massive
66- 69 m As per interval 57- 63 m; but the oolitic limestone only.
69- 78 m LIMESTONE - c., light brown/ black, fresh, hard; quite massive; some white limestone fragments contain *rare sea-green, micro-crystalline haloes of apatite (or possibly fluorite?).*
78- 87 m LIMESTONE - whiter than above or below, translucent (rare ooids 78- 81 m), interbedded with v.c. white limestone; calcite lathes diffused with pyrolusite (?). Rare re-healed fractures infilled with f. calcite.

87- 93 m LIMESTONE - c., mottled, light brown/ cream/ black, fresh and hard; speckled with pyrolusite(?).
93- 96 m LIMESTONE - c. -v.c., white, fawn, SW; rare perfect gravel-size calcite rhombs in colourless calcite matrix; rarely fragments coated by white calcite silt. Rare vugs coated by goethite. (More porous than above).

96- 99 m LIMESTONE - dolomitised, c. - v.c., white, fawn, SW, vuggy; re-crystallized.. Some specks of haematite (very to extremely porous). Calcite crystals as above.
99- 102 m LIMESTONE - c., fawn, light brown, white/ translucent, orangish, fresh-SW, hard; dolomitised? (Above 100 m extremely porous - secondary porosity). Dolomitised f., medium brown, contact with v.c. limestone observed. Also a fossil echinoid spine in this limestone. Dolomitised limestone is grain-supported with 50% open area.

102- 114 m 50% MICRITE 50% LIMESTONE - Micrite - medium grey, fresh, thinly bedded; limestone is coarse, lighter grey with rare haematite speckling and rarely has a micro-honeycomb texture. Rare m., medium grey limestone; SW; haematite stained and laminated.
114- 117 m As above, plus rare yellow/ translucent chert (silicified calcareous siltstone).
117- 120 m 70% MICRITE; 30% LIMESTONE - As interval 102- 114 m plus rare white calcareous, laminated siltstone, yellow where silicified.
120- 138 m LIMESTONE - alternating 50% f., 50% micritic -c., variegated, white, light brown/ grey, fresh, hard; some white, calcite lined ellipsoidal vesicles (former ooliths?) (some infilled) giving secondary porosity in the coarse limestone. Becoming finer grained and less variegated with depth.
138- 141 m - As above, plus some black carbonate; micritic on bedding surfaces and rare white/ yellow, non-calcareous mudstone
141- 144 m As per interval 120- 138 m.
144- 147 m As per interval 138 -141 m. Traces of fossils in the white c. limestone?
147 - 150 m As per interval 120- 138 m.
150- 153 m Ditto, plus silicified (or dolomitised?) lathes covering bedding surfaces.
153- 159 m As per interval 120- 138 m. (White c. limestone appears to have consumed micritic grey limestone; latter forming rafts in former). (Cross - hair lathes of white calcite observed). Rare fragments of silicified, white/ yellow mudstone.
159- 162 m As per interval 120- 138 m, but some SW with secondary porosity. Darker colour and finer grained.
162- 165 m As per interval 120- 138 m ; fine limestone laminae on c. limestone bedding planes.
165- 168 m LIMESTONE - c., light brown/ medium grey, SW; calcite veined and lathes; 30% MICRITE - medium grey, brittle and laminated; interbedded. Some sub-rounded limestone granules in calcareous c. sand and white silt.
168- 174 m As above, except last sentence. Re-crystallized fossil bivalve (?) observed.
174- 186 m LIMESTONE - c., variegated, white/ light brown to medium grey, fresh; thinly bedded; translucent/ white crystalline overgrowths. Mn speckled. Low porosity.

186- 189 m LIMESTONE - c., variegated, light grey/ brown, fresh, massive; SW closed fractures and micro-vugs in matrix of calcareous, m.-c. EW sand and yellow silt (EW residual limestone). Rare bottle green mineral inclusion - Glauconite (?). Rare calcareous white mudstone; yellow limonite-stained. (Secondary porosity).
189- 192 m As above, except limestone is lighter grey; no EW matrix material nor mudstone.
192- 195 m As above, with some crystal ingrowths - dolomite? Lighter than above inc. pinkish white fragments of the limestone.

195- 198 m As per interval 189- 192 m; limestone is also white; plus some mudstone - silty, yellow/ white, red stained and Mn stained; earthy/ greasy lustre; (residual limestone?).
198- 201 m EOH As per interval 189- 192 m.

GEOLOGIST'S LOG – RN 30852, ALEXANDRIA STATION

0-3 m SAND - slightly calcareous, gypsiferous, clayey, silty, v.f., grey brown; earthy to vitreous lustre; slakes and swells on wetting.
3-6 m As above; but tan and sticky and firm.
6-9 m SILICIFIED LIMESTONE/ MUDSTONE - cherty; LIMESTONE - fine-coarse, off-white, yellowish, chalky (calcrete?); (v. porous). All in matrix of white SILTSTONE/ MUDSTONE.
9-15 m MUDSTONE/ SILTSTONE - slightly calcareous, off-white, minor mottling, EW, soft and earthy; (residual limestone?); haematite/ Mn speckled, enclosing minor remnant white limestone granules and rare quartz fine gravel; angular and chert. Minor dolomite.
15-18 m As above, plus MICRITE - white to yellowish, SW, well-jointed, v. thinly bedded; partly silicified. Mudstone only as above. CHERT and 50% DOLOMITE - tan, laminated.
18-21 m 80% MICRITE - fawn, fresh, hard and massive; some Mn/ Fe staining. 10% SANDSTONE - calcareous, fine-medium. 10% LIMESTONE - fine-coarse, off-white; pitted; rare dendrites of Mn on bedding planes; laminae of f.-coarse calcite; some fragments coated with white, calcareous silt; rare silicified, angular, limonite stained, angular pebbles.(moderately porous). Minor mudstone - calcareous, white/ yellow, EW. Interbedded calcareous sandstones and limestones.
21-24 m As above but no limestone.
24-27 m 70 % CALCAREOUS SANDSTONE - orange, yellow brown, SW, poorly sorted with calcareous matrix inc. Rounded granules of quartz and SANDSTONE - calcareous, f.-medium. LIMESTONE and CHERT - fine, white and rare brick red, HW residual limestone.
27-30 m 90% CHERT - variegated. 10% CALCAREOUS SANDSTONE - yellow; (v. porous). Minor limestone - v.f., cream, light grey, speckled with diffuse Mn. Some cherty quartz - white/ translucent; ghost laminae observed; quartz lathes mimic calcite crystals which have been replaced.
30-33 m LIMESTONE; SILICIFIED LIMESTONE - variegated, yellow/ white/ light brown, MW, vuggy. Angular-sub-rounded granules of above in calcareous, buff silt matrix; swelling. ("Muddy sample"). Fracture zone.

33-36 m LIMESTONE - fine, white, tinged pink, light grey (Mn stained), SW-fresh, hard, sugary; re-crystallized; some diffuse haematite speckling; (low porosity); 30% SILICIFIED - colourless/ orange, with variegated chert and remnant calcite crystals. LIMESTONE - coarse, white/ light brown, fresh and hard; chalky lustre; partly siliceous (?); (v. porous).
36- 42 m LIMESTONE - medium-coarse, salmon pinkish white, white, colourless, fresh-SW, hard; v. thinly bedded; (moderate to good porosity). Partly re-crystallised, overgrowths delineated by goethite staining and coatings on bedding; yellow/ brown nodular limonite pitting on bedding planes. 10% LIMESTONE - white, residual some silicified, silty, sandy, HW, v. thinly bedding laminae; rare tiny pyrolusite dendrites observed. Some cream coarse, micro-vuggy limestone; (v. porous) and light brown, fine calcareous sandstone.
42-45 m 80% LIMESTONE - medium, white/ slightly pinkish, uniform; 5% chert and silicified limestone. Some fine, dark grey limestone and light brown, micro-oolitic limestone.
45-48 m As per sample interval 36- 42 m.
48-51 m As above but less diverse assemblage with pinkish limestone predominant plus rare calcareous, brown, EW siltstone and fine, yellow/ cream calcareous sandstone.
51-54 m As above but only the limestone.
54-57 m LIMESTONE - fine, fawn, cream ,white tinged pink, SW, hard; v. thinly bedded; diffuse speckling with orange haematite and metallic pyrolusite (?) and some micro-vugs partially infilled by calcite. LIMESTONE - coarsely crystalline, light brown/ smoky. Translucent / light grey chert. Contact white limestone with chert observed; ghost laminae in chert parallel those in limestone. Fluted and nodular bedding plane forms observed; latter covered with yellow brown limonite.
57- 63 m LIMESTONE - As above but white, fresh without speckling and no chert.
63- 66 m LIMESTONES - mixed assemblage; medium, colourless, crystalline (good porosity); white, microcrystalline; and smoky, cryptocrystalline, fresh and hard; conchoidal fractures. Some fragments ragged, pitted crystals - light brown/ colourless calcite, coated with white calcitic silt with rare haematite crystals infilling voids; (extremely porous). Generally, limestones becoming more uniform with depth; v. thinly bedded; bedding planes are smooth and finer-grained.

66- 69 m As above, plus fine, fawn limestone laminae with Mn speckling and yellow/ tan limonite staining.
69- 72 m As above but fresh, un-laminated, no staining.
72- 75 m LIMESTONE - fine, , pinkish white, fresh, sugary texture, v. thinly bedded. Rare calcareous sandstone - weakly laminated, and yellow limonite stained bedding planes with Mn inclusions. Micro-vuggy with partial crystal growth in voids inc. red haematite colouring calcite. (Good porosity).
75- 78 m As above; plus rare fine, greenish buff limestone.
78- 81 m As above; limonite coated joint planes and large yellowish translucent calcite rhombs observed; (moderately porous).
81- 84 m As above; whiter and more fresh.
84- 90 m LIMESTONE - m.-c., grey, SW, in light brown silty matrix; earthy lustre. LIMESTONE - re-crystallized oolite (?); goethite stained; (moderately porous). “Muddy sample”.

90- 93 m LIMESTONE - m.-c., medium/ dark grey, fresh, hard, thinly bedded. Some iron staining and partially re-crystallized oolitic limestone.
93- 96 m LIMESTONE - partly oolitic, cream/ light -medium grey, fresh-SW, v. thinly bedded, quite fossiliferous. Ooliths have been infilled with ragged calcite crystals. Mn staining.
96- 99 m OOLITIC LIMESTONE - as above; some ooliths dissolved out leaving disconnected voids.
99- 102 m As per sample interval 90- 93 m.
102- 105 m As above; but non-oolitic.
105- 108 m MICRITE - slate grey, fresh, hard, v. thinly bedded, laminated; (no porosity). Some beds coarser grained.
108- 114 m As above, but uniformly v.f. grain size.

114- 117 m OOLITIC LIMESTONE - fossiliferous, m., light grey, fresh and minor fossiliferous, white, v.c. limestone. Ooliths are matrix supported; matrix of colourless, cryptocrystalline calcite. Some ooliths are dissolved out. Fossils casts are pyrolusite-lined; (extremely porous). Rare v.f., white limestone.
117- 126 m As above, but v.f. limestone absent. (V. porous).
126- 135 m LIMESTONE - c., white, fresh and hard with colourless calcite crystals; (v. porous). Veins and speckling of pyrolusite (?) and rare bottle green apatite (or possibly glauconite), some as haloes.

135- 138 m LIMESTONE - c., mottled; light/ medium grey/ black/ white, hard, fresh, thinly bedded; re-crystallized. Some micro-vugs partially infilled with calcite and some white/ translucent v.c. limestone with rare light green apatite (?) crystals.

138- 141 m As above, but only the first named limestone above; more uniform and competent and less porous.
141- 147 m LIMESTONE - micritic, slate grey, fresh, hard and thinly bedded. Rare mottled, light/ grey, oolitic limestone.
147- 153 m As above, but no oolitic limestone and finer grained-MICRITE. (No porosity)
153- 156 m MICRITE - light/ medium slate grey, fresh, hard, thinly bedded; Mn speckled. Rare c., white, re-crystallized limestone (No porosity).
156- 159 m As above but micrite only with 10% light brown micrite; laminated; laminae of alternating “heavy” and “light” minerals.
159- 162 m As above, but grey micrite only; (similar to interval 111- 114 m).
162- 200 m EOH No samples. (No returns - lost circulation).

GEOLOGIST'S LOG – RN 30853, ROCKLANDS STATION

0- 1 m SILT - clayey, grey, slaking, swelling.
1-9 m SILT - clayey, f. sandy (sub-angular quartz), yellowish brown, EW, v. stiff, dense; non-calcareous; cracking but non-slaking, swelling.
9-12 m SILTSTONE - calcareous, black, rust, EW, v. stiff; ghost laminae and veining; contains c. sand and c. gravel of chert and rounded quartz grains, plus some siliceous limestone and chert fragments with ferruginous stained joints.
12- 15 m SILTSTONE - calcareous, black, EW; Mn stained with Mudstone, clayey, EW, stiff inc. white, angular limestone fragments with c., rounded quartz sand, botryoidal haematite and ghost minerals.
15-18 m As above, but the siltstone only.

18-21 m MUDSTONE - As per interval 12- 15 m, plus GRAVEL - c., variegated, yellow, black sub-angular to sub-rounded, large pebbles, EW, hard; ferruginous - residual limestone. Some Limestone - brown/ white; re-crystallized.
21-27 m 80% MUDSTONE - yellow, orangish brown, EW, variably hard and soft; earthy lustre; black, botryoidal haematite-rich gravel enc. White micrite surrounds dolomitised , yellow, brown, re-crystallized limestone in some gravel; with snowflake-like Mn speckling on residual joint planes Ghost fossil mould seen in re-crystallized micrite (?). A fragment of calcite had polished surfaces. Fault gouge?

27- 30 m As above, but less decomposed, plus LIMESTONE - variegated, yellowish fawn, hard; Mn speckled. Silicified Limestone - translucent, yellowish fawn. Limestone - dolomitised, mottled, yellowish brown/ white with detrital, c., sub-angular quartz sand enc. And rare Chert.
30- 33 m 50% MUDSTONE - calcareous, off-white, HW; conchoidally fractured; ghost laminae with Mn veinlets seen - residual limestone.

33- 36 m As above with soft, dendritic Mn and goethite traces re-healed fractures. Limestone contains frosted fragments - Fault gouge (?)
36- 39 m MICRITE - dolomitised, white, some yellowish, hard; re-healed fractures; calcite veinlets. As per interval 21- 27 m white micrite, etc in MUDSTONE/ Siltstone - slightly calcareous, mottled, orange/ off-white, EW, soft; earthy lustre; slakes with v.f. quartz and residual limestone Gravel; rare c. calcite fragments; frosted, earthy lustre.
39-45 m As above but no gravel plus, at depth, DOLOMITISED LIMESTONE - f., cream/ light salmon pink, SW, hard, thinly bedded, pitted and limonite stained bedding planes and ferruginous stained joint and gouged fractures. Little porosity.
45- 48 m - As above, but dolomitised limestone only; plus Limestone - c., variegated, white, angular; re-crystallized; dolomitised and veined with rare quartz Gravel enc.
48- 54 m As above; plus some Siltstone - brown, EW.
54- 57 m - DOLOMITISED LIMESTONE - v. light brown, fawn, fresh, v. hard, massive; conchoidal fractures; SW joints Mn speckled and red haematite stained; limonite stained and pitted bedding; some ferruginous veining.
57- 60 m As per interval 45- 48 m, without gravel.
60- 63 m DOLOMITISED LIMESTONE - f., cream/ light salmon pink, fresh, hard; v. thinly bedded. No porosity.
63- 66m 40% MICRITE - dolomitised, variegated, medium brown, fawn; v. thinly bedded. 30% LIMESTONE - pink/ white,; pitted, limonite stained bedding planes; some micro-vughs. 30% LIMESTONE - f., blue grey, fresh, variably hard, brittle, fissile; no jointing. Little porosity.
66- 72 m 100% MICRITE - As above but more fawn coloured with white coatings on bedding and Mn speckling. Rare micro-vuggy Limestone.

72- 75 m MICRITE - orange brown, fresh, v. hard, more massive, conchoidal fractures and well-jointed; 3 sets; some micro-folding observed.

75- 78 m As above but micrite is less orange and some is siliceous; smooth and pitted joint planes observed.. Chert - light grey/ brown. Calcareous sandstone - f.-m., brown; rounded quartz grains in calcite matrix;

78- 81 m As above with 80% Micrite.

81- 87 m 100% MICRITE - light brown, slightly pinkish, mottled yellow/ orange, fresh, v. hard; Silicified in places, SW joint surfaces are Mn speckled and pitted. Some re-crystallisation near top, SW, micro-vuggy calcite partial ingrowths; limonite coats some vugs. Slightly porous.

87- 90 m As above, plus rare Limestone - c., white, re-crystallized; SW joints and Limestone - dolomitised, siliceous, v.f., white, yellowish; re-crystallized.
90- 93 m MICRITE -; mottled, off-white/ light brown/ tan, fresh; fissile; partially Silicified; limonite strained joint surfaces.
93- 96 m As above, plus 5% Micrite - medium grey, some yellowish (dolomitised), fresh, hard, massive; pitting and micro-ripple marks observed on bedding.
96- 99 m As above, but 30% medium grey Micrite; some dolomitised light brown with black haematite sealing joints.
99- 102 m As per interval 90- 93 m.
102- 108 m LIMESTONE - f., v. light brown/ cream, fresh, hard; some re-crystallized, darker brown, coarser and micro-vuggy; partly silicified; moderate to good porosity. Trace of light grey Limestone and Chert.
108- 111 m As above (90%), plus Limestone grading to Calcareous Siltstone - v.f., blue grey, fresh, brittle, fissile. Rare Breccia - limestone/ ferruginous, brown, angular-rounded gravel in m.-c. sand matrix.
111- 117 m As per interval 102- 108 m (95%), but none silicified below 114 m; plus breccia as above but variegated and silicified, too.
117- 120 m MICRITE - 60% light grey; 40% light brown, fresh, hard; v. thinly bedded; numerous yellowish orange, limonite stained joints present with Mn speckling with rare black, botryoidal haematite inclusions. No porosity.

APPENDIX B

WHOLE ROCK ANALYSIS

A total of 16 samples from six bores were sent for major element analysis to Amdel Laboratories, Adelaide. Samples of limestone, dolomitic limestone, dolomite and calcareous sandstone were selected, usually from the aquifer zone and a distance below the aquifer zone.

The registered number of the bore and the interval sampled are as below:

RN	*INTERVAL (m)*
16886	108 - 111
	117 - 120
16887	138 - 144
	159 - 165
	195 - 200
30852	108 - 114
	129 - 135
	156 - 162
30853	108 - 111
	117 - 120
31194	69 - 75
	114 - 120
	153 - 159
	174 - 178
31198	75 - 81
	105 – 107

Description of Test

'IC 4' test (commonly called 'total digestion') is used for whole rock (mineral) analysis. The whole rock sample is pulverised and totally fused in an alkaline solution at a temperature of 1000°C. Major element concentrations" [Aluminium oxide (Al_2O_3), Calcium oxide (CaO), total iron as ferric oxide (Fe_2O_3), potassium oxide (K_2O), magnesium oxide (MgO), manganese oxide (MnO), sodium oxide (Na_2O), phosphorus oxide (P_2O_5), silica (SiO_2), titanium oxide (TiO_2)] are analysed using *'Inductively coupled plasma emission spectrometry' ('ICP')*[11]. (Note: the digestion process oxidises the sample; thus the results are expressed in the oxide form of the element).

[11] *ICP emission spectrometry is a 'flame' technique with a flame temperature of magnitude 10,000°C. The prepared sample solution is passed as an aerosol from a nebulizer into an argon plasma. The ICP is a stream of argon atoms,*

Also, *'loss of ignition' ('LOI')* is measured at 1000°C; simply, this is a measurement of "volatile" substances in the rock (e.g. moisture, carbon, sulphur and, in the case of these samples, carbon dioxide (CO_2) gas from carbonate-forming limestones).

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heated by the inductive heating of a radio-frequency coil and ignited by a high-frequency spark. The sample dissociates in the argon plasma and a large number of atomic and ionic spectral lines are excited. The spectral lines are detected by a range of photomultipliers, they are compared with calibration lines, and their intensities are converted into concentrations. Elements are measured simultaneously and a complete, precise analysis can be made within a couple of minutes.

APPENDIX C

IDENTIFICATION OF FOSSILS

Thirteen fossil samples were selected from three bores. These were delivered to Dr. P Kruse, palaeontologist, Northern Territory Geological Survey, Darwin. The registered number of the bore and the intervals where the specimens were collected are as follows:

RN	*INTERVAL (m bgl)*
30851	21 - 24
	30 - 39
	144 - 147
	168 - 174
30852	93 - 96
	114 - 117
	117 - 120
31194	108 - 111
	111 - 117
	117 - 120
	120 - 123
	123 - 126

Department of Mines and Energy

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GEOLOGICAL SURVEY DIVISION

Facsimile: (08) 8999 6824
Telephone: (08) 8999 5451

Our Ref.
Your Ref.

Eric Rooke
NT Department of Lands, Planning and Environment
PO Box 1512
Alice Springs NT 0871

Dear Eric

RE: FOSSIL SPECIMENS - BARKLY REGION

I have examined the chip samples from drill holes RN 30851, 30852 and 31194 which you supplied via lan Matthews. Results are as follows:

RN 30851	21-24 m	caliche/palaeosol?
	30-39 m	?trilobites
	144-147 m	trilobites, hyoliths and sponge spicules
	168-174 m	sponge spicules and ?trilobites
RN 30852	93-96 m	indeterminate fossils
	114-117 m	numerous trilobites
	117-120 m	indeterminate fossils including trilobites
RN 31194	108-111 m	barren
	111-114 m	lingulate brachiopods
	114-117 m	trilobites and lingulate brachiopods
	117-120 m	lingulate brachiopods
	120-123 m	lingulate brachiopods
	123-126 m	barren

None of the material is further identifiable in its present form. However, the fauna has a Cambrian aspect and can be reasonably presumed to be of that age. The sample RN 30851 21-24 m may be of post-Cretaceous age by comparison with palaeosols in the region.

These Cambrian limestone samples are undoubtedly fossiliferous and appear to be eminently suitable for acetic acid digestion. Thus far I have done no work on this particular interval of the Middle Cambrian, but it is part of my long-term work programme to examine faunas of the central and southern Georgina Basin. As always, this project would of necessity be based on cored drill holes where outcrop sections are insufficient (which is generally the case), and I can foresee samples from your drilling becoming an important contribution to our understanding of the basin, in allowing correlation of your drill holes in to a regional reference section. Such an outcome should benefit both our departments.

With this long-term prospect in mind, if you are agreeable, I propose that samples be collected from your drill holes on a routine basis and passed to me for eventual study. Please note that this work could be meaningful only if you can supply a geologist's log for each hole, and if accurate sample depth control can be maintained. Only carbonate rocks need be sampled (limestone is preferred to dolostone). Each sample should be 1-2 kg in weight, and taken at, say, 5 - 10 m intervals. It would be helpful to wash samples to remove finer material and contaminants.

I look forward to a potentially fruitful collaboration. Please advise as to what you would like done with the supplied samples.

Yours

DR PD KRUSE
GEOLOGIST

7 January 1998

Department of Mines and Energy

CENTREPOINT TOWERS BUILDING, THE MALL, DARWIN N.T. 0800

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Our Ref.
Your Ref

Eric Rooke
NT Department of Lands, Planning and Environment
PO Box 1512
Alice Springs NT 0871

Dear Eric

RE: ADDENDUM TO FOSSIL SPECIMENS - BARKLY REGION

I have examined the two additional chip samples from drillholes RN 30851 and RN 30852 which you supplied via Ian Matthews. Results are as follows:

RN 30851	36-39 m	trilobites, lingulate brachiopods, ?sponge, colonial organism
RN 30852	126-132 m	trilobites, ?colonial organism

These results do not materially alter the conclusions or proposals outlined in my letter of 7 January 1998.

All samples are returned together with this letter. As agreed, I have retained the rock chips containing the ?sponge and colonial organisms for further study. If and when a thorough palaeontological study of the Cambrian of the Barkly region is made, these may prove to be of more than regional significance.

Yours

DR PD KRUSE
GEOLOGIST
18 March 1998

APPENDIX D

WATER QUALITY

BORE RN	BORE NAME	EASTING	NORTHING	DATE SAMPLED	pH	ELECTRICAL CONDUCTIVITY	TOTAL DISSOLVED SOLIDS	SODIUM	POTASSIUM	CALCIUM	MAGNESIUM	IRON	CHLORIDE	SULPHATE	NITRATE	BICARBONATE	FLUORIDE	SILICA	HARDNESS	ALKALINITY	TEMPERATURE DEGREES C
							mg/L														
33	No. 2	776129	7790211	Oct-96	7.40	2330	1470	246	6	144	66	0.1	412	440	8	229	0.9	22	631	188	31.0
45	BARRY CAVES ARMY Bo.RE (No 105)	676173	7782186	May-64	8.00		1338			124	148		335	214		214	0.6		680		
		676173	7782186	Aug-68	7.72	1700	1090	155	19	122	77	2.9	315	233	1	148	0.5	13	570	244	
		676173	7782186	Aug-79	7.50	2100	1280	150	20	144	85	23.0	331	276	1	370	1.0	22	709	303	
83	OLD No. 5	774301	7801758	Jul-68	7.85	900	596	75	6	65	30	10.0	134	95	0	15	1.2		324	34	
84	No. 6	757600	7803600	Jul-68	6.95	650	373	50	6	35	25	10.0	90	95	0	5	0.3		208	8	
		757600	7803600	Sep-52			610	128	8	58	0	0.0	115	120	0	177	2.0		20	0	
92	No. 17 BORE EX 17 AVON DOWNS	760200	7723400	Sep-52			1218	348		85			497	166		116	1.0		300		
93	NO 16 BORE	759568	7735782	Jul-68	7.70	2800	1680	265	17	135	95		570	368	3	28	1.4	20	870	46	
95	NO 19 BORE	759728	7735629	Jul-68	7.75	1600	823	165	32	6	59	5.1	205	120	3	49	0.8	60	250	80	
96	No. 20	762613	7820210	Nov-68	7.70	1000	700	63	7	86	50	8.0	140	197	0	111	0.4		418	182	
98	NO 22 BORE	768036	7775593	Sep-52			878	239		65			319	142		104	0.4		200		
98		768036	7775593	Nov-68	8.00	1300	850	105	9	94	50	2.0	230	168		117	1.8	9	455	191	
331	No. 14	767933	7752109	Sep-52			2030	430	278	118			958	128		98	1.2		780		
		767933	7752109	Jul-68	7.70	2100	1290	180	16	135	75	0.3	430	228	22	28	1.0	27	680	46	
		767933	7752109	Nov-96	8.10	2300	1450	204	14	132	88	0.9	485	280	5	273	0.7	30	691	224	28.0
340	No. 3	774100	7768200	Sep-52			1490	369		161			674	128		146	3.2		560		
366	No. 1	772606	7782024	Jul-62			700														
		772606	7782024	Nov-96	7.70	1330	774	127	10	44	54	0.1	242	200	1	108	0.8	18	331	89	27.0
384	NO 23 AT HOMESTEAD	760219	7782844	Sep-62			700			85	44		45	58		437			392		
		760219	7782844	Jun-80	7.40	1740	880	114	11	108	64		178	154	3	477	1.3	58	532	391	
495	NO 1 GOVT. BORE	675086	7839101	Aug-68	7.80	2700	1735	335	19	173	80	0.4	500	484	0	133	2.0		685	218	
532	ALEXANDRIA BORE (18TH)	681237	7888459	Jul-68	7.50	950	629	85	6	52	56	0.1	146	137	0	107	0.0		372	176	
		681237	7888459	May-96	7.60	740	438	30	3	68	37	0.0	59	70	2	318	0.2	24	322	261	
		681237	7888459	Aug-52	0.00	0	530	81	32	44	0	0.0	35	21	0	311	1.1		300	0	
533	BUCHANAN (ex-GOVT.)	690363	7872381	Aug-68	7.60	610	353	23	5	52	29	0.3	32	44	0	150	0.2		284	246	
534	NO 20 RANKEN PLAIN (ex-GOVT.)	696331	7854069	Aug-68	7.35	1100	707	110	14	52	72	0.0	136	84	0	165	0.0		424	270	
		696264	7853941	Sep-52			680	80	20	41	49	0.0	135	165	0	171	2.9		600	0	
536	NO 24 AVON	757997	7797556	Sep-52			1604	286	221	103	0	0.0	550	203	0	213	0.0		420	0	
		757997	7797556	Jul-68	7.60	1250	813	95	7	110	50	0.3	195	184	0	21	1.1		500	34	
537	NO 25 ROCKLANDS WEST	782293	7792290	Sep-52			1158	175	0	97	66	0.0	355	252	0	459	0.0		700	0	
		782293	7792290	Jul-68	7.50	2000	1262	215	74	95	71	0.0	505	216	0	26	0.4			42	
545	ROCKLANDS EAST	801644	7795088	Sep-52			956	110	0	92	58	0.0	266	157	0	207	0.6		500	0	
		801644	7795088	Jul-68	6.60	2600	1682	220	1	215	105	0.2	435	600	0	190	0.4		794	16	
735	NO 1 BUCHANAN	696190	7873478	Sep-52			540	27	0	46	52	0.0	50	128	0	226	0.3		260	0	
		696190	7873478	Nov-68	7.30	660	370	24	5	66	32	1.0	28	43	0	165	0.9		294	270	
737	NO 3	708410	7882535	Nov-68	7.70	1000	620	98	5	68	38	11.0	140	120	0	142	0.6		333	232	
		708410	7882535	Aug-96	7.90	828	501	62	5	58	37	0.2	84	83	1	328	0.2	17	297	269	
738	NO 4	688436	7893796	Jul-68	7.32	800	405	38	3	80	41	0.0	80	37	0	201	0.1		378	330	
739	NO 5 SOUDAN HOMESTEAD	721346	7780050	Nov-68	7.70	2800	1700	285	20	152	98		710	273	2	104	1.0	70	805	170	
744	NO 9	703158	7832020	Nov-68	7.90	1900	1180	263	13	90	50	0.2	330	308	0	123	3.4		440	202	
745	NO 10	710451	7843202	Nov-68	7.40	750	480	50	8	58	32	0.1	86	1	0	112	2.6		290	184	
746	NO 11	723567	7817687	Aug-68	7.40	2100	1356	250	16	105	77	10.0	490	306	0	39	1.6		545	64	
747	NO 12 (HOMESTEAD NO.1)	679250	7891800	Nov-68	7.50	630	330	27	4	51	34	0.1	54	32	0	148	0.5		274	242	
748	NO 13	720906	7901750	Dec-52			560	40	111	27	10	0.0	60	80	0	207	0.5		280	0	
		720906	7901750	Nov-68	7.60	700	390	35	6	60	42	0.1	38	44	0	185	0.8		318	304	
749		720010	7917397	Nov-68	7.50	690	360	21	6	58	48	0.2	24	27	0	195	0.8		326	320	
751	NO 16	672914	7869958	May-96	7.10	902	553	71	5	65	39	0.1	75	140	4	312	0.4	26	322	256	
		672914	7869958	May-96	8.50	760	456	69	5	22	46	0.0	78	130	0	206	0.3	24	244	192	
752	No. 17	693573	7814172	Aug-68	6.30	5100	3655	850	27	289	125	10.6	1180	1350	0	5	2.5		1360	8	
		693573	7814172	Oct-96	7.80	3860	2450	700	31	142	90	3.6	906	640	1	270	1.9	16	724	221	
753	NO 18	701676	7792992	Aug-68	7.75	1900	1189	220	25	102	84	0.0	360	286	0	142	0.7		520	232	
755	NO 20 (GALLIPOLI)	757085	7889186	Jul-68	7.30	1300	917	95	7	122	61	0.2	206	187	0	150	0.7		530	246	
756	NO 21	779548	7890168	Jul-68	7.10	950	640	60	6	82	53	0.0	114	87	0	194	0.4		424	318	
758	OLD NO 23	723061	7836423	Aug-68	8.05	750	457	60	7	62	32	0.1	90	110	0	102	1.6		294	168	
		723061	7836423	Nov-68	7.70	700	440	48	7	53	34	3.6	86	94	0	98	1.5		270	160	
769	NO 6, 4 MILE BORE	781975	7732842	Aug-52			1501	204		143	94		461	242		348			740		
		781975	7732842	Jul-68	7.70	2000	1232	175	15	85	71		405	240	2	31	0.4	31	490	50	
772	SHAKESPEAR NO 2	784585	7752834	Jul-68	7.65	2000	1266	200	8	70	85		335	260		41	0.5	31	670	68	
774	NO 6 MIDDLE BLUE BUSH	801345	7730640	Jul-68	7.95	2770	1537	190	12	135	95	0.7	505	264	1	28	0.6	16	810	46	
		801345	7730640	Nov-96	7.40	2310	1420	228	11	130	87	0.5	485	290	6	275	0.5	28	682	226	27.0
776	NO 7 YELLOW HOLE	811700	7740600	Nov-68	7.10	1200	730	125	9	34	59	0.1	274	143		50	0.9	16	316	82	
777	NO 3 BLUE BUSH BORE	812621	7720204	Nov-96	7.40	1460	894	112	9	85	56	0.4	242	170	1	264	0.6	27	442	217	24.0
		812621	7720204	Jul-16			1782														
778	NO 11 COOLABAH	790718	7711201	Aug-52			1985	460		133	42		586	490		207	3.7		680		
		790718	7711201	Jul-68	7.90	1650	920	125	13	45	65	10.8	265	152		39	0.6	32	340	64	
932	RANKEN DIP	700587	7831332	Aug-68	7.75	3100	2068	460	20	162	80	0.2	565	600	0	118	0.0		194	194	
941	NO 10 REDFORD	805797	7824276	Jul-68	7.80	900	541	50	5	50	42	0.1	132	81	0	24	0.4		354	40	
942	NO 11 KIAMA	787029	7793407	Nov-68	7.80	1900	1120	165	6	119	73	0.1	460	179	0	90	0.5		610	148	
944	NO 13 LETICA	791614	7806917	Nov-68	7.40	1300	760	100	5	71	55	9.1	304	94	0	62	0.7		402	102	
948	NO 17 SCRUBBY	807689	7812406	Jul-68	7.50	800	468	60	5	40	34	4.6	126	70	0	23	0.2		306	38	
949	OLD NO 19 MIKADO	807453	7839220	Jul-68	7.60	760	456	65	5	45	36	9.2	130	109	0	13	0.7		268	22	

BORE RN	BORE NAME	EASTING	NORTHING	DATE SAMPLED	pH	ELECTRICAL CONDUCTIVITY	TOTAL DISSOLVED SOLIDS	SODIUM	POTASSIUM	CALCIUM	MAGNESIUM	IRON	CHLORIDE	SULPHATE	NITRATE	BICARBONATE	FLUORIDE	SILICA	HARDNESS	ALKALINITY	TEMPERATURE DEGREES C
950	NO 23 ROCKLANDS	806811	7857988	Jul-68	7.75	1000	589	65	4	40	45	1.5	168	80	0	27	0.2		274	44	
951	NO 11	773200	7828274	Oct-96	7.50	2580	1600	238	9	167	102	0.1	519	400	9	221	0.7	18	836	181	31.0
994	NO 24	777068	7742008	Nov-96	7.30	2320	1480	229	14	115	88	4.5	494	290	3	242	0.7	28	648	198	28.0
997	NO 9 BLUE BUSH BORE	808079	7723741	Aug-52			1782	349		66	146		781	315		116			680		
		808079	7723741	Jul-68	7.05	2200	1342	200	10	70	84	8.9	485	180		11	0.6	19	545	18	
		808079	7723741	Nov-68	7.80	2000	1200	210	10	94	77		430	187		154	1.0	35	588	252	
		808079	7723741	May-90	7.30	1550	860	233	15	47	24	0.8	340	149		145	0.5	28	216	119	
999	NO 24	795021	7844268	Jul-68	7.75	800	448	44	4	40	34	1.0	126	51	0	22	0.3		308	36	
1142	NO 32 H/S	679450	7891650	May-96	7.40	722	430	27	4	71	35	0.1	56	40	1	340	0.4	23	321	279	28.9
1143	NO 29	685142	7838397	Nov-68	7.70	2900	1880	435	14	92	94	9.4	475	669	0	99	3.5		615	162	
		685142	7838397	May-96	7.10	2930	1990	392	16	131	84	0.6	402	760	0	290	2.9	16	672	238	27.4
1147	NO 35	721537	7745587	Jul-96	7.50	1430	864	121	18	73	67	0.2	176	140	8	458	0.7	53	457	376	
		721537	7745587	Jul-96	7.50	1430	864	121	18	73	67	0.2	176	140	8	458	0.7	53	457	376	30.4
1148	NO 41	718162	7797560	Nov-68	7.70	2400	1470	260	28	88	104	0.9	515	278	0	154	1.0		660	252	
1150	NO 24	724979	7855655	Aug-68	7.75	750	505	36	7	67	37	0.0	72	114	0	126	1.4		336	206	
		724979	7855655	Aug-96	7.70	786	488	36	8	63	39	0.3	63	130	0	272	0.9	22	317	223	
1151	NO 25	710024	7863742	Nov-68	8.00	660	390	29	6	60	32	0.1	48	68	0	131	1.8		274	214	
1152	NO 26	739531	7884399	Jul-68	7.65	650	460	30	6	64	32	0.1	46	88	0	139	0.4		318	228	
		739531	7884399	Nov-82	7.40	760	470	32	7	68	35	0.1	40	98	0	281	0.6		314	230	
		739531	7884399	Jul-96	7.30	709	447	27	5	64	36	0.1	40	99	0	287	0.5	20	308	235	29.4
1153	NO 1 GALLOPOLI	802293	7881078	Jul-68	7.35	850	547	43	5	67	48	0.5	96	73	0	166	0.6		378	272	
1154	NO 7 GALLOPOLI	807574	7892939	Nov-68	7.80	690	380	32	4	56	37	0.2	48	15	0	150	1.7		288	246	
1155	NO 5 GALLIPOLI	809135	7871429	Nov-68	7.80	850	500	47	4	67	53	1.0	118	35	0	176	0.8		380	288	
1156	NO 31 GALLIPOLI	787232	7873027	Jul-68	7.70	650	430	25	6	67	38	0.0	38	43	0	189	0.6		330	310	
1185	NO 5 GOOSE HOLE BORE	786088	7742600	Jul-68	7.50	800	444	26	5	35	39		102	40		28	0.2	25	260	46	
1871	HOMESTEAD	710919	7781410	Oct-59	7.50	1697							480						280	310	
		710919	7781410	Oct-59	7.60			138	17	114	67		280	129	4	400	0.6		437		
		710919	7781410	Feb-95	7.50	2200	1390	224	27	92	92		495	239		251	0.5	26	206	206	
1906	POLICE STATION	760307	7783842	Jan-60			1230	137	13	108	84		235	196	3	453	1.2		614		
		760307	7783842	Sep-62			700			84			50	60		384			384		
1906		760307	7783842	Oct-63	7.80		1208	128	12	112	79		245	195	2	434	1.0		604		
		760307	7783842	Mar-80	7.60	1940	1100	128	12	114	77	0.6	233	214		408	1.6	35	601	335	
2140	NO 15 BORE	748090	7719061	Nov-68	7.90	1000	630	55	22	60	69		86	41	8	254	1.6	70	432	402	
		748090	7719061	Sep-90	8.00	1068	625	58	21	57	69	0.1	86	61	5	492	1.3	60	426	403	
2141	NO 20	733566	7734977	Jul-68	7.90	2000	1025	175	29	12	71	10.0	360	128		49	0.6	28	390	80	
2486	NO.49	658012	7893912	May-96	7.10	1190	727	77	5	80	66	0.2	147	170	1	367	0.7	28	471	301	27.7
2487	SOUDAN NO 19	748774	7787042	Oct-96	8.00	1850	1200	149	10	117	66	0.1	301	330	2	259	0.8	22	563	212	30.0
2634	O'REILLY	736173	7798281	Aug-52			1569	240	0	141	83	0.0	497	231	0	336	1.0		680	0	
2634		736173	7798281	Jul-68	7.55	2300	1411	210	16	135	85	0.1	475	256	0	38	0.8		770	72	
2769	NO 51	666930	7852932	May-96	7.00	4350	2840	502	17	170	163	0.1	1150	620	0	95	0.7	19	1090	78	
		666930	7852932	May-96	6.90	3310	2130	346	12	172	118	0.6	804	430	1	255	0.8	24	914	209	
3125	NO 50	662200	7868000	May-96	7.50	1540	1060	81	6	125	94	33.0	140	430	1	351	0.6	33	698	288	25.2
3126	NO 36 (BOREMAN'S HOUSE)	735779	7866267	Aug-68	7.70	700	483	32	6	70	34	0.1	62	120	0	118	0.8		316	194	
		735779	7866267	Nov-82	7.20	650	440	34	8	72	34	0.1	56	130	0	240	1.0		319	197	
3127	NO 37	706840	7901401	Nov-68	6.20	105	60	9	2	7	3	0.3	14	6	0	20	0.5		32	32	
3128		792100	7907200	Jan-60		866	441	16	3	95	55	0.0	19	21	0	541	0.4		0	0	
3131	OLD NO 42	674370	7818040	Nov-68	7.70	4300	2740	600	41	158	128	0.1	1030	643	0	137	2.5		930	224	
3133	NO 44	724363	7882201	Nov-68	7.70	700	460	31	5	74	40	0.2	56	77	0	150	3.3		344	246	
3135	OLD NO 46	743366	7850390	Aug-68	7.80	680	420	35	6	45	29	3.7	70	117	0	79	0.7		274	130	
3136	NO 47	675954	7895437	Jul-68	6.20	70	61	6	2	3	3	0.6	12	4	0	12	0.0		44	20	
3137	NO 48	684442	7868375	May-96	9.60	427	251	30	4	14	32	0.0	31	62	0	96	0.3	26	166	154	
		684442	7868375	May-96	7.70	635	369	23	5	61	33	0.0	24	56	0	339	0.3	25	288	278	
3156	NO 27	807348	7798639	Jul-68	6.50	1900	1158	180	22	125	69	0.4	385	260	0	9	0.4		535	14	
3157	NO 28 NEW LOVES	790963	7826047	Jul-68	7.70	1000	576	48	5	65	45	0.7	182	86	0	20	0.5		400	32	
3158	NO.4 HERBERT VALE	815260	7889546	Aug-96	7.60	1550	862	73	4	128	94	0.3	242	130	1	395	0.3	17	705	324	
3162	NO 26	740577	7805250	Jul-68	7.80	1250	1025	33	18	70	90	6.0	330	146	0	27	0.7		525	44	
3163	OLD WILFRED BORE	707130	7818537	Aug-68	8.00	2200	1428	320	18	122	55	0.6	425	391	0	107	1.4		495	176	
3180	OLD NO 18	766464	7713498	Jul-68	8.27	1750	1018	185	24	40	84		290	168		35	1.0	20	435	58	
		766464	7713498	Nov-68	8.00	1800	1100	210	27	70	75		290	171	8	230	1.2	47	510	377	
3543	NO 31	780537	7857310	Jul-68	7.65	1000	602	60	6	45	45	0.1	118	152	0	29	0.4		288	48	
		780537	7857310	Dec-62	7.50	694		0	0		0	0.0	62	0	0	0	0.0		300	240	
3548	NO 25	791996	7857657	Dec-62	6.80	815		0	0		0	0.0	83	0	0	0	0.0		350	0	
		791996	7857657	Jul-68	7.50	800	483	55	12	20	48	0.0	120	117	0	13	0.4		286	22	
		791996	7857657	Nov-68	7.70	750	470	43	5	67	42	0.9	90	97	0	124	1.0		332	204	
3549	NO.35	778044	7845690	Jul-63	7.60		568	0	0	78	0	0.0	110	76	0	248	0.0		344	0	
3662	NEW TOP BORE NO 1	791093	7766760	Jul-68	7.70	1050	633	85	7	50	36		174	106		27	0.8	20	364	44	
3663	NO 10	799711	7717674	Jul-68	7.70	3850	2798	265	8	260	168	0.2	1130	320	1	15	1.0	12	1360	24	
3727	NO 2A	775200	7790200	Nov-68	8.10	900	680	75	6	70	35	0.4	130	105	0	120	1.5		320	196	
3805	NO 4	736389	7823932	Nov-68	7.90	750	510	43	7	66	33	0.1	78	122	0	111	0.8		314	182	
		736389	7823932	Aug-69	7.10	1350	880	257	12	38	20	0.1	200	110	0	459	0.4		190	376	
3828	NO 17 REPLACEMENT	768083	7760292	Jul-68	7.55	2000	1195	195	24	65	77		345	212	7	49	0.4	10	580	80	
		768083	7760292	Jul-68	7.50	1700	1019	150	12	90	59		310	250		21	0.6	27	505	34	
3890	GIDYEA JOB 17 NO 1	701639	7808133	Aug-63	7.40	1275		0	0			0.0	450	0	0		0.0		340	292	
4032	NO 32 WALKER'S BORE	800513	7773039	Jul-68	7.55	850	480	80	6	70	31	4.9	100	66		22	0.6	15	282	36	
4056	NO 3A	774191	7768371	Nov-68	8.00	2200	1400	205	11	138	81	0.1	490	266	11	117	1.8	23	690	192	
4057	NEW NO 9	765667	7810955	Jul-68	7.55	900	608	42	6	70	35	2.5	128	104	0	12	1.1		362	30	
4082	NO 34	784103	7836386	Aug-63	7.70		602	0	0	59		0.0	120	67	0	232	0.0		290	0	
		784103	7836386	Jul-68	7.55	850	490	37	5	55	39	0.0	112	78	0	23	0.3		360	38	
4112	School Bore No 52	680003	7891971	May-96	7.30	1060	635	54	4	97	49	0.0	113	75	4	426	0.5	37	443	349	
4113	NO 53	663324	7883086	May-96	8.10	1420	984	109	11	50	99	0.1	137	500	1	177	0.8	5	531	145	

BORE RN	BORE NAME	EASTING	NORTHING	DATE SAMPLED	pH	ELECTRICAL CONDUCTIVITY	TOTAL DISSOLVED SOLIDS	SODIUM	POTASSIUM	CALCIUM	MAGNESIUM	IRON	CHLORIDE	SULPHATE	NITRATE	BICARBONATE	FLUORIDE	SILICA	HARDNESS	ALKALINITY	TEMPERATURE DEGREES C
		663324	7883086	May-96	7.60	1320	925	73	8	125	65	0.6	93	350	0	384	0.8	22	579	315	
4287	No. 56	770485	7875986	Jul-68	7.55	650	378	20	6	55	34	2.8	24	34	0	181	0.7		298	296	
		770485	7875986	Nov-82	7.00	540	380	38	10	16	50	0.1	54	71	0	235	0.9		245	193	
		792704	7722830	Jul-68	7.82	1900	1113	165	11	76	62	1.7	405	120		22	1.0	11	470	36	
5087	OLD NO 7	769241	7874956	Nov-68	7.40	2250	1540	155	10	182	100	7.4	505	356	0	77	0.6		880	127	
5956	No. 59	660269	7834197	Oct-96	7.50	3120	1840	469	47	111	64	0.2	640	440	7	245	1.6	35	540	201	30.0
5958	No. 61	737488	7835902	Oct-96	7.00	793	492	42	6	55	38	0.1	23	150	1	188	0.7	19	293	154	30.0
5962	No. 36	806770	7848853	Nov-68	8.00	520	290	27	4	42	29	0.3	38	30	0	121	0.9		224	198	
5964	NO 25 MONKEY POINT	802573	7743012	Jul-68	7.70	1550	889	135	12	65	88	1.2	295	148		24	0.4	9	470	40	
6166	LILLY HOLE NO 32	785574	7760292	Nov-96	7.40	1600	975	139	9	95	56	0.2	286	220	1	257	0.8	22	467	211	30.0
6511		734400	7916800	May-69	7.60	670	390	25	7	66	43	6.8	18	65	0	346	0.8		334	284	
		734400	7916800	Jul-69	7.45	500	320	25	5	42	35	36.0	26	28	0	283	0.3		232	232	
6756	No. 58	759577	7856110	Aug-68	7.90	670	422	28	6	60	29	0.0	46	81	0	129	0.8		286	212	
6757	NO 55 GALLIPOLI	753563	7878169	Nov-68	7.90	530	290	19	6	40	34	11.1	22	43	0	131	0.9		242	214	
		753563	7878169	Aug-68	7.90	560	331	21	7	30	37	0.0	24	71	0	128	0.7		284	210	
6759	No. 27	749277	7806576	Oct-96	7.20	1410	849	99	9	96	58	0.6	216	220	2	229	1.0	20	478	188	30.0
6762	No. 23	748409	7727417	Jul-68	8.00	2050	1071	230	126	4	59	5.0	245	140		76	1.2	18	250	124	
		748409	7727417	Nov-96	7.70	2290	1440	346	28	78	76	3.1	264	320	5	743	1.4	50	507	609	30.0
6765	No. 21	766115	7741197	Jul-68	7.55	2000	1046	205	29	15	71	4.7	290	172		51	0.8	39	300	84	
9198	STAND BY BORE	760000	7784000	Nov-78	8.10	1600	990	128	12	100	75	3.3	250	191	1	366	1.4	33	558	300	
9814	REPLACEMENT NO 23	723019	7836416	Jul-79	7.30	880	520	54	9	60	36	0.8	93	128	0	204	1.4		298	167	
9815	REPLACEMENT RANKEN	700619	7831289	Jul-79	7.10	2530	1470	302	25	87	69	0.5	397	440	0	195	4.0		501	160	
		700619	7831289	Jul-79	7.60	2490	1440	294	19	84	68	0.6	384	440	0	190	4.0		488	156	
9816	2ND ATTEMPT REPLACE	700587	7831332	Jul-79	7.30	3800	2240	470	25	146	87	0.3	617	670	0	268	4.5		722	220	
		700587	7831332	Jul-79	7.30	3790	2180	468	25	144	86	0.2	620	670	0	268	4.5		713	220	
9817	HOMESTEAD (DUPLICATE)	679750	7891600	Jul-79	7.60	570	290	15	4	48	34	3.4	20	19	0	310	0.5		259	254	
		679750	7891600	Jul-79	7.70	540	270	16	5	43	34	2.8	19	19	0	292	0.5		247	239	
9819		679750	7906000	Jul-79	7.90	680	360	16	8	57	42	4.9	18	43	0	366	0.6		315	300	
14330	A55/85 (No. 35)	742346	7743745	May-85	7.90	2320	1390	252	25	92	76	3.6	440	233	7	314	0.8	54	542	258	
		742346	7743745	May-85	7.90	2760	1710	318	27	105	91	0.5	550	332	7	310	0.9	52	636	254	
14379	BARKLEY HIGHWAY NO 1 ROAD BORE	730879	7786016	Feb-86	8.00	1880	1125	140	15	103	81	4.4	390	193	4	248	1.7	23	590	203	
14380	BARKLEY HIGHWAY NO 2 (No 109)	742291	7784681	Nov-96	8.00	2620	1700	268	18	155	94	2.3	576	300	5	284	0.6	23	773	233	30.0
14381	BARKLEY HIGHWAY NO 3	750652	7784297	Feb-86	8.10	995	650	64	8	66	45	6.8	140	149	1	196	1.1	22	350	161	
14605	A107/2 (POISON BORE A)	808572	7705294	Feb-86	7.60	4350	2800	498	18	185	171	5.1	1020	483	8	342	0.8	44	1164	281	
		808572	7705294	Nov-96	7.80	4630	3130	548	19	151	191	0.2	1170	580	2	285	0.6	36	1160	234	23.0
14758	No 3 SHAKES PEAR CREEK	787225	7753399	Nov-91	7.70	1570	927	141	9	107	54	0.7	278	187	1	247	1.0	17	490	203	
15706	NO 33 DUCK HOLE BORE	767993	7722802	Nov-96	7.70	2810	1860	321	21	122	102	0.5	494	520	6	395	0.8	44	723	324	27.0
15707	NO 34 BORE	773491	7714106	Sep-90	8.00	1735	1015	192	26	45	76	0.1	260	222	2	368	0.9	43	425	301	
16240	AVON DOWNS POLICE STATION	760318	7783798	Mar-80	7.20	1950	1000	124	11	116	77	28.0	225	208	1	412	1.5		606	338	
		760318	7783798	Mar-80	7.20	1950	1000	124	11	116	77	0.4	225	208	1	412	1.5	28	606	338	
		760318	7783798	Mar-80	7.50	1970	1060	125	11	117	76	0.5	229	211	1	415	1.5	29	605	340	
		760318	7783798	Apr-81	7.10	1820	1130	130	11	118	72		244	208	1	409	1.5	33	590	335	
		760318	7783798	Apr-81	7.10	1820	1130	130	11	118	72		244	208	1	409	1.5	33	590	335	
		760318	7783798	Sep-89	7.50	1615	975	127	10	114	72	0.1	238	197	1	397	1.2	34	580	325	
		760318	7783798	Sep-89	7.50	1615	975	127	10	114	72	0.1	238	197	1	397	1.2	34	580	325	
16243	A2/80 (No 86)	715316	7783129	Jul-96	7.10	1950	1210	166	18	121	73	1.1	371	190	1	384	0.6	29	602	315	34.2
16243		715316	7783129	Nov-96	7.70	1950	1190	158	18	115	71	0.2	362	190	1	388	0.6	30	579	318	34.0
16244	ROADS BORE NO1	696357	7779112	Nov-80	7.30	710	450	52	12	49	24	1.1	80	68	15	201	1.2	46	221	165	
		696357	7779112	Jan-81	7.40	910							44			519			435	426	
		696357	7779112	Jan-81	7.30	910	570	31	11	98	46		40	30	15	519	1.1	62	434	426	
16255		741524	7757619	Aug-84	7.60	1570	980	144	13	86	58	4.4	290	175	2	253	0.8	39	453	207	
16256	No. 33	756617	7742928	Aug-84	7.40	1330	840	118	9	70	57	2.1	180	228	3	264	0.4	18	409	217	
16257	A24/84 (No 103)	727206	7768742	Jul-84	7.60	4200	2560	520	21	160	142	0.9	1040	400	9	349	0.4	74	982	286	
16491	NO 25 BORE REPLACEMENT	744069	7765307	Nov-96	7.40	2200	1370	173	17	111	86	1.8	480	230	4	254	1.1	28	630	208	30.0
16620	No 70	710352	7768740	Nov-96	7.60	2620	1580	270	16	138	102	0.1	554	240	9	456	0.6	56	763	374	33.0
16886	MONITORING S	710954	7781308	Oct-96	7.20	2190	1350	215	14	145	112	0.0	543	203	11	218	1.3	17	823	179	
		710954	7781308	Oct-96	7.20	1410	852	135	18	72	75	0.0	248	151	3	300	0.9	17	488	246	
		710954	7781308	Oct-96	7.20	1430	880	160	17	91	61	0.0	243	149	4	311	0.8	17	479	255	
16887		773118	7696004	Nov-96	6.40	1050		98	18	49	69	0.0	57	107	0	452	0.5	13			
		773118	7696004	Nov-96	6.00	977	590	92	25	45	67	0.0	44	83	0	470	2.4	17	388	385	
		773118	7696004	Nov-96	6.50	1140		90	20	49	76	0.0	92	88	0	490	1.6	15			
20399		770183	7911718	Jul-80	8.00	710	380	51	6	28	44	0.7	72	36	0	290	1.0		250	238	
20482	92 BORE	694239	7840182	Aug-80	7.20	4060	2610	504	38	128	142	0.2	780	795	0	326	3.5		902	267	
20569	No..90	680289	7810869	Sep-80	7.90	3270	2010	495	18	112	63	0.5	662	480	0	268	3.2		538	220	
		680289	7810869	Oct-96	7.60	2920	1690	387	18	110	65	0.2	553	450	0	312	2.0	14	542	256	34.0
20570	No. 91	685316	7826237	Sep-80	7.60	6190	4110	858	46	257	185	2.1	1500	960	0	292	2.7		1402	239	
		685316	7826237	Sep-80	7.50	6210	4120	865	44	248	189	0.9	1490	1000	0	234	2.4		1395	192	
		685316	7826237	Nov-82	7.10	9300	6020	1185	105	404	274	0.3	2270	1620	0	249	3.9		2160	204	
		685316	7826237	Nov-82	6.80	6130	3900	824	68	273	163	3.9	1390	960	0	321	2.9		1351	263	
		685316	7826237	Nov-82	7.20	9320	6050	1270	90	412	268	0.5	2190	1600	0	277	3.9		2129	227	
		685316	7826237	Oct-96	7.50	5710	3700	738	38	218	164	6.6	1370	870	1	275	1.4	20	1220	226	
20571	No. 93	687277	7859587	Sep-80	7.90	910	520	68	10	49	44	0.6	68	113	0	293	1.6		303	240	
		687277	7859587	Sep-80	7.70	1540	870	267	9	24	24	0.4	240	180	0	287	5.2		158	235	
		687277	7859587	Aug-96	7.60	711	399	35	6	56	37	0.2	55	85	0	299	0.7	18	292	245	
20572	No. 94	712250	7825733	Sep-80	7.10	2220	1360	265	13	124	45	3.0	418	315	0	226	3.1		495	185	
		712250	7825733	Sep-80	7.20	1530	950	141	13	90	54	20.0	270	238	0	189	2.4		446	155	
20573	No. 95	748630	7839305	Oct-80	7.90	1390	810	121	9	52	71	0.3	290	208	0	88	1.4		421	72	
20575	No. 97	704013	7891369	Oct-80	7.60	630	370	48	4	43	28	1.0	58	58	0	238	2.2		223	195	
20576	No. 98	671445	7880710	Oct-80	8.10	838	460	91	7	43	35	0.6	94	47	0	336	0.7		252	276	

BORE RN	BORE NAME	EASTING	NORTHING	DATE SAMPLED	pH	ELECTRICAL CONDUCTIVITY	TOTAL DISSOLVED SOLIDS	SODIUM	POTASSIUM	CALCIUM	MAGNESIUM	IRON	CHLORIDE	SULPHATE	NITRATE	BICARBONATE	FLUORIDE	SILICA	HARDNESS	ALKALINITY	TEMPERATURE DEGREES C
		671445	7880710	May-96	7.00	477	267	10	3	50	26	0.1	11	26	1	286	0.3	25	232	235	
20579	No..88	726861	7792245	Sep-80	7.70	3060	1900	286	19	180	114	0.6	700	390	0	226	0.7		917	185	
		726861	7792245	Oct-96	7.70	2050	1290	151	15	125	78	0.1	388	220	6	301	0.6	25	632	247	31.0
20580	No. 89	692132	7802887	Sep-80	7.50	2830	1670	275	17	164	101	0.9	622	355	0	206	0.9		824	169	
20675	NO 2 BARKLY HWY	672131	7788329	Jan-81	7.30	1490		0	0			0.0	204	0	0	397	0.0		505	326	
		672131	7788329	Dec-80	7.80	1510	940	133	25	75	62	1.1	224	174	0	336	0.8		442	276	
		672131	7788329	Jan-81	7.40	1540	1020	125	18	104	62	1.0	226	162	0	418	0.9		514	343	
20699	NO 42 REPLACEMENT	674367	7818014	Nov-80	7.70	4720	2870	700	47	140	123	10.0	1050	729	0	250	3.1		854	205	
21896	NO. 100 GALLIPOLI	745043	7895752	Nov-82	7.10	860	590	85	14	64	34	1.4	110	118	0	287	1.1		299	235	
21897	No.. 101	765560	7865399	Nov-82	7.00	2090	1510	418	11	87	31	5.7	460	370	0	257	1.2		345	211	
21899	DUPLICATE NO.18	701608	7793009	Jul-96	7.20	1880	1130	168	20	104	72	0.1	329	220	6	376	0.6	22	555	308	31.5
22245	No. 44	779684	7847682	May-83	8.30	840	510	51	8	45	51	1.8	100	127	0	183	0.6		322	150	
22247	No. 45	792553	7800946	Jun-83	7.60	780	480	55	7	54	40	1.8	70	67	0	304	0.6		299	249	
		792553	7800946	Jun-83	8.00	790	470	56	7	54	40	11.0	64	68	0	304	0.6		299	250	
23298		768037	7825026	Aug-84	7.50	1500	940	131	25	68	62	0.7	240	115	0	382	0.4		424	313	
23299	No. 46	799968	7829954	Oct-84	7.90	640	390	33	4	50	31	1.7	65	70	0	205	0.9		252	168	
23356	No 36	735407	7812506	May-85	7.90	940	560	63	8	64	39	4.7	125	131	0	204	1.2		324	167	
23357	No.. 37	767790	7829783	May-85	7.80	1080	680	71	7	83	49	0.0	130	194	0	247	0.7		409	203	
23358	No. 82	753625	7795980	May-85	7.80	820	540	44	6	66	36	10.0	96	128	0	207	0.9		313	170	
23361	No..106	734422	7902261	Jul-85	7.90	790	460	56	7	54	41	0.0	70	88	0	294	0.5		303	241	
23895	No. 107	712036	7801692	Jul-85	7.80	2340	1450	228	22	119	84	2.1	460	256	0	318	0.8		642	261	
23909		782150	7916600	Apr-86	8.30	590	360	23	5	25	51	0.0	24	30	0	340	0.2		270	277	
24814	No. 112	776586	7868096	May-96	7.10	665	371	23	6	64	35	0.0	31	54	0	349	0.8	24	304	286	
25700		800850	7911000	May-88	7.90	615		0	0			0.0	13	0	0	399	0.0		345	327	
25863	DUPLICATE NO.74A	716714	7891465	May-96	7.30	642	376	27	5	63	33	0.0	29	48	1	354	0.2	22	293	290	
25868	WONARA COMMUNITY			Jun-97	6.70	1520	903	119	17	88	62	0.3	221	160	3	431	0.7	21	474	354	32.0
25992	NO. 1 GALLIPOLI (replacement)	802257	7881243	May-96	7.40	2040	1300	137	6	159	94	0.2	309	320	12	393	0.6	25	783	322	
26213	No. 80	712163	7815982	Oct-96	7.50	2570	1620	327	17	100	68	0.7	470	450	2	264	2.4	22	529	217	
26215	No..83	706582	7852094	Aug-96	7.70	887	510	74	8	48	38	0.1	87	150	1	244	3.2	15	276	200	
27943	DUPLICATE ROCKLANDS WEST	782150	7792192	Nov-91	8.00	1500	867	136	7	81	57	4.8	230	171	0	193	0.9		437	158	
28123	DUPLICATE WILFRED BORE	707120	7818518	May-92	7.60	2220	1300	284	14	93	54	1.2	312	363	0	315	1.1		455	258	
28448	No..66	654884	7844100	Jun-96	7.60	9590	6370	1330	125	296	355	0.0	2380	1500	4	298	1.1	37	2200	244	
29369	3/94	673975	7894408	Sep-94		237	153	8	5	15	15	1.4	14	12	1	118	0.4		99	97	
		673975	7894408	Aug-96	6.60	211	120	15	6	10	10	0.1	12	9	1	104	0.3	16	66	85	
29370		737000	7916000	Sep-94		656	387	27	8	53	38		37	80	1	301	0.7		289	247	
29371	WILFRED CK. BORE	813277	7903859	Sep-94		775	422	28	4	53	62	15.7	63	37	1	397	0.3		388	326	
30667	NO. 77 GA	767832	7884645	Jul-96	7.20	1670	1100	145	7	123	65	0.9	181	400	6	348	0.7	23	574	285	28.4
30850		736704	7804365	Oct-96	7.20	1900	1180	234	19	108	76	0.0	343	260	3	281	1.0	11	583	230	
		736704	7804365	Oct-96	6.90	2030	1290	230	20	142	79	0.0	374	258	3	364	0.9	13	680	298	
30851		675630	7853387	Oct-96	7.40	2830	1610	274	9	140	123	0.0	620	339	0	208	1.4	10	855	170	
		675630	7853387	Oct-96	7.10	2960	1630	280	9	146	126	0.0	612	348	0	211	1.2	10	883	173	
		675630	7853387	Oct-96	6.90	2240	1230	192	7	111	98	0.0	427	293	0	208	2.0	8	680	170	
		675630	7853387	Oct-96	7.40	2310	1290	210	8	115	103	0.0	451	312	0	179	1.7	7	711	147	
30852	BAGPIPE	727112	7896026	Oct-96	7.00	838	457	56	5	47	48	0.0	60	104	0	272	0.8	8	315	223	
		727112	7896026	Nov-96	7.50	649	354	23	2	48	45	0.0	36	62	0	276	0.4	9	305	226	
30853		813945	7863600	Nov-96	6.10	631	312	39	0	39	36	0.0	43	26	0	258	0.5	10	245	211	
		813945	7863600	Nov-96	6.70	829	420	66	0	38	38	0.0	102	41	0	268	1.1	10	251	220	
		813945	7863600	Nov-96	6.20	465	226	0	0	31	39	0.0	12	9	0	271	0.4	10	238	222	
30899	NO.5 NEV	774439	7801658	Jun-94	6.80	1680	1040	177	7	110	54	0.0	301	272	4	213	1.0	12	497	175	

REPORT ON CHEMICAL WATER QUALITY OF BORE RN 30853 (near DARIEL GATE), ROCKLANDS STATION
drilled by Water Resources Branch, DLPE, Alice Springs in November 1996

BORE_Registered Number	30853	
EASTING	813945E	Zone 53, AGD 66
NORTHING	7863600N	
DATE SAMPLED	Nov-96	
Conductivity (µS/cm)	465	
pH	6.20	
Temperature (ºC)	-	
Alkalinity	222	
Bicarbonate	271	
Hardness	238	
Carbonate Hardness	222	
Non-carbonate Hardness	16.00[i]	
Total Dissolved Solids	226	
Calcium	31	
Chloride	12	
Magnesium	39	
Nitrate	0	
Potassium	0	
Sodium	0	
Sulphate	9	
Fluoride	0.40	
Iron	0.00	
Silica	10	
Strontium	0.28	
Manganese	3.30	
Bromide	-	
Lithium	-	
Iodide	-	

Standing Water Level 85.9 metres below ground level

Airlift Yield of 1.6 Litres per second from Drill pipe inlet of 99.5 metres (after hole cased)

BORE_RN	30853
EASTING	813945
NORTHING	7863600
DATE SAMPLED	Nov-96
Conductivity (µS/cm)	829
pH	6.70
Temperature (ºC)	_
Alkalinity	220
Bicarbonate	268
Hardness	251
Carbonate Hardness	220
Non-carbonate Hardness	31.20
Total Dissolved Solids	420
Calcium	38
Chloride	102
Magnesium	38
Nitrate	0
Potassium	0
Sodium	66
Sulphate	41
Fluoride	1.10
Iron	0.00
Silica	10
Strontium	0.48
Manganese	8.30
Bromide	-
Lithium	
Iodide	-

Airlift yield of 1 litre per second from drill pipe inlet of 110 metres (open hole, before cased)

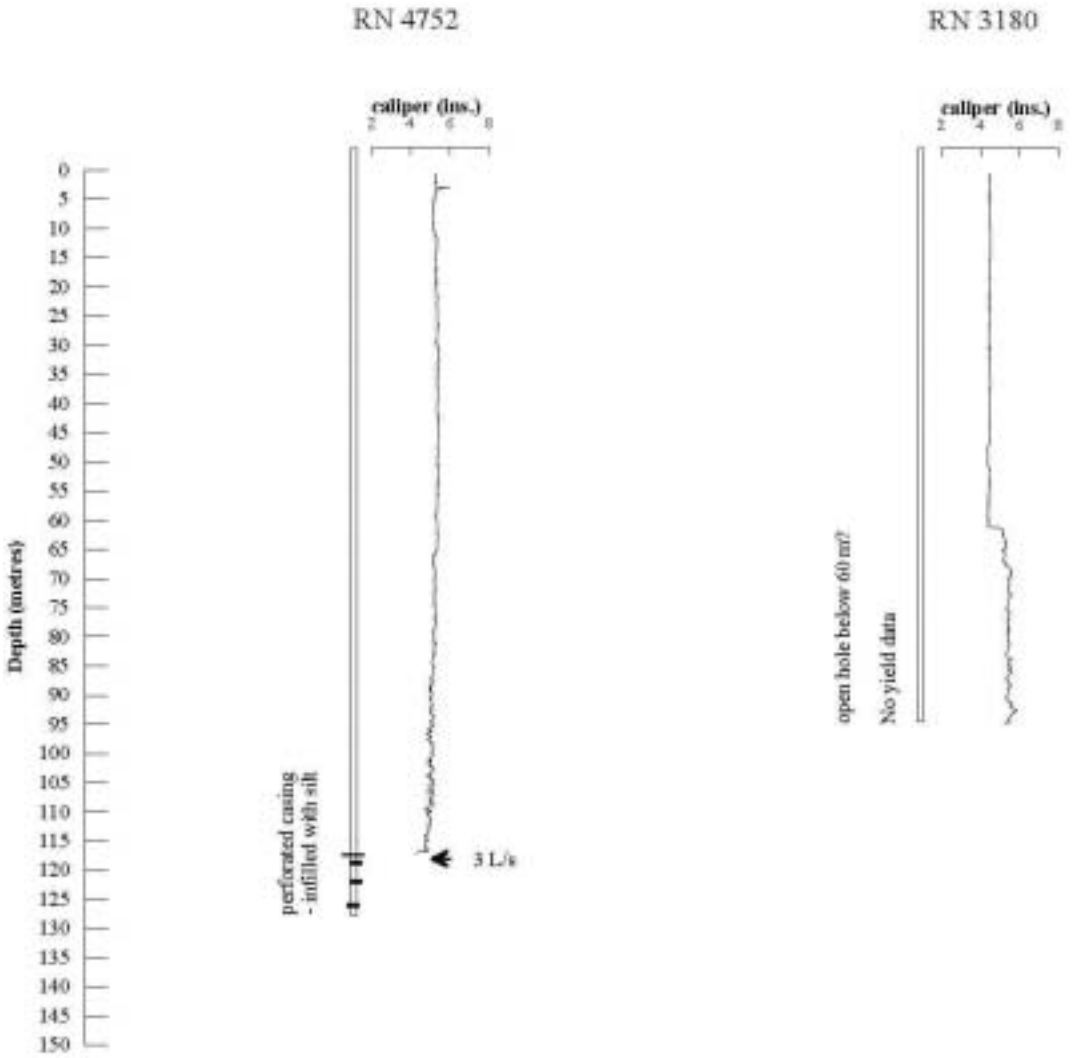
BORE_RN	30853
EASTING	813945
NORTHING	7863600
DATE SAMPLED	Nov-96
Conductivity (µS/cm)	631
pH	6.10
Temperature (ºC)	-
Alkalinity	211
Bicarbonate	258
Hardness	245
Carbonate_Hardness	211
Non-carbonate_Hardness	34.10
Total Dissolved Solids	312
Calcium	39
Chloride	43
Magnesium	36
Nitrate	0
Potassium	0
Sodium	39
Sulphate	26
Fluoride	0.50
Iron	0.00
Silica	10
Strontium	0.43
Manganese	3.10
Bromide	-
Lithium	-
Iodide	-

Airlift yield of 2 Litres per second from drill pipe inlet of 103 metres (open hole, before cased)

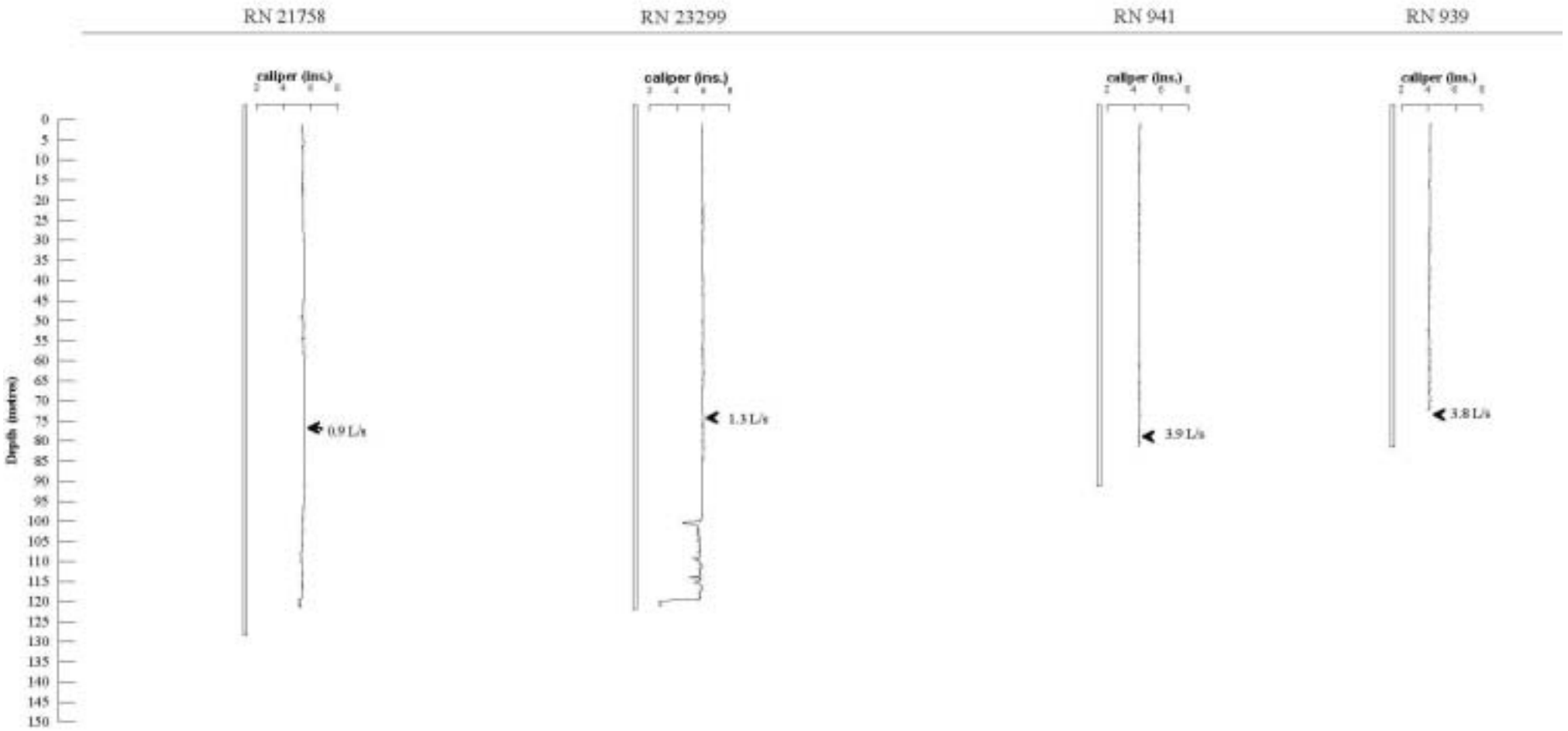
APPENDIX E

GEOPHYSICAL LOGS

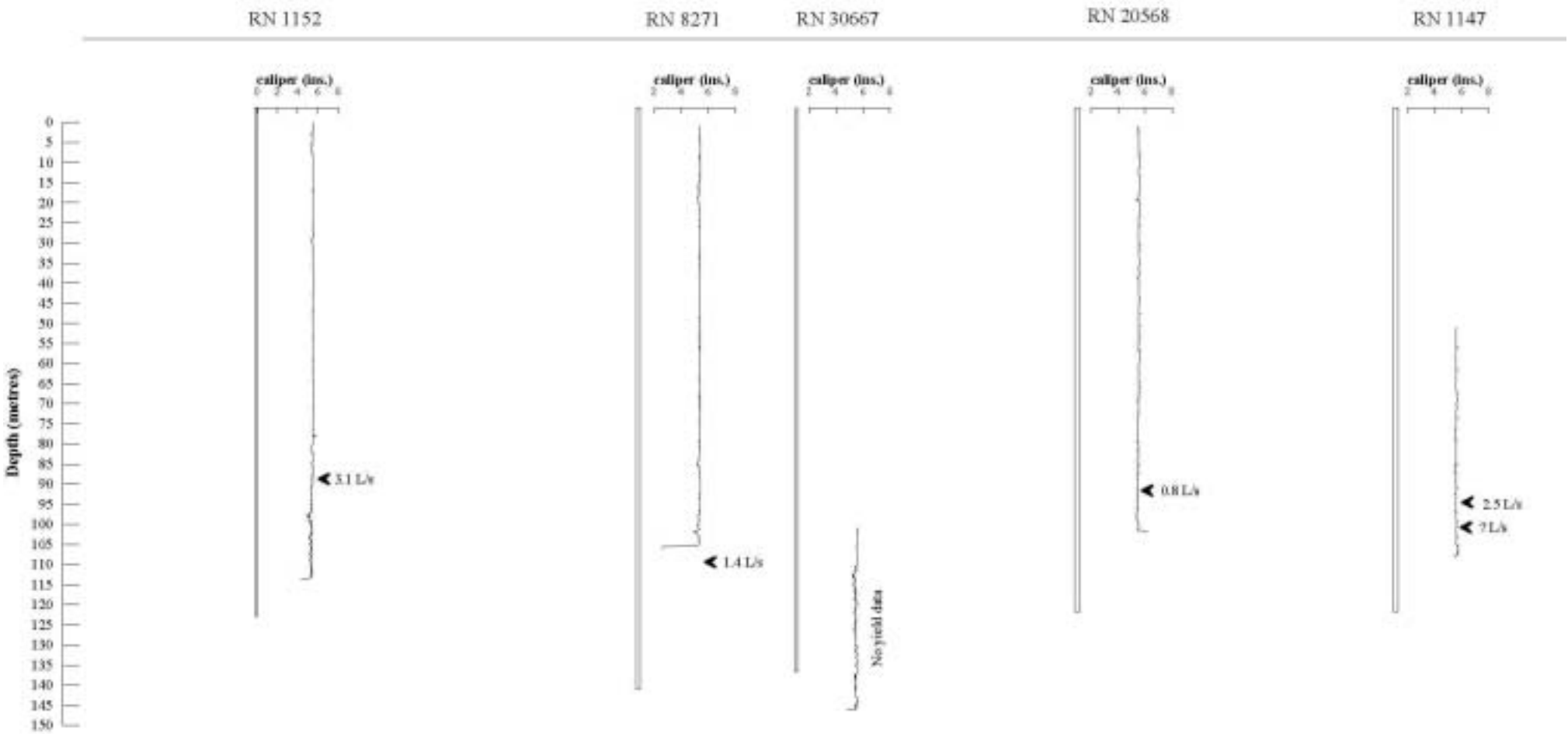
CALIPER LOGS ON CASED BORES - AVON DOWNS & BURRAMUURA



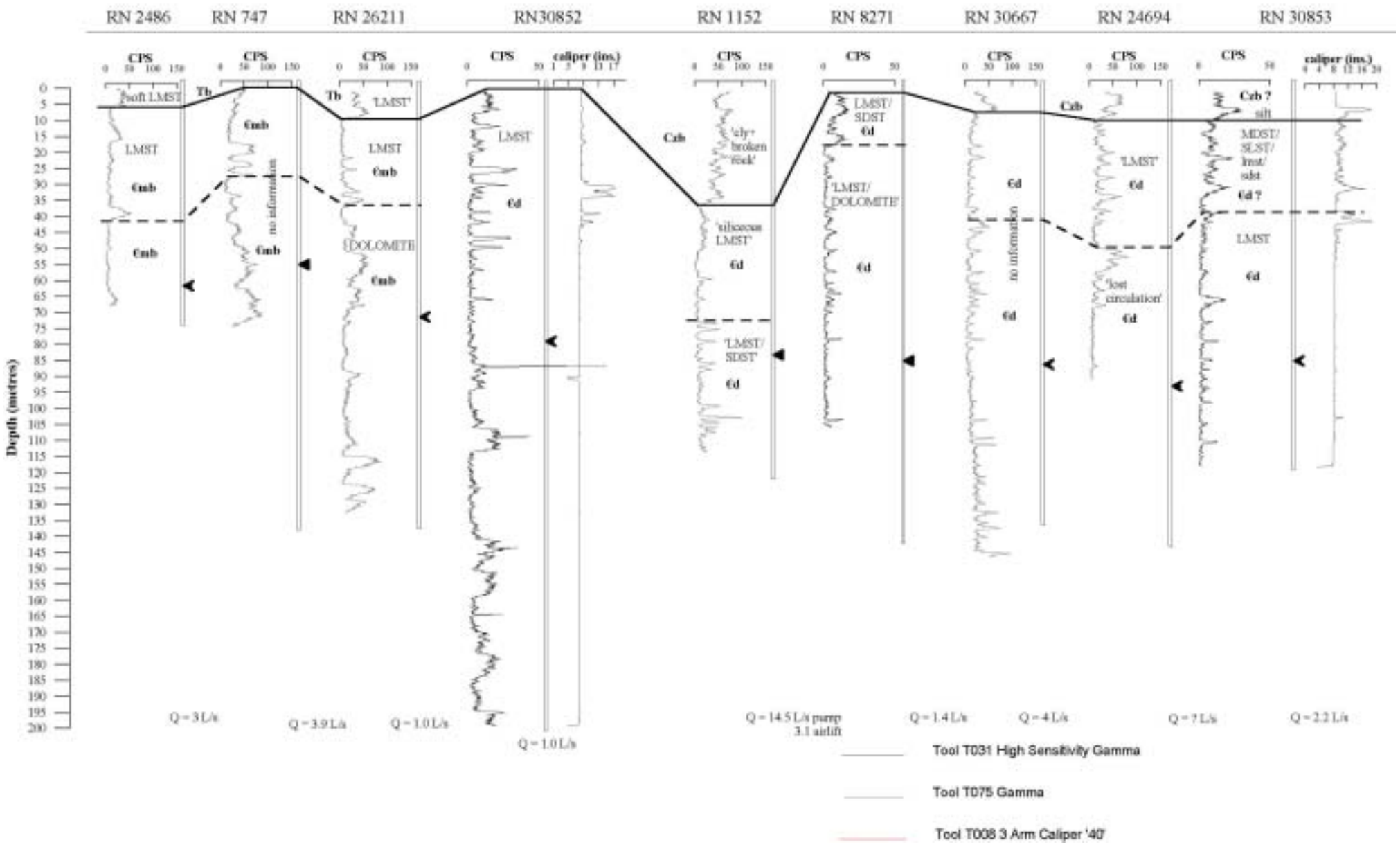
CALIPER LOGS ON CASED BORES - ROCKLANDS STATION



CALIPER LOGS ON CASED BORES - ALEXANDRIA STATION

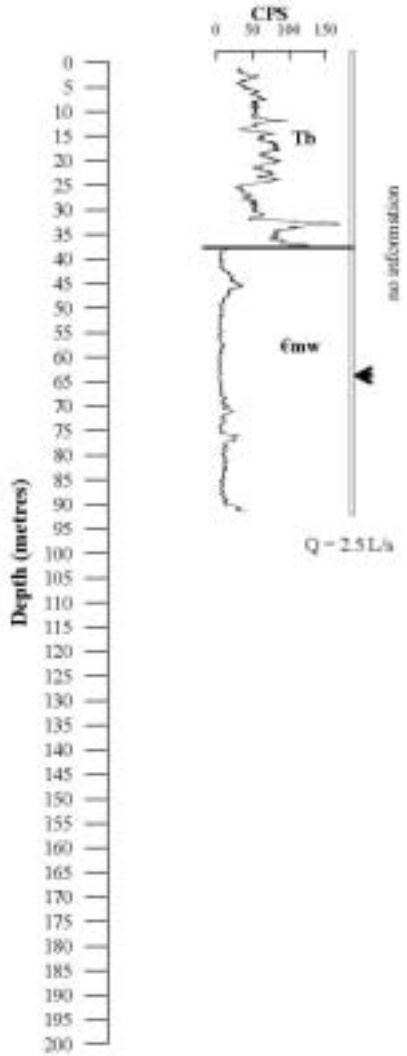


TRANSECT 1 - ALEXANDRIA STATION



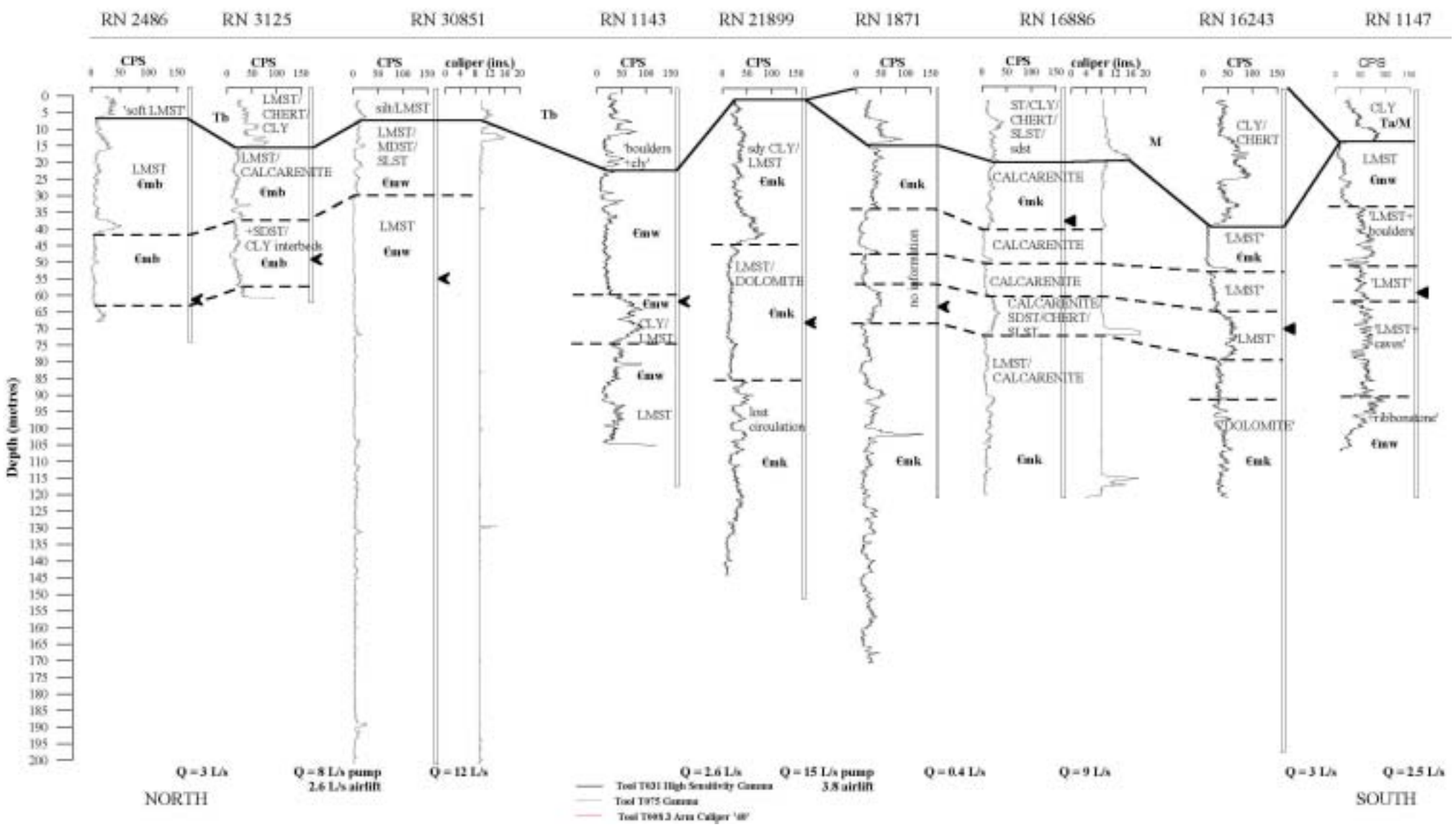
TRANSECT 1A - ALEXANDRIA STATION

RN 28448

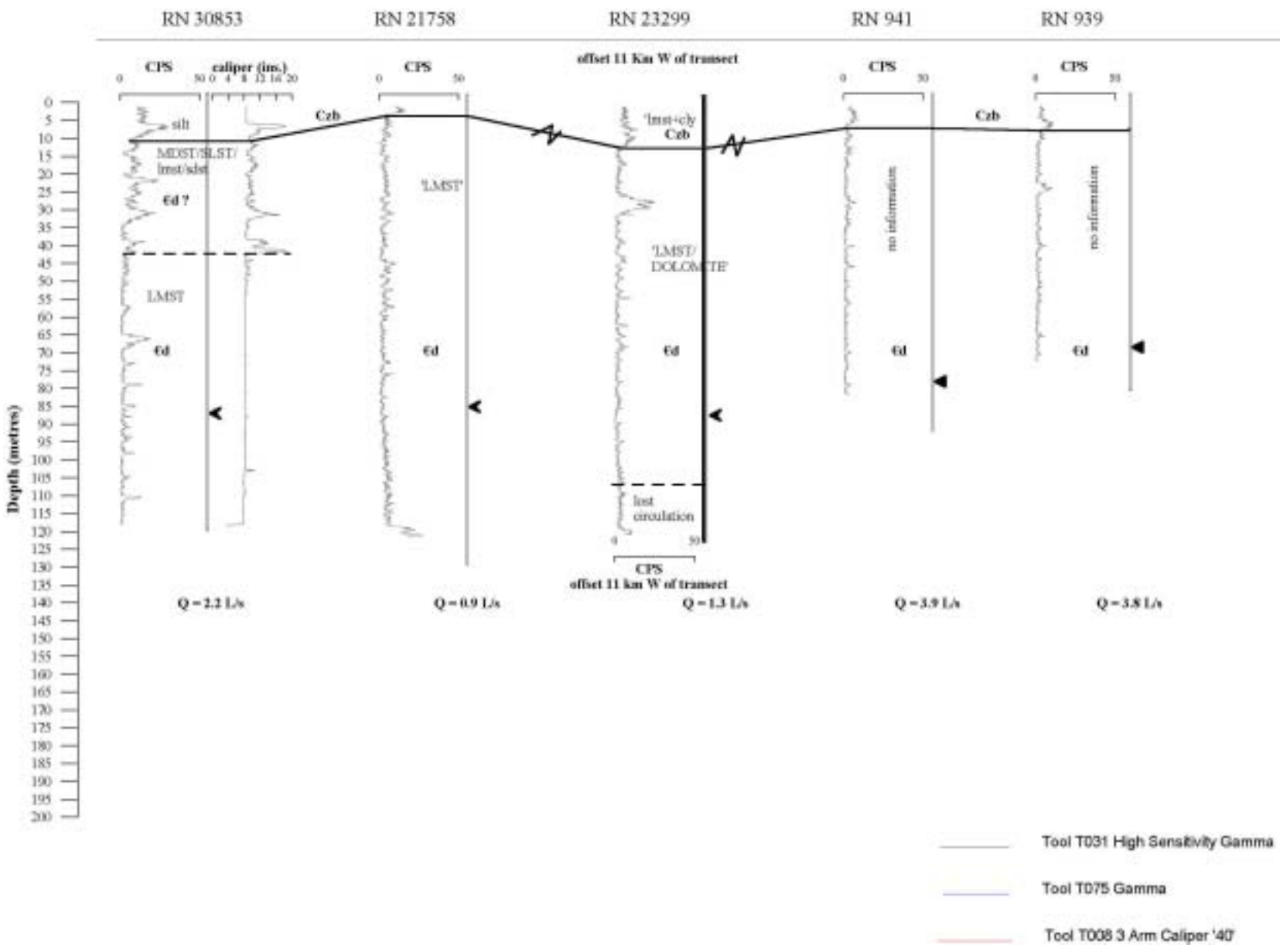


Tool T031 High Sensitivity Gamma

TRANSECT 2 - ALEXANDRIA STATION



TRANSECT 3 - ROCKLANDS STATION

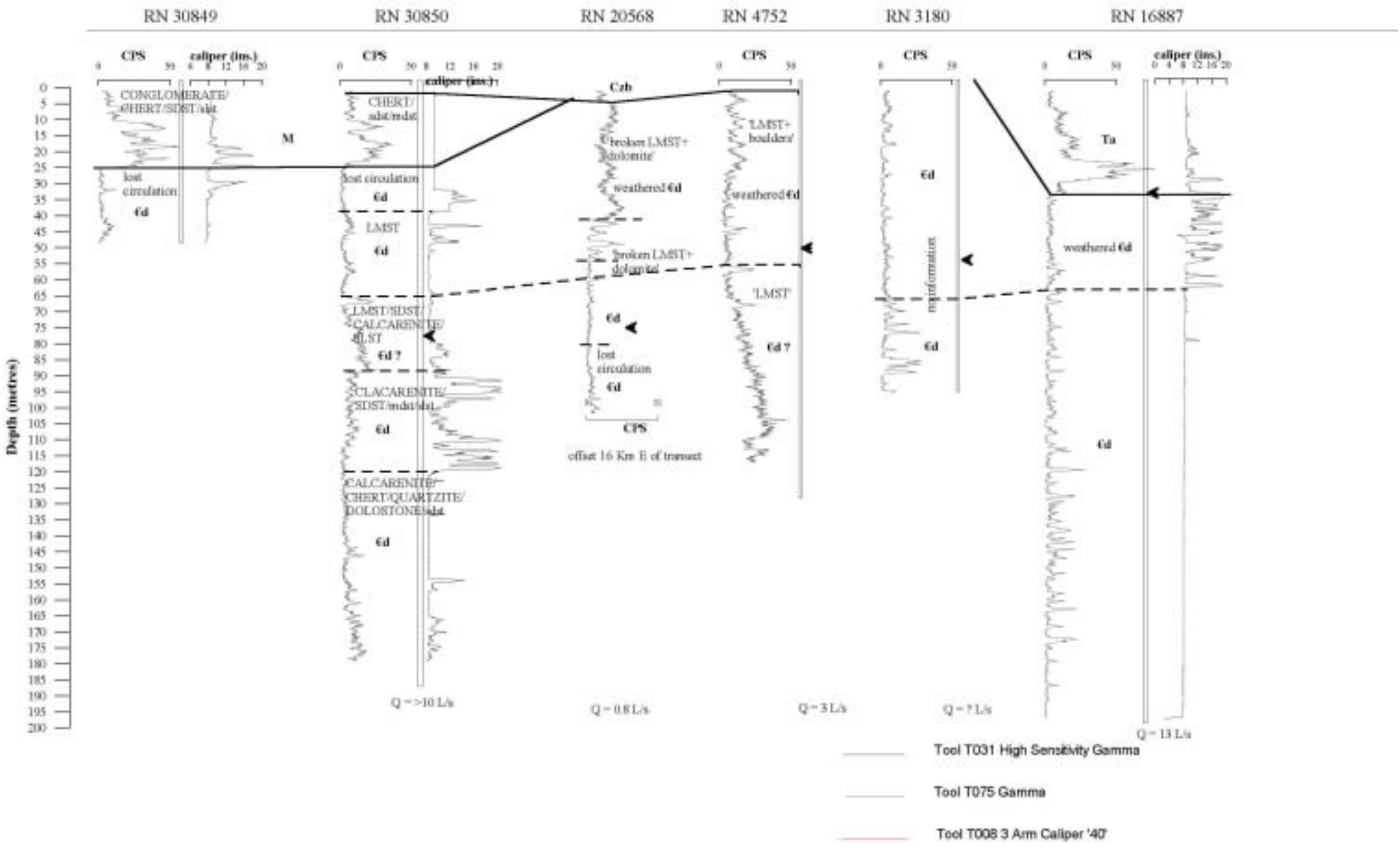


Tool T031 High Sensitivity Gamma

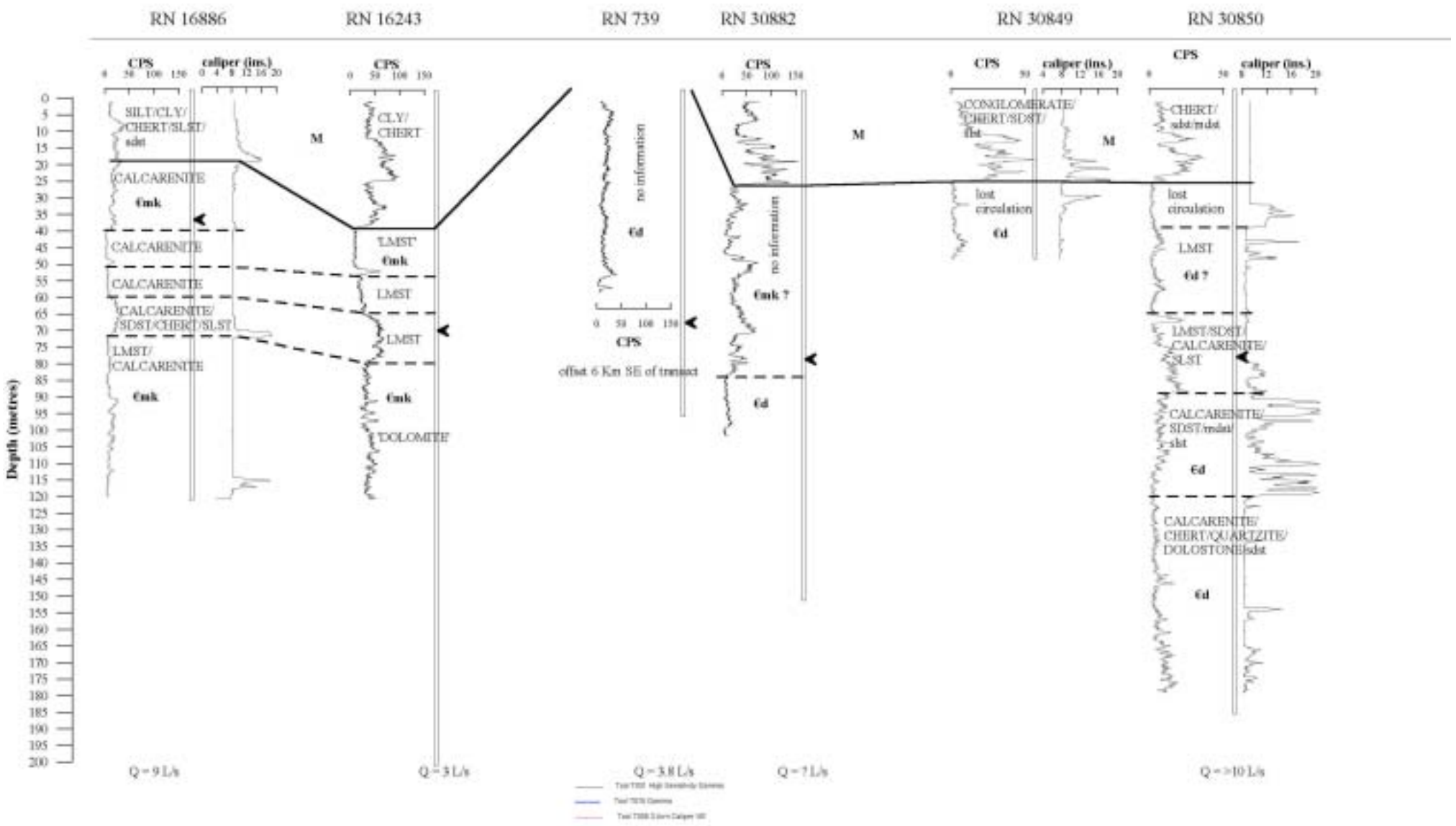
Tool T075 Gamma

Tool T008 3 Arm Caliper '40'

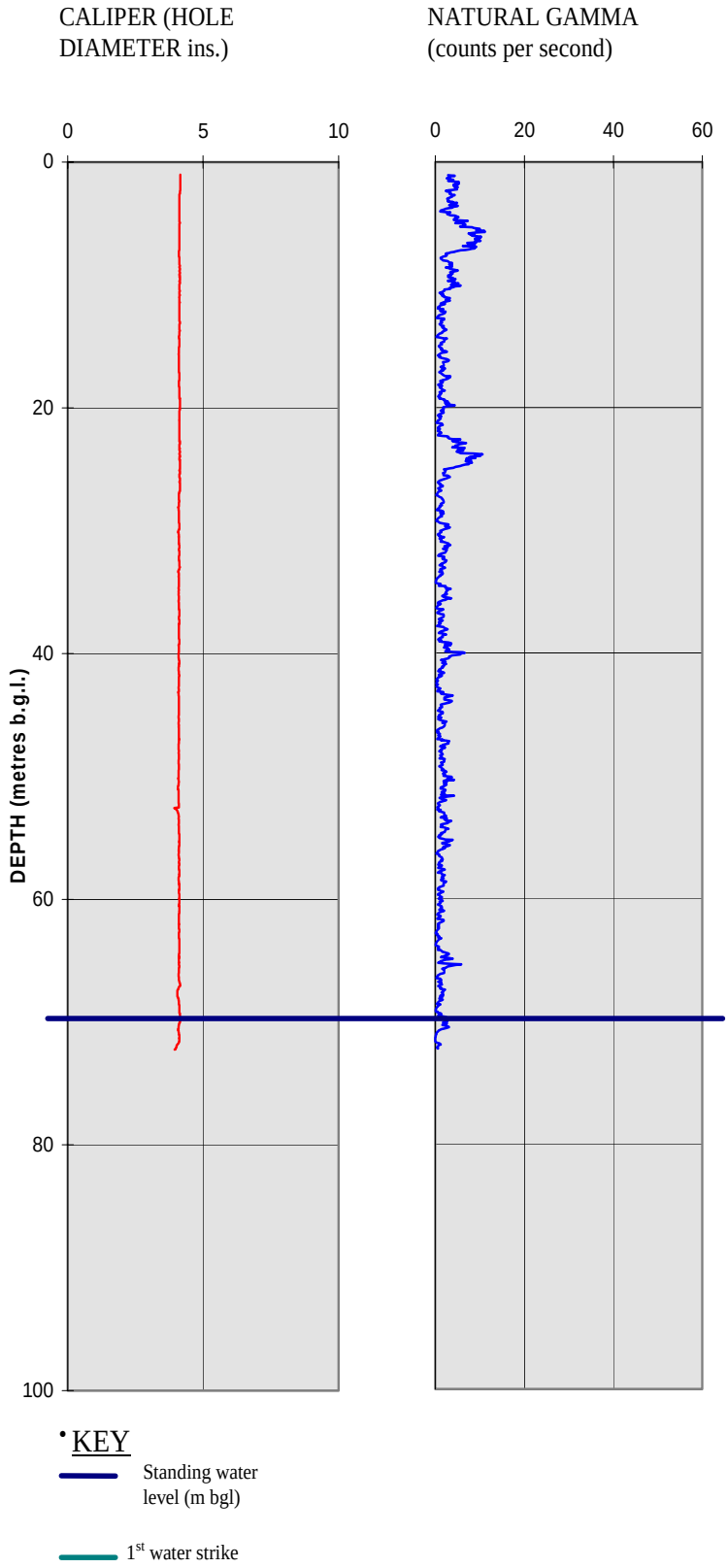
TRANSECT 4 -AVON DOWNS & AUSTRAL DOWNS (BURRAMURRA) STATIONS



TRANSECT 5 - SOUDAN BLOCK & AVON DOWNS

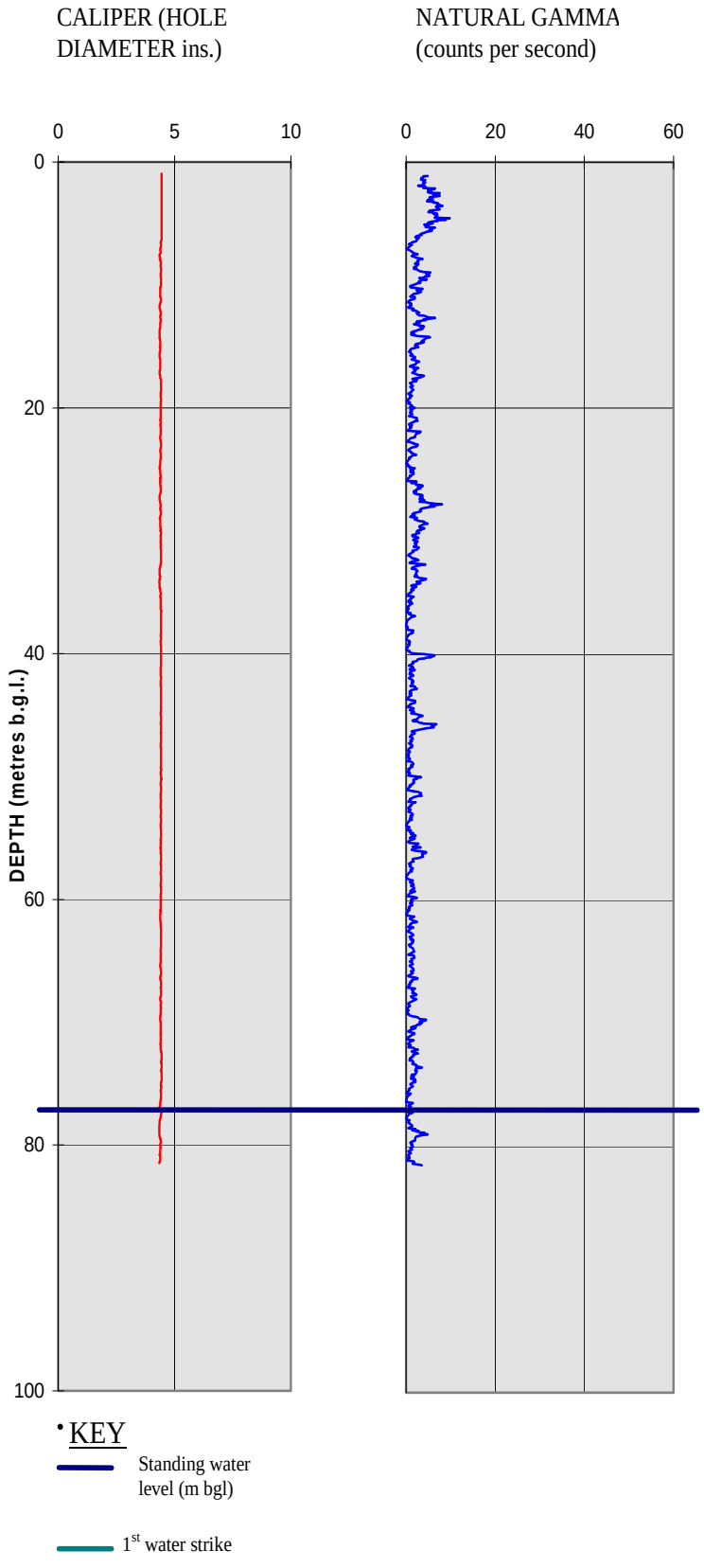


RN 939 (No.5 WESTERN CREEK) EX-STOCK BORE, ROCKLANDS STATION - DOWN-HOLE GEOPHYSICAL LOGS, OCTOBER 1996



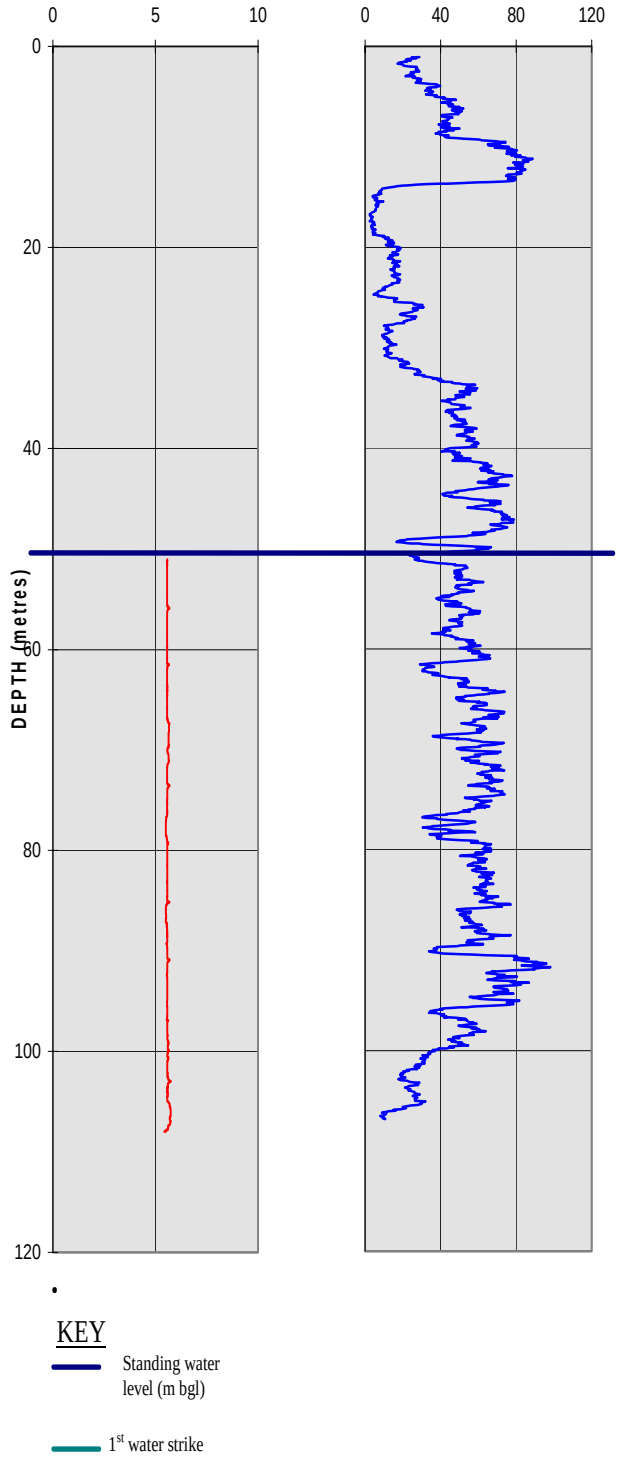
• logged to 71.4 m total depth;
(original depth when constructed was 81.1 m).

RN 941 (No. 10 REDFORD) - STOCK BORE, ROCKLANDS STATION - DOWN-HOLE GEOPHYSICAL LOGS, OCTOBER 1996



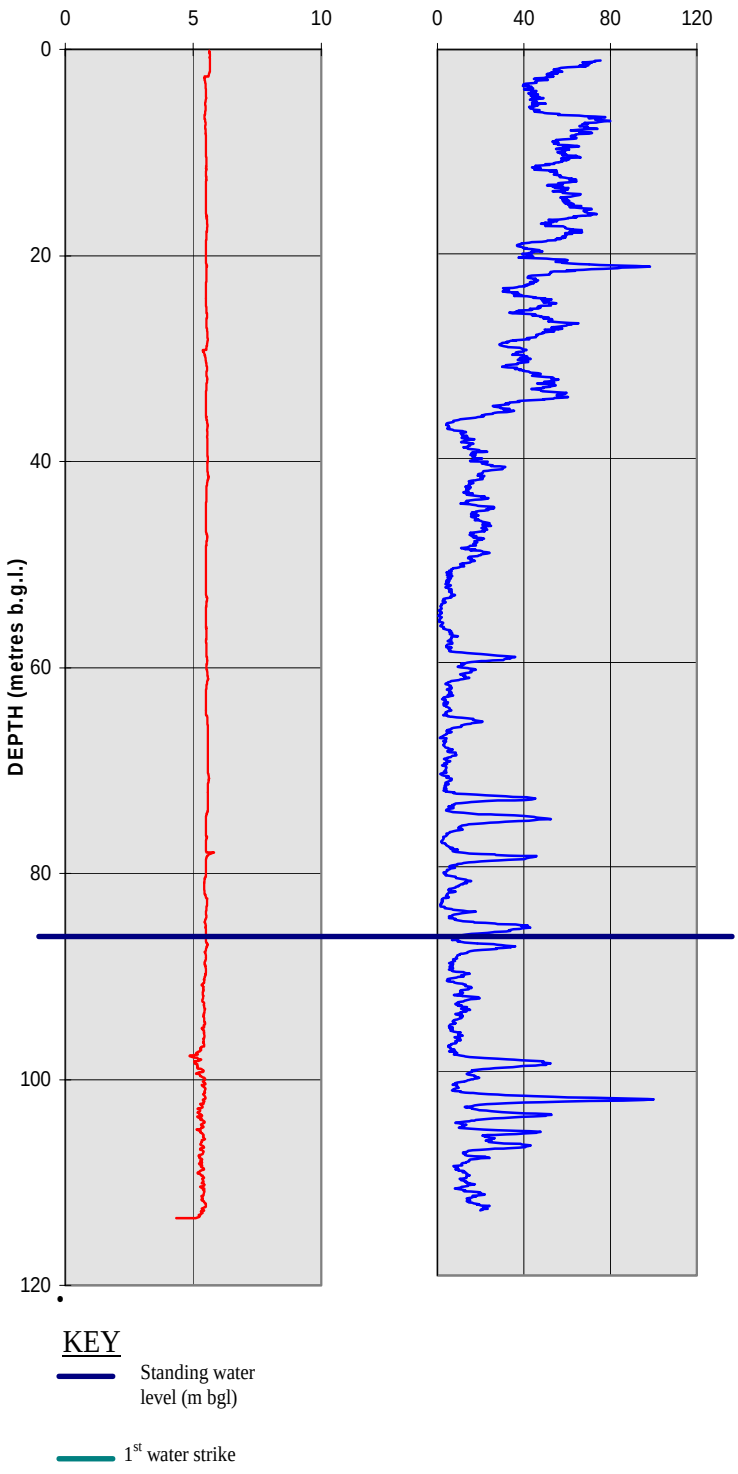
• logged to 80.7 m total depth;
(original depth when constructed was 91.4 m).

RN 1147 (No. 35) - STOCK BORE, SOUDAN BLOCK, ALEXANDRIA STATION - DOWN-HOLE GEOPHYSICAL LOGS, JULY 1996



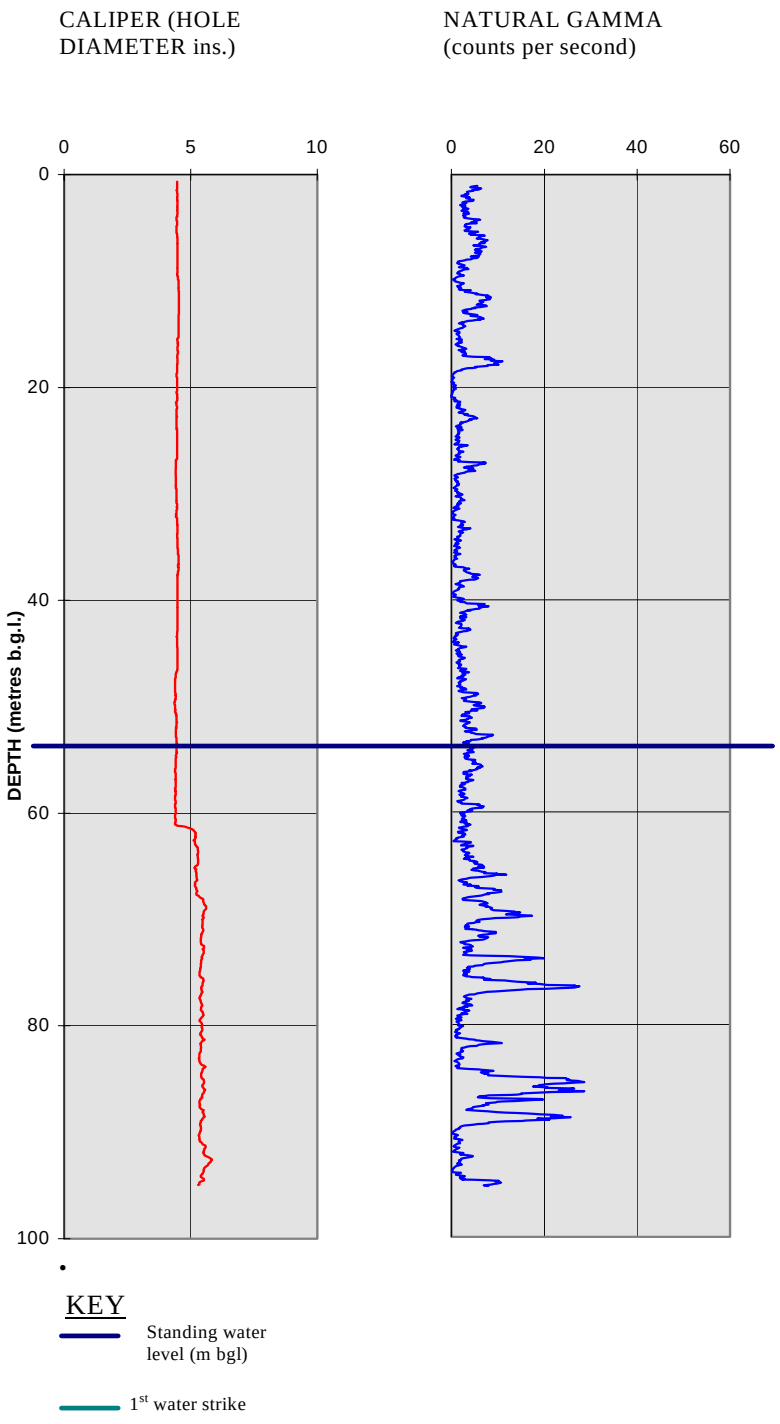
• logged to 107.2 m total depth;
(original depth when constructed was 121 m).

RN 1152 (No. 26) - STOCK BORE, ALEXANDRIA STATION - DOWN-HOLE GEOPHYSICAL LOGS, JULY 1996



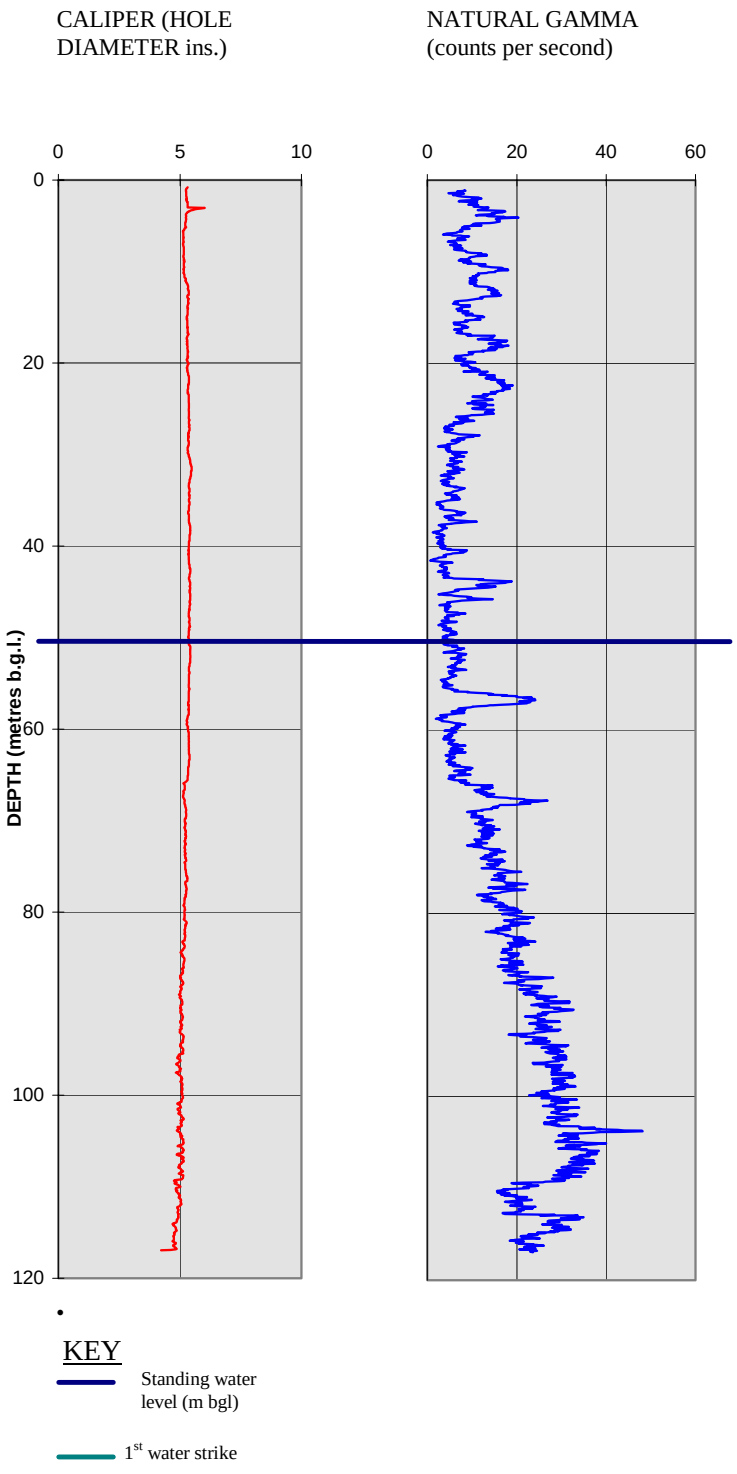
• 6" casing to 80 m bgl logged to 114 m total depth; (original depth when constructed was 122.5 m).

RN 3180 (OLD No. 18) EX-STOCK BORE, BURRAMURRA BLOCK, AUSTRAL DOWNS STATION - DOWN-HOLE GEOPHYSICAL LOGS, NOVEMBER 1996



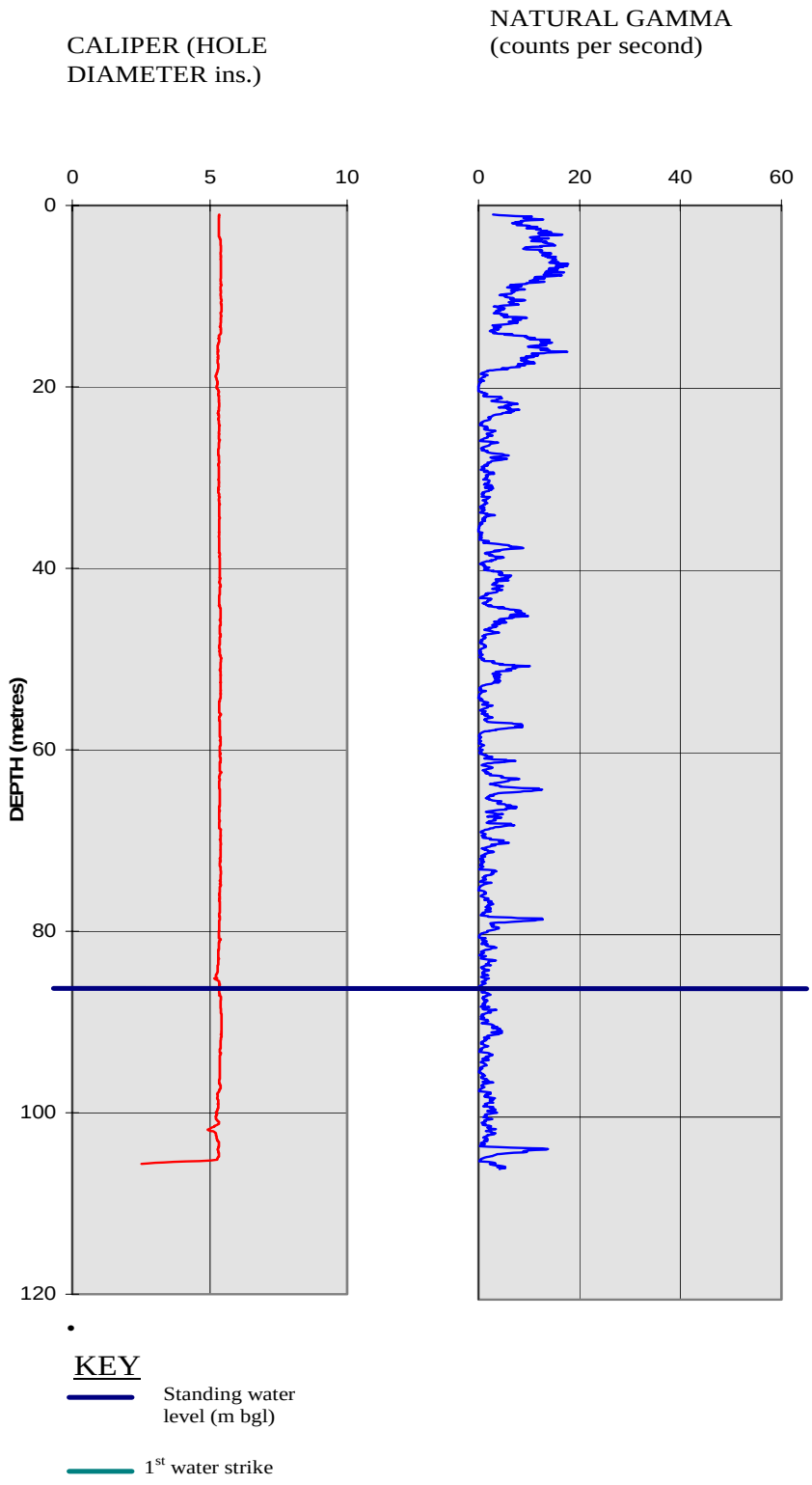
• 5" casing to 61 m; logged to 94.3 m total depth; (original depth when constructed was 94.5 m).

RN 4752 (No. 25 REPLACEMENT) EX- STOCK BORE, AVON DOWNS STATION - DOWN-HOLE GEOPHYSICAL LOGS, NOVEMBER 1996



• logged to 116.1 m total depth;
(original depth when constructed was 128 m).

RN 8271 (No. 77) EX-STOCK BORE, GALLIPOLI BLOCK, ALEXANDRIA STATION - DOWN-HOLE GEOPHYSICAL LOGS, OCTOBER 1996

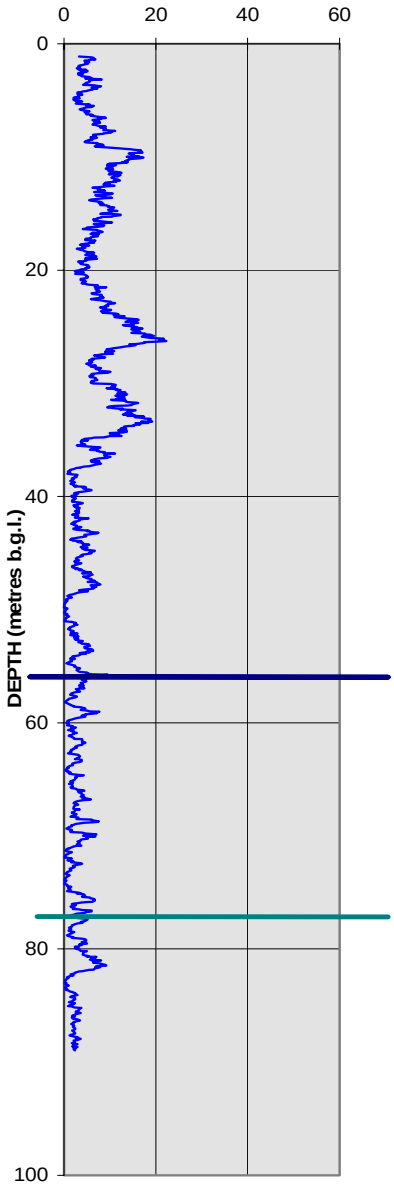


• logged to 104.9 m total depth.

RN 16837 GARDEN IRRIGATION BORE, AVON DOWNS POLICE STATION - DOWN-HOLE GEOPHYSICAL LOGS, APRIL 1997

CALIPER (HOLE DIAMETER ins.)

NATURAL GAMMA (counts per second)



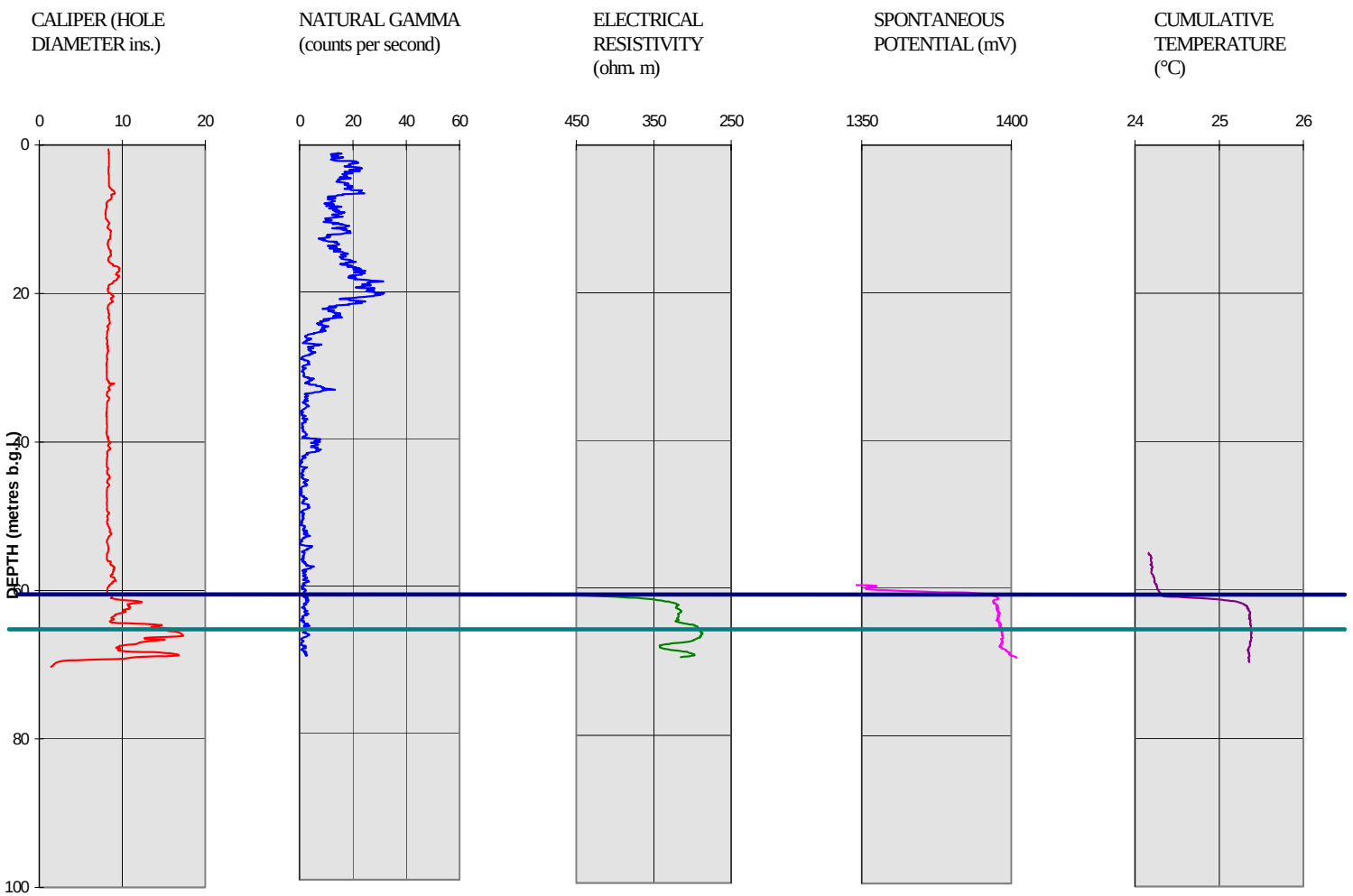
KEY

Standing water level (m bgl)

1st water strike

• logged to 88.1 m bgl; drilled to 89.3 m.
(Caliper log not run due to time constraints).

RN 16838 (No. 3 DUPLICATE) STOCK BORE, AVON DOWNS STATION - DOWN-HOLE GEOPHYSICAL LOGS, APRIL 1997



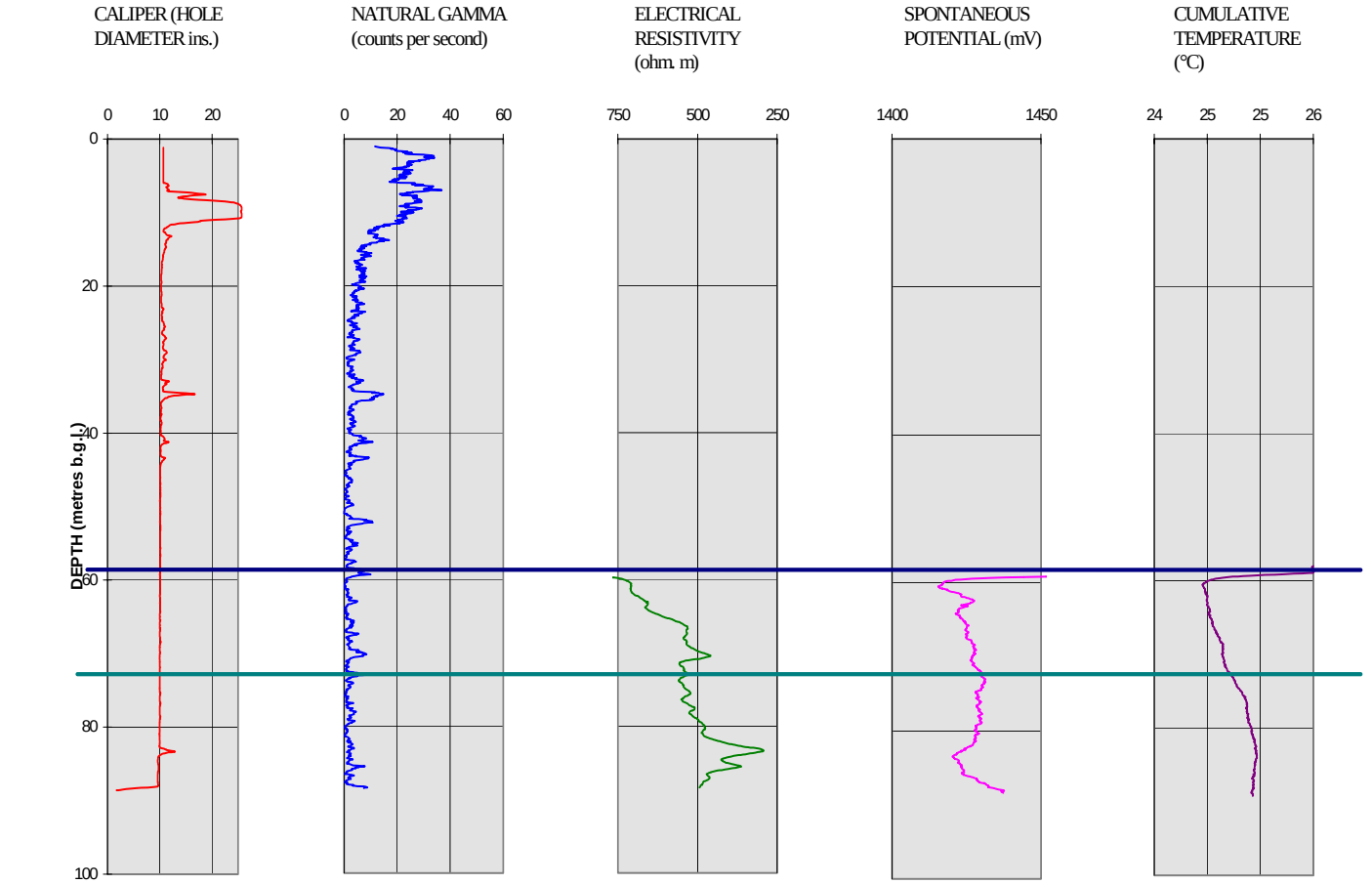
• KEY

Static water level (m bgl)

1st water strike

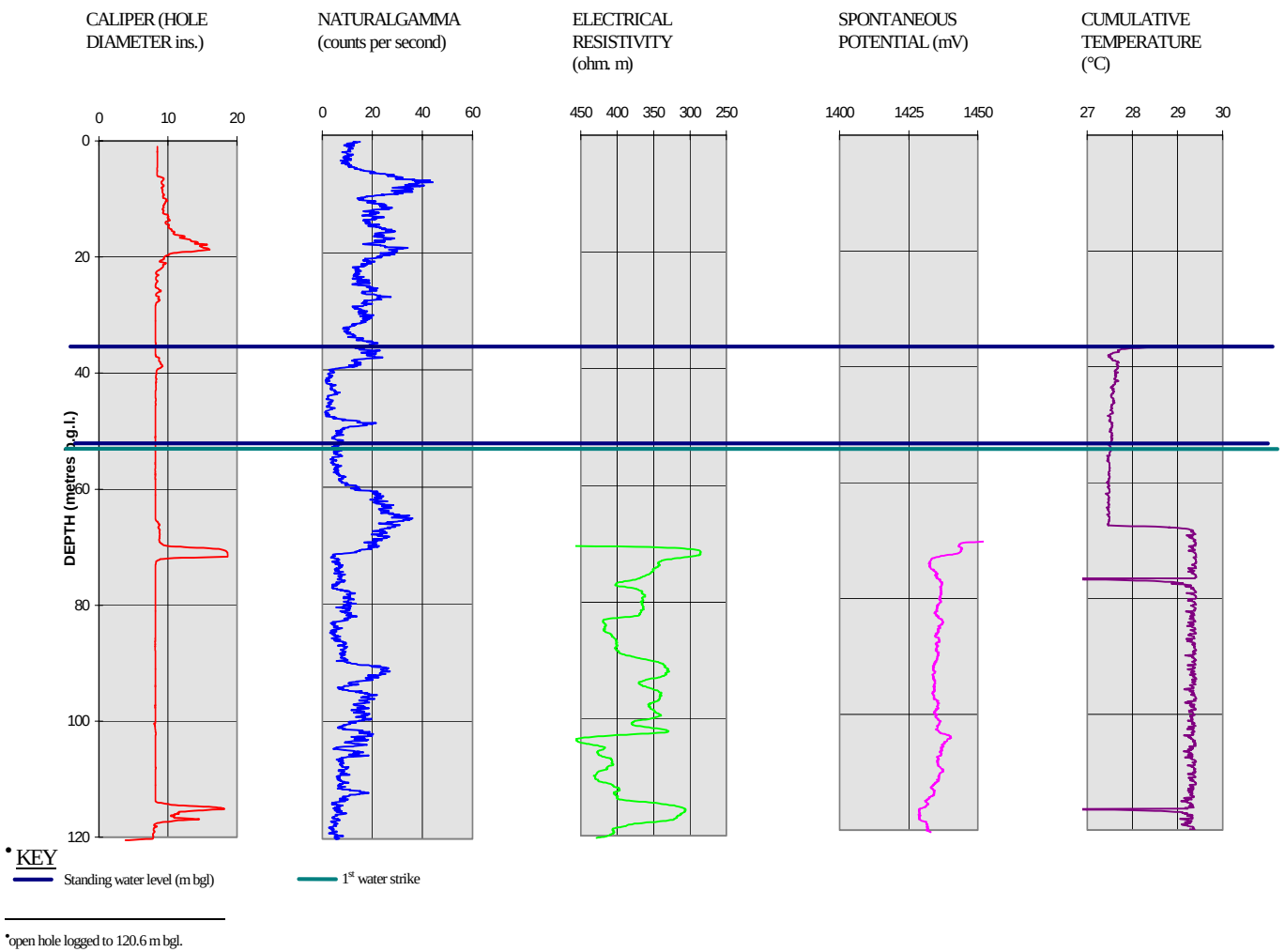
•open hole logged to 68.9 m bgl; drilled to 77.3 m.

RN 16839 STOCK BORE, AUSTRAL DOWNS STATION - DOWN-HOLE GEOPHYSICAL LOGS, APRIL 199



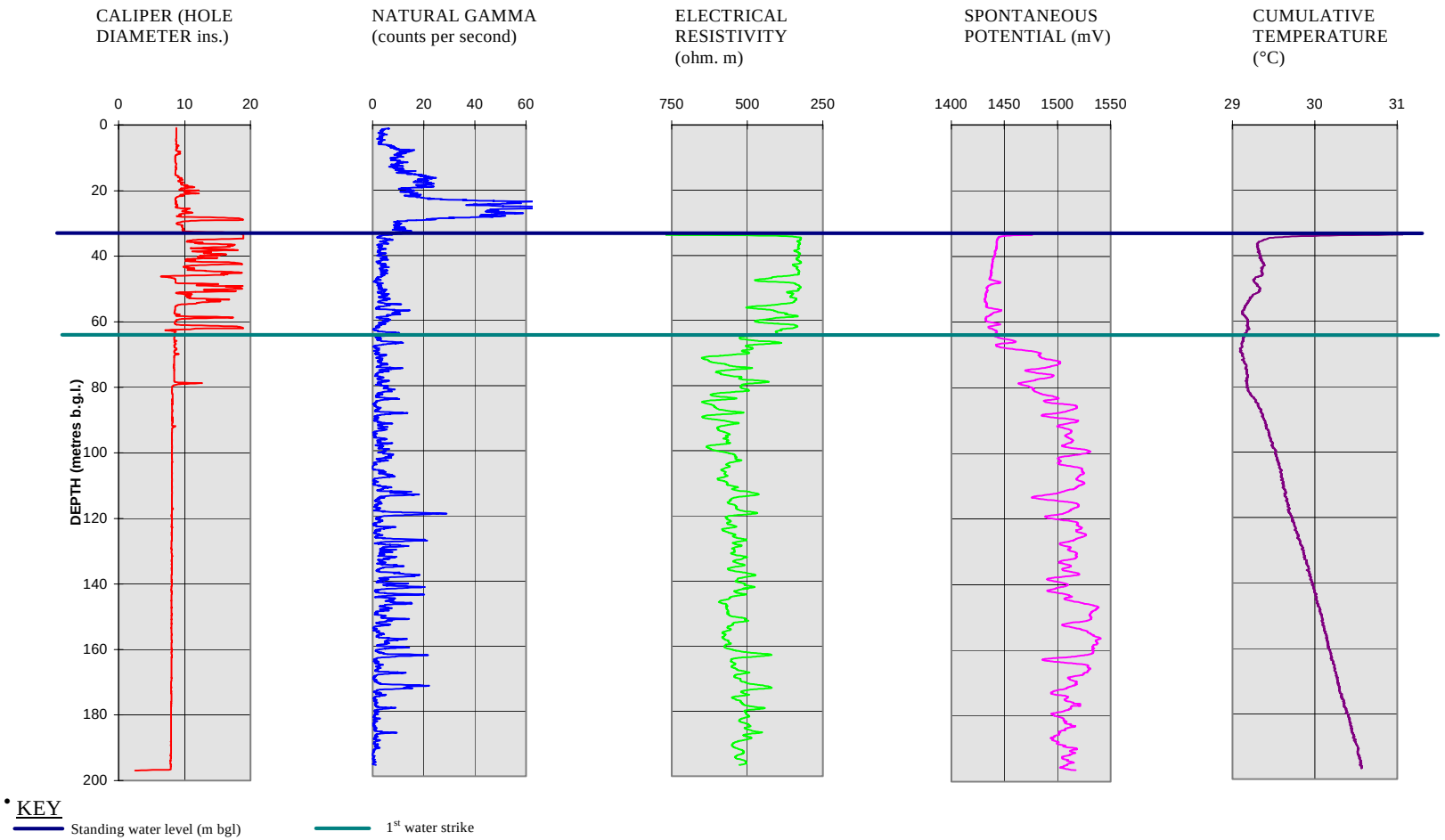
•open hole logged to 87.8 m bgl; drilled to 89.3 m.

RN 16886 MONITORING BORE, SOUDAN BLOCK, ALEXANDRIA STATION - DOWN-HOLE GEOPHYSICAL LOGS, OCTOBER 1996



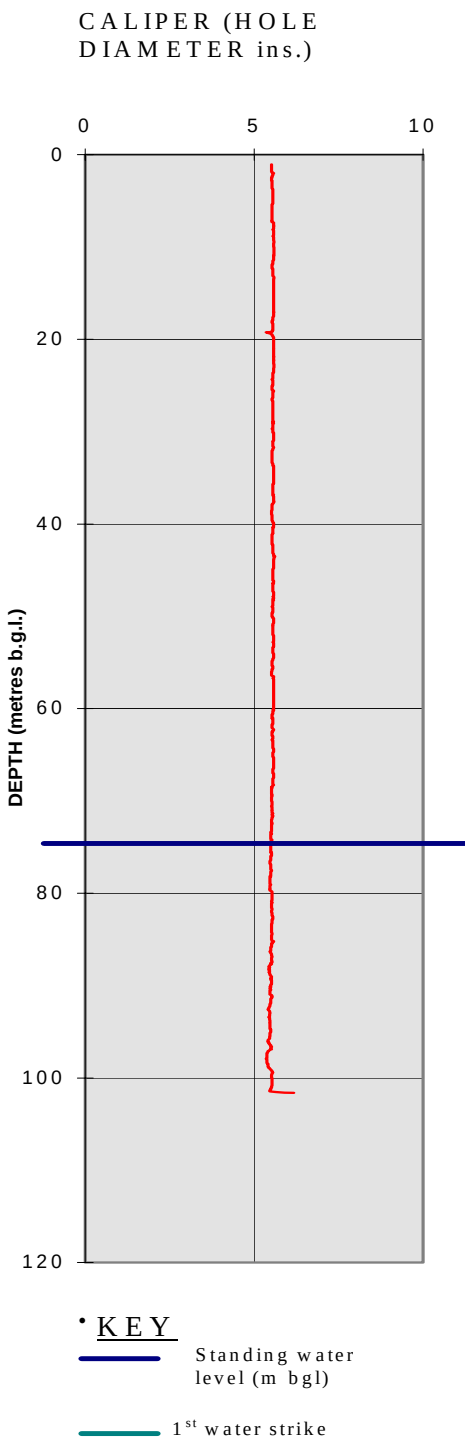
•open hole logged to 120.6 m bgl.

RN 16887 INVESTIGATION BORE, BURRAMURRA BLOCK, AUSTRAL DOWNS STATION - DOWN-HOLE GEOPHYSICAL LOGS, NOVEMBER 1996



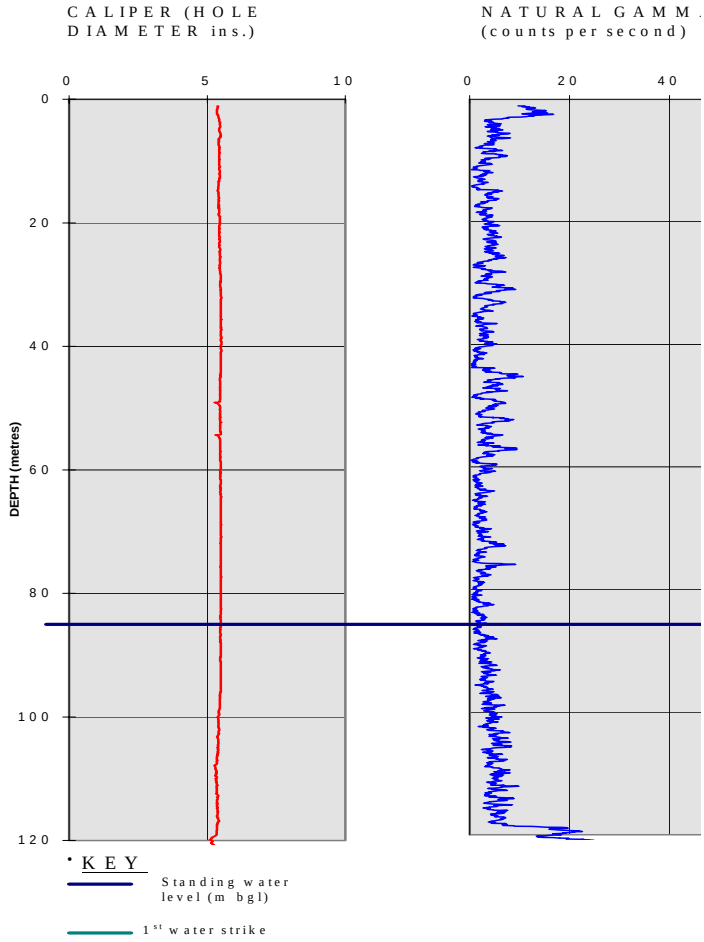
•open hole logged to 196..3 m bgl.

RN 20568 (No. 82) EX- STOCK BORE, SOUDAN BLOCK, ALEXANDRIA STATION - DOWN-HOLE GEOPHYSICAL LOGS, OCTOBER 1996



.00.9 m total depth;
)th when constructed was 104 m).

RN 21758 (No. 19 MIKADO REPLACEMENT) STOCK BORE, ROCKLANDS STATION - DOWN-HOLE GEOPHYSICAL LOGS, OCTOBER 1996

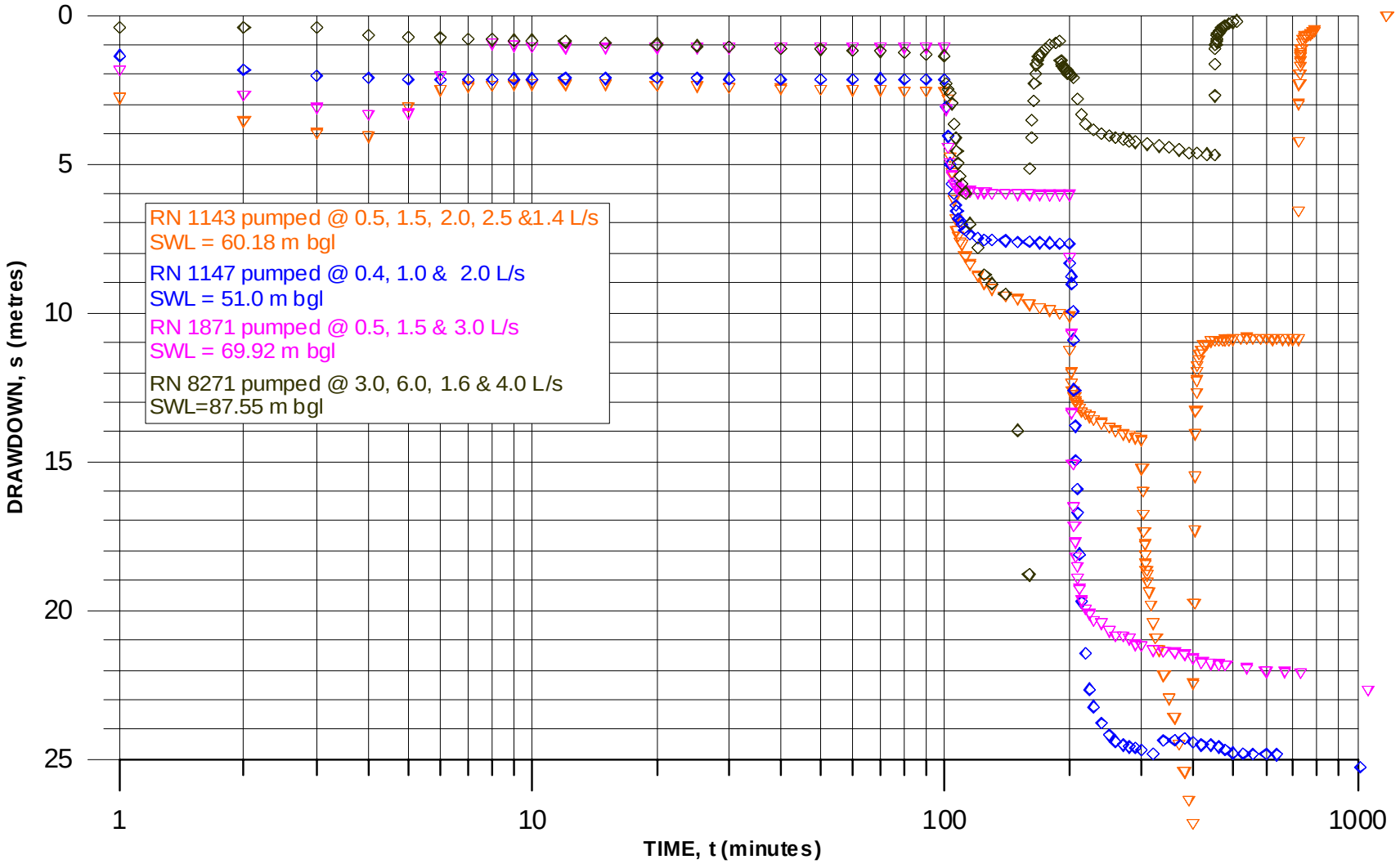


• logged to 120.7 m total depth;
(original depth when constructed was 129 m).

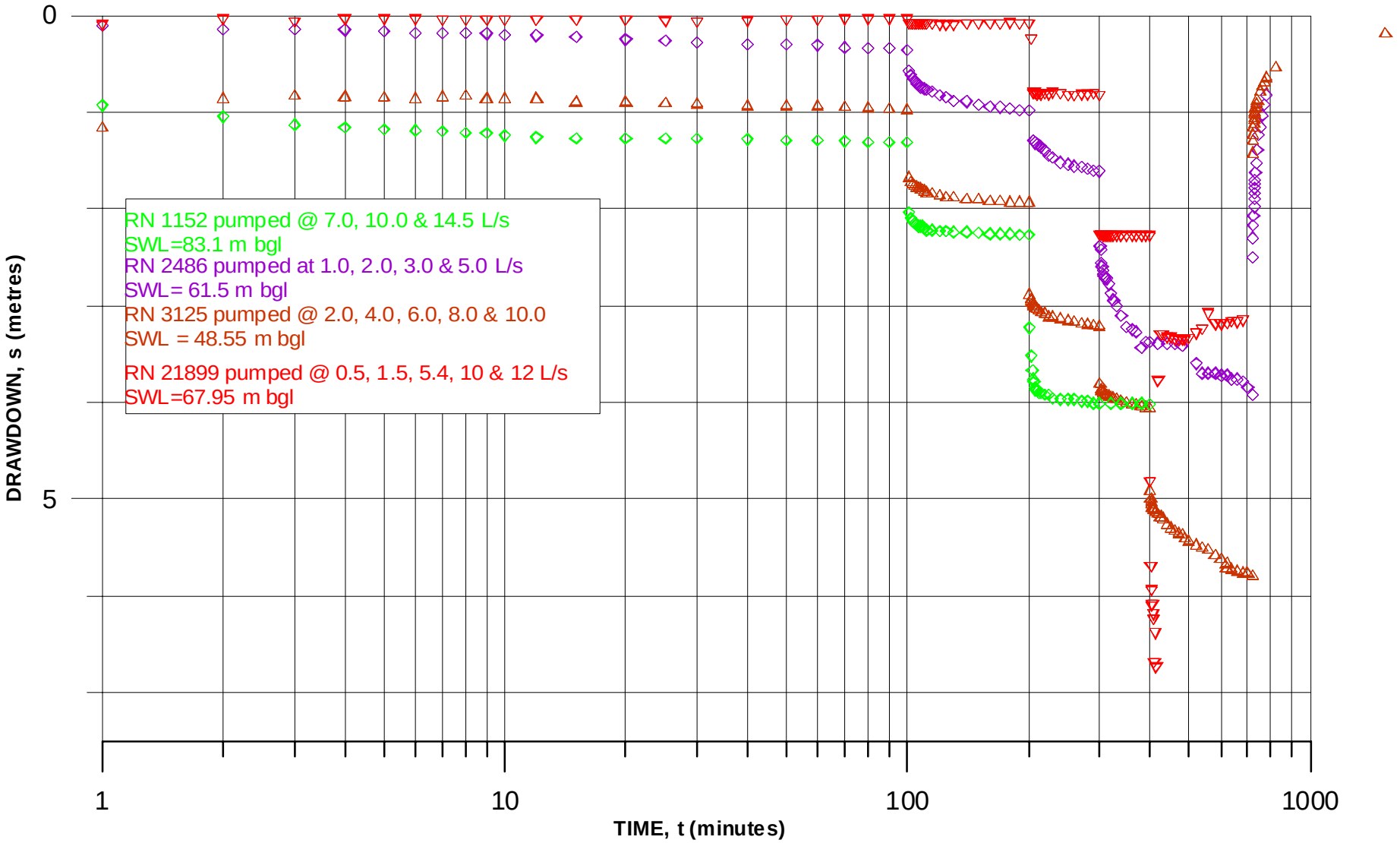
APPENDIX F

DRAWDOWN GRAPHS

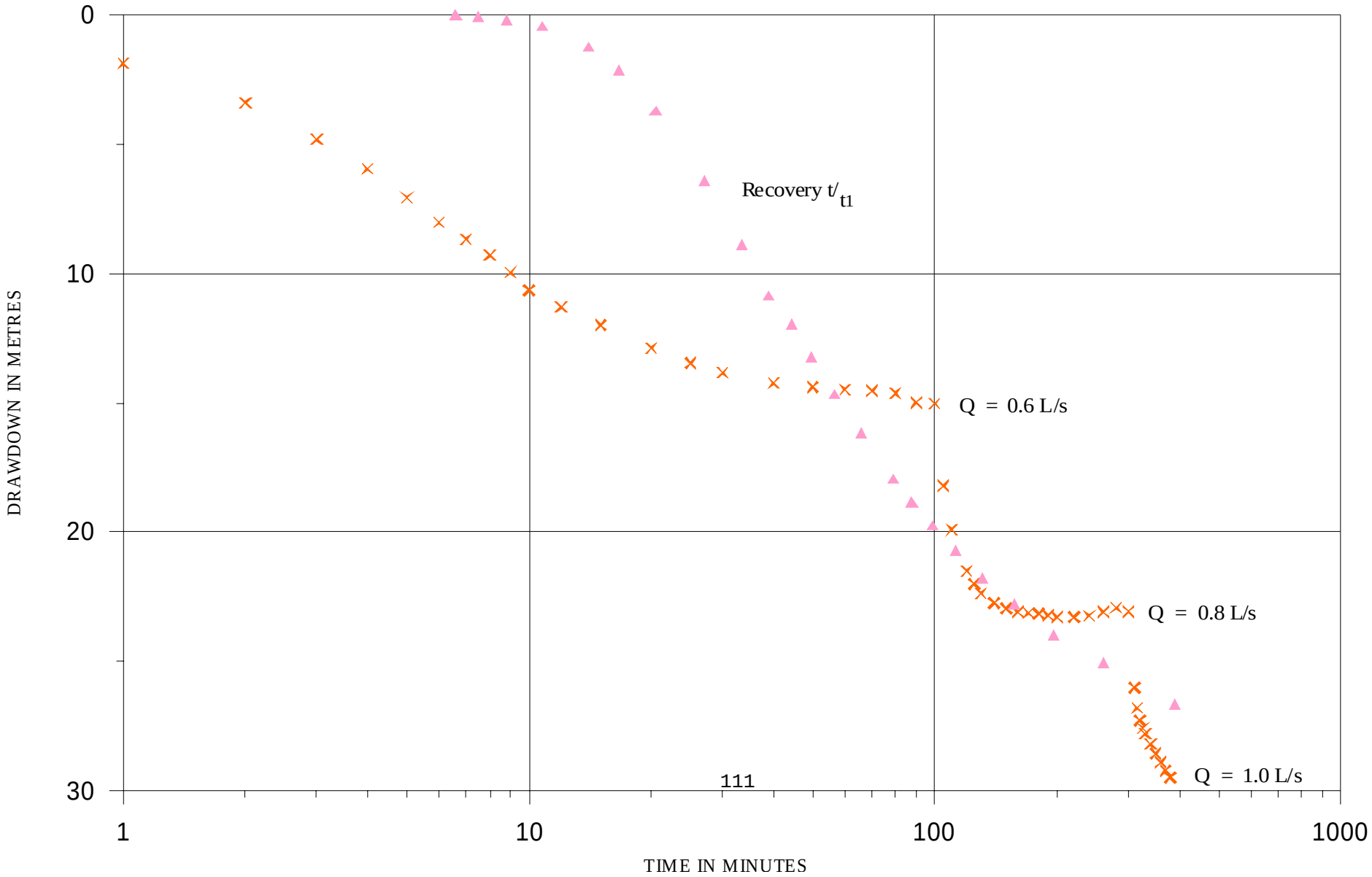
Step Rate Test s- RNs 1143, 1147, 1871 & 8271, Alexandria Station (incl. W. Ranken, Soudan Blocks)



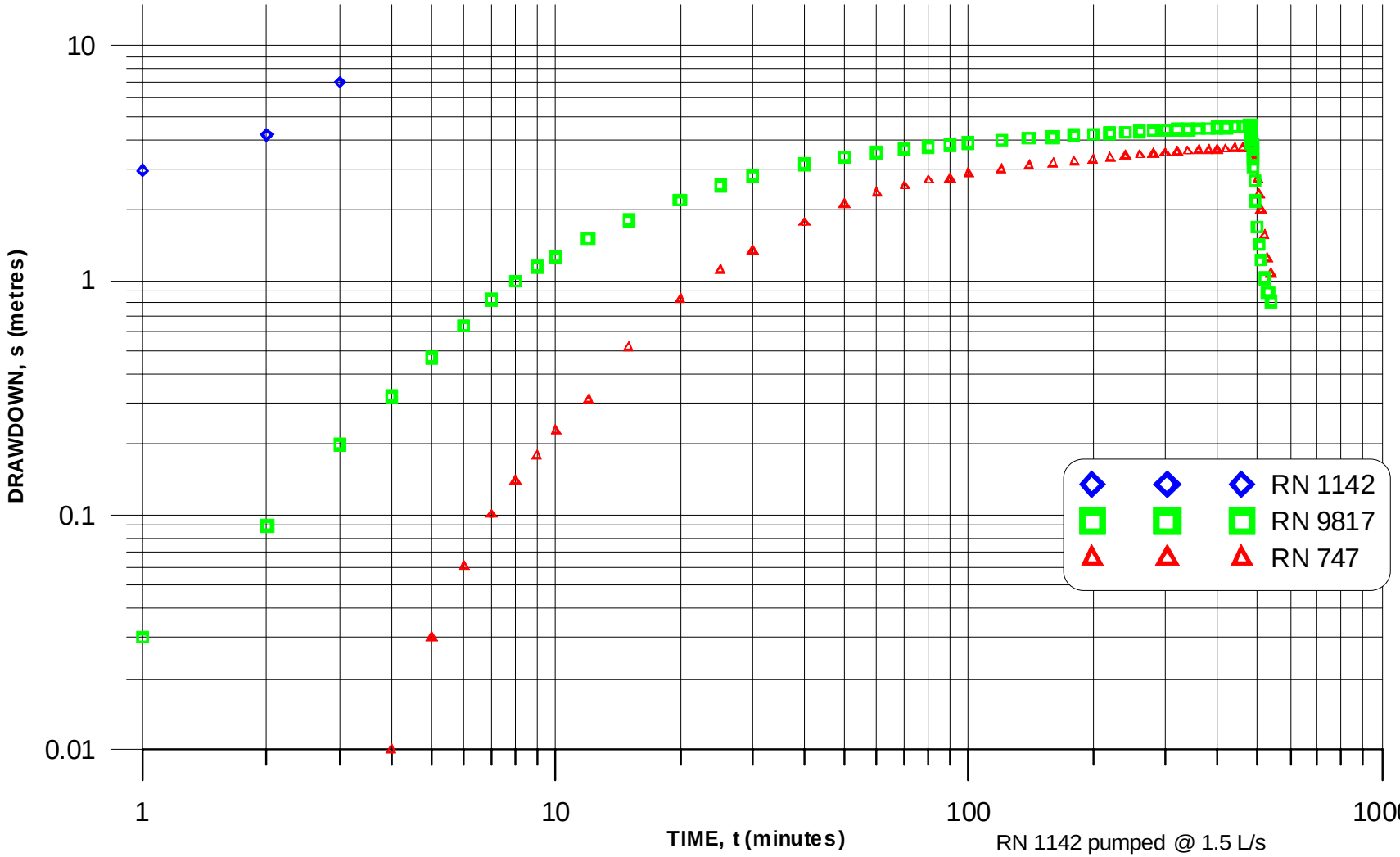
Step Rate Test s- RNs 1152, 2486, 3125 & 21899, Alexandria Station (incl W. Ranken Block)



RN30852, Alexandria Station

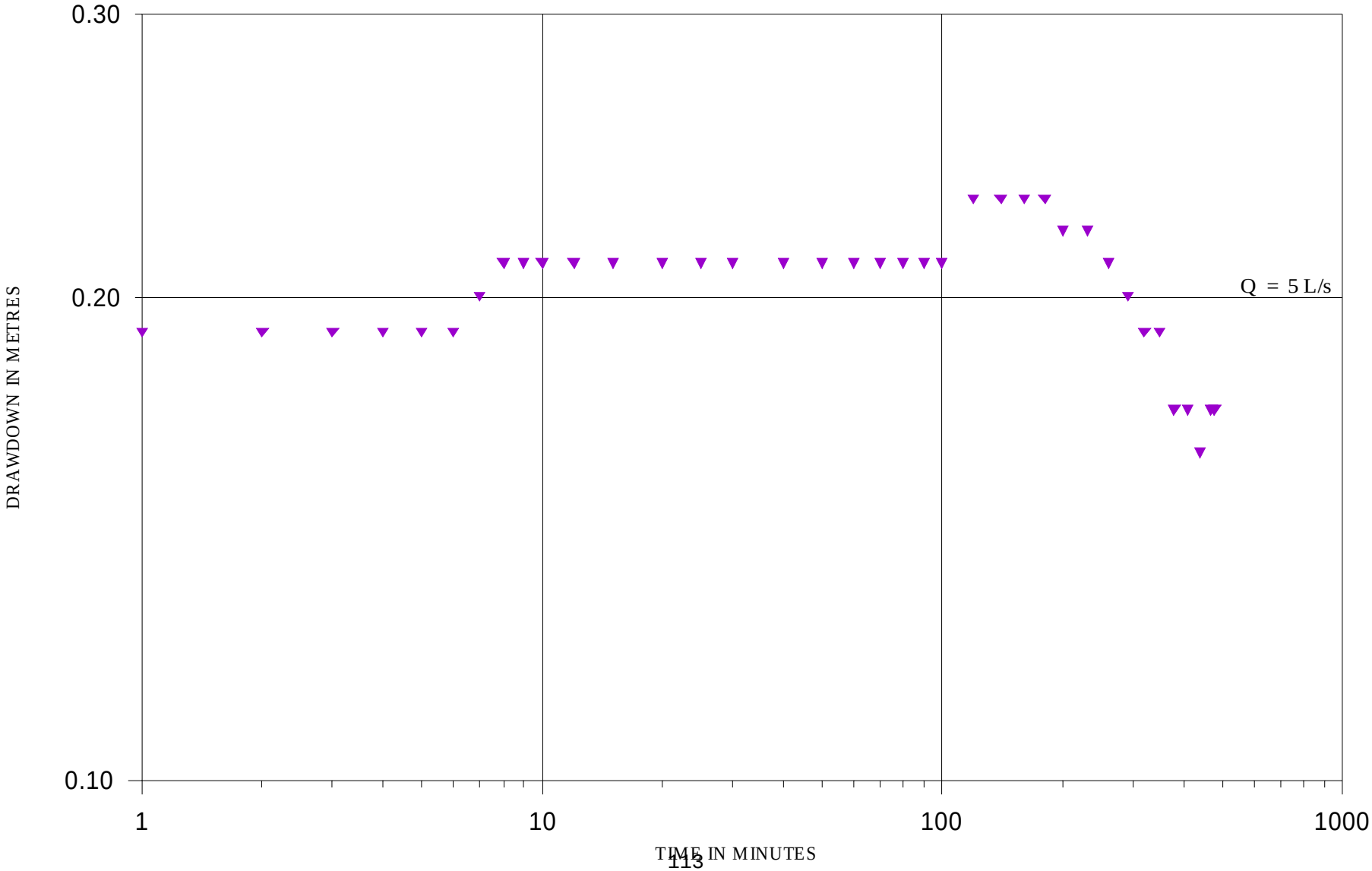


Constant Rate Test - RN 1142 pumped; RNs 747 and 1142, observation bores

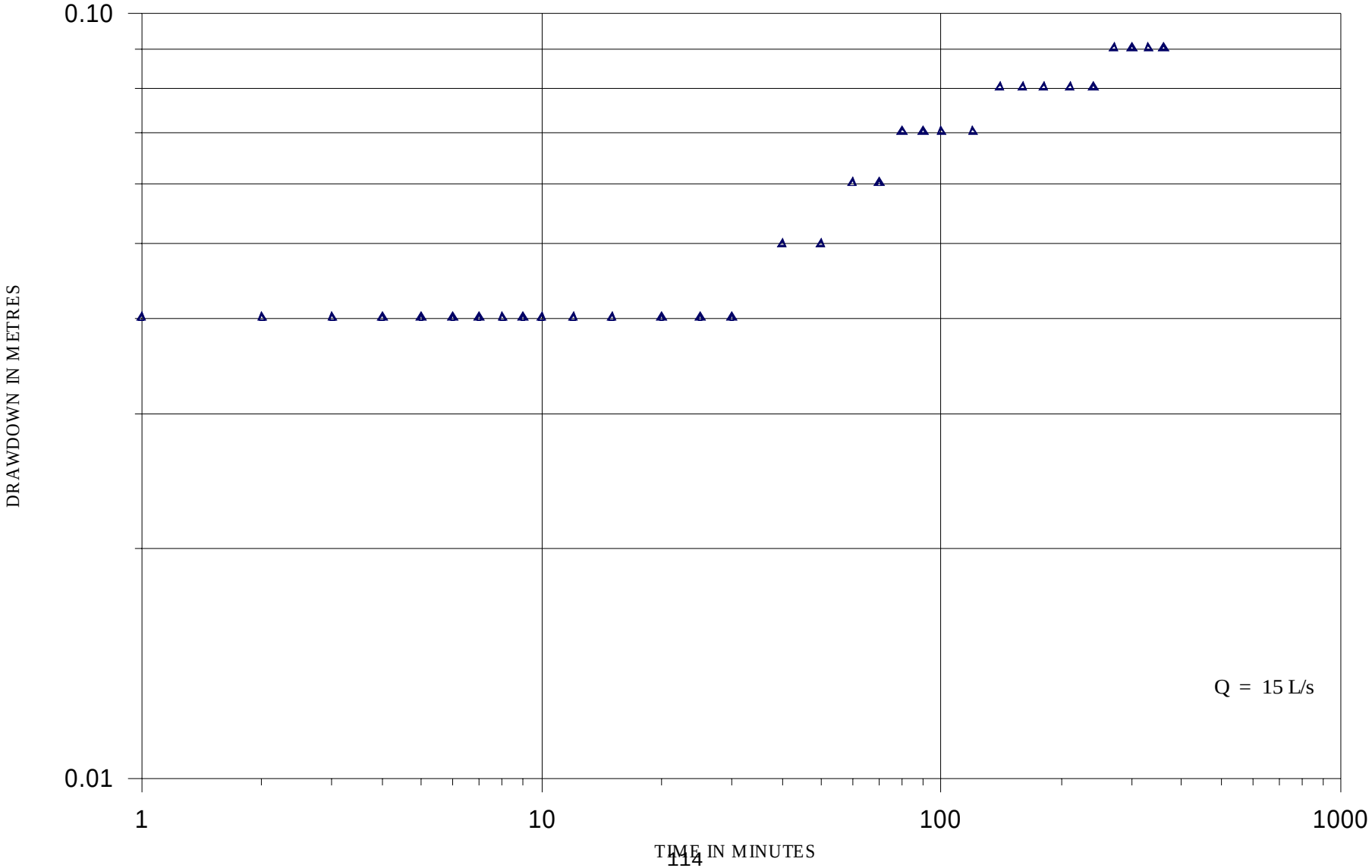


RN 1142 pumped @ 1.5 L/s
SWL=51.1m bgl
D/D=8.8 m after 4 mins thereafter probe obstructed

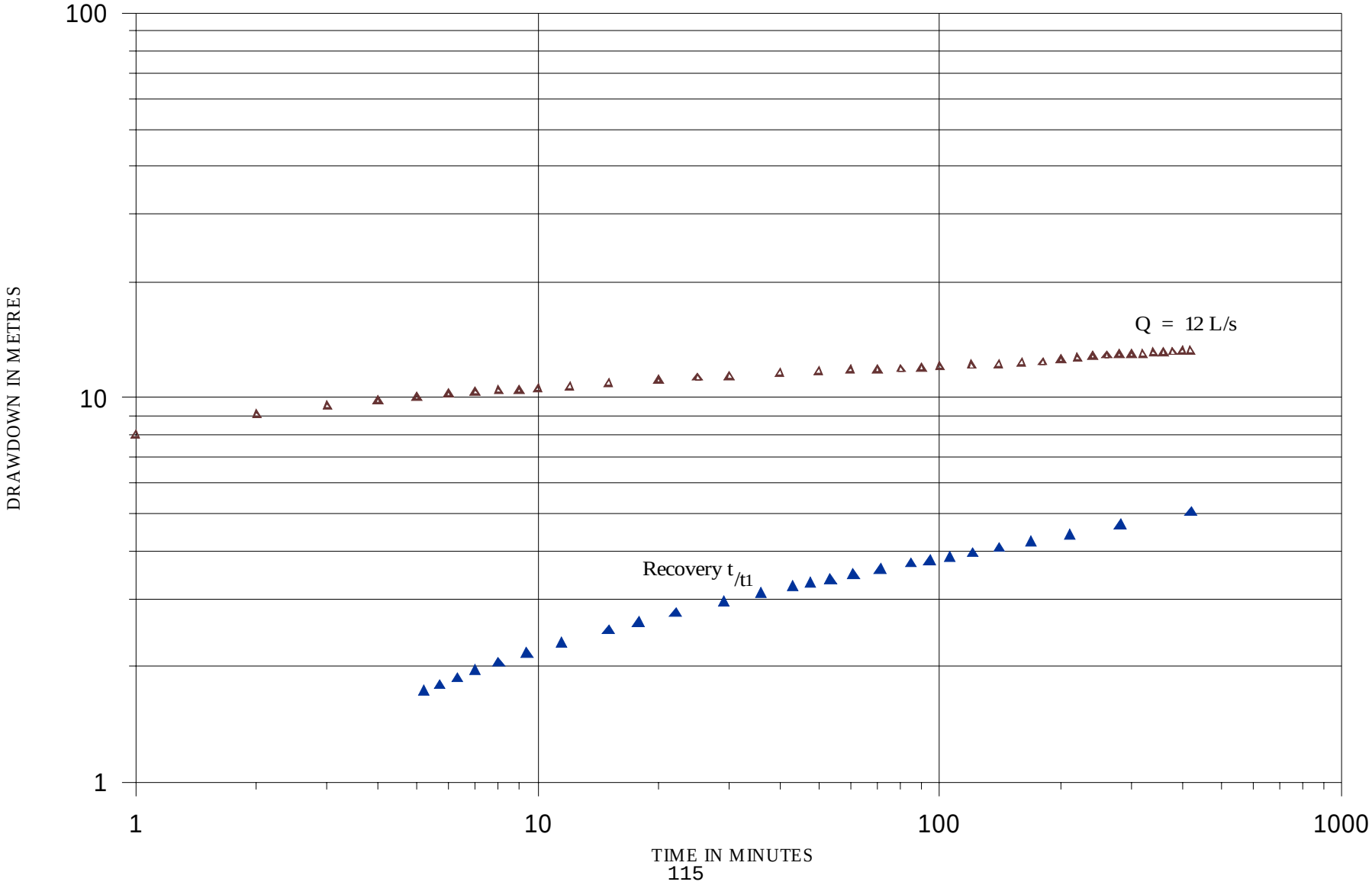
Constant Rate Test - RN 31193, Alroy Station



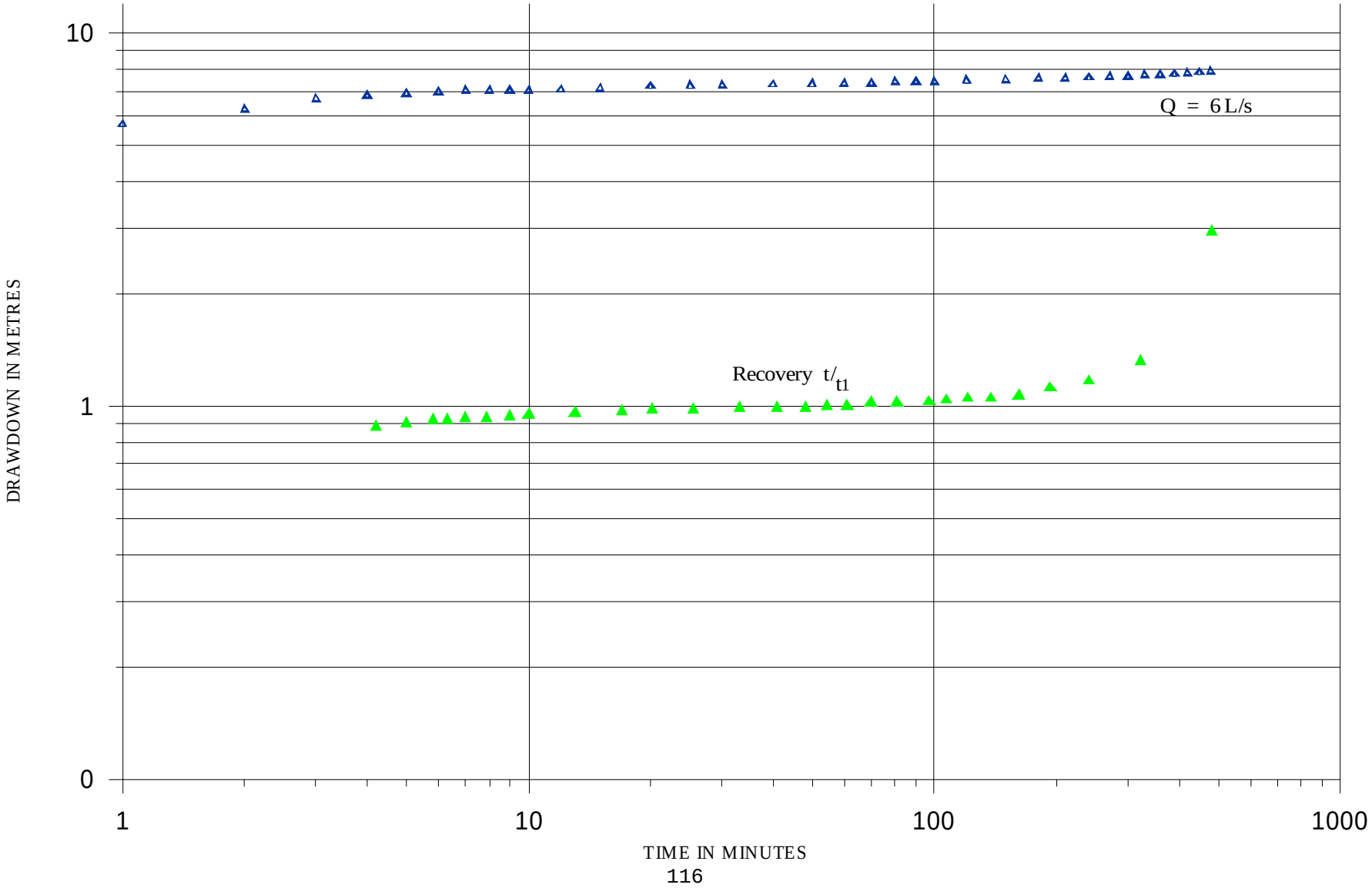
Constant Rate Test - RN 31194, Alroy Station



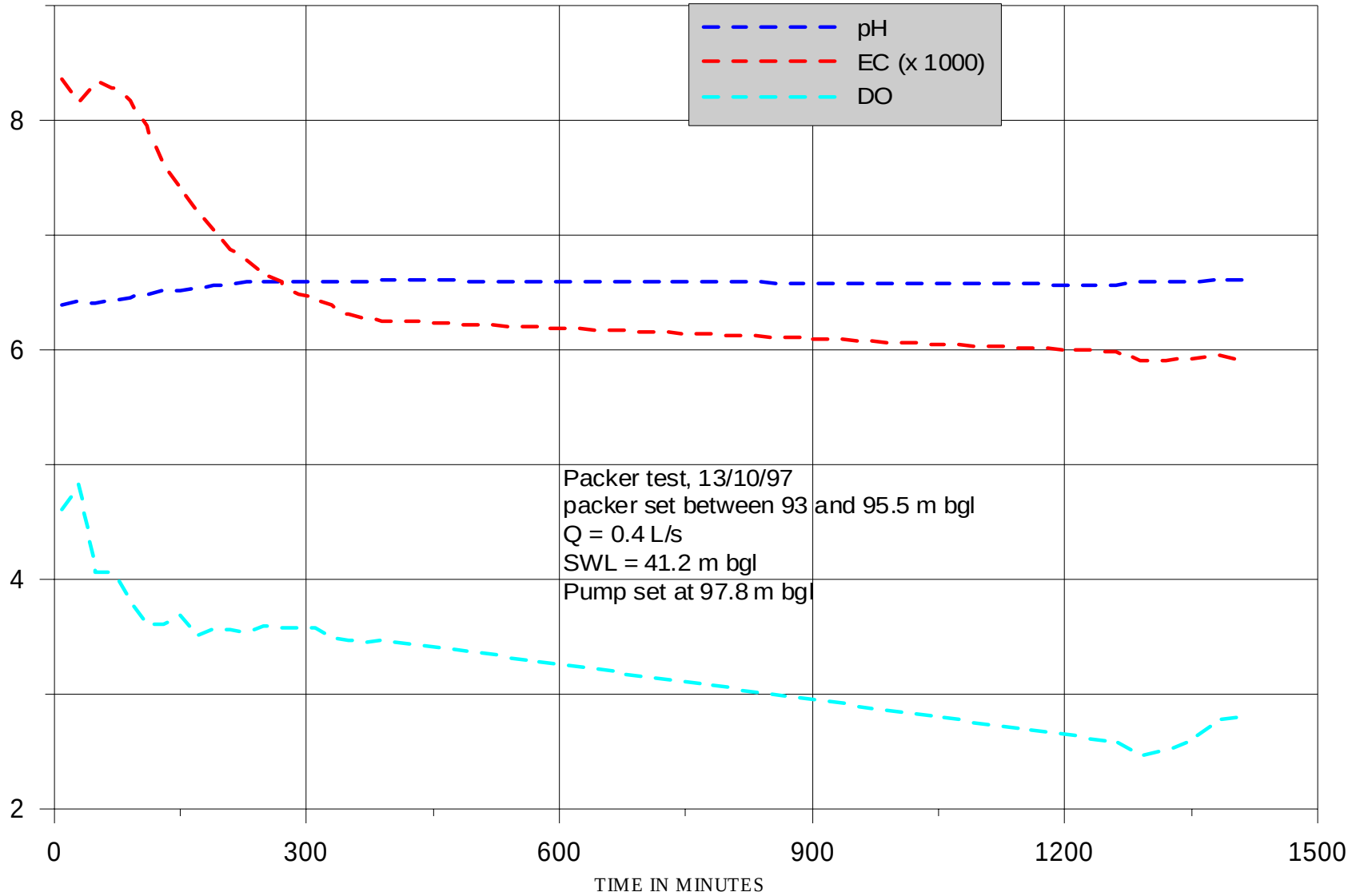
Constant Rate Test - RN 31198, Anthony Lagoon Station



Constant Rate Test - RN 31197, Mittiebah Station



Packer Test - RN 31194, Alroy Station



APPENDIX G

TEST REPORTS

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 1142

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Domestic
Map: Ranken SE 53 - 16
Grid Reference: 679400 E 7891600 N

****

RECOMMENDATIONS

Pumping Rate: 1.5 L/sec **Pump Setting: 85.4 m below Ground Level**

General recommendations are given on the reverse side. The aquifer and bore cannot sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **135.9** m
Completion Date: **04/05/1951**
Standing Water Level: **51.22** m on 25/06/1996

TESTING DETAILS

Test Date: **26/06/1996**
Test Rates: **1.5 L/s**
Test Duration: **480 minutes**

BORE CONSTRUCTION

Interval (m)	Description
	No details available

WARNING: Minimum internal bore diameter is 138 mm.

Notes: 1. Top of casing as constructed was **0.15** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on a constant rate test at 1.5 L/s for 8 hours and assume hydrogeological conditions remain constant

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

The local name for this bore is No. 32

****

WATER QUALITY
EC = 790 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 1143

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Pastoral
Map: Ranken SE 53 - 16
Grid Reference: 685140 E 7838400 N

****

RECOMMENDATIONS

Pumping Rate: 1 L/sec **Pump Setting: 80 m below Ground Level**

General recommendations are given on the reverse side. The aquifer and bore can sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **118.7** m
Completion Date: **1950**
Standing Water Level: **60.18** m on 30/05/1996

TESTING DETAILS

Test Date: **31/05/1996**
Test Rates: **0.5,1.5,2.0 & 2.5** L/sec
Test Duration: **720 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 6.0	193 mm ID steel casing
0 .0 - 118.7	143 mm ID steel casing

WARNING: Minimum internal bore diameter is 138 mm.

Notes: 1. Top of casing as constructed was **0.1** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on a four step step test for 12 hours and assume hydrological conditions remain constant.

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

The local name for the bore is No. 29

****

WATER QUALITY
EC = 3500 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 1147

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Pastoral
Map: Avon Downs SF 53 - 4
Grid Reference: 721540 E 7745556 N

****

RECOMMENDATIONS

Pumping Rate: 1.5 L/sec **Pump Setting: 80 m below Ground Level**

General recommendations are given on the reverse side. The aquifer and bore can sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **121** m
Completion Date: **1952**
Standing Water Level: **51** m on 16/07/1996

TESTING DETAILS

Test Date: **16/07/1996**
Test Rates: **0.4,1.0 & 2.0** L/sec
Test Duration: **1020 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 96.0	143 mm ID steel casing
96.0 - 108.0	143 mm ID slotted steel casing

WARNING: Minimum internal bore diameter is 143 mm.

Notes: 1. Top of casing as constructed was **0.3** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on an extended step test at rates to 2 L/s for 17 hours and assumes hydrological conditions remain constant

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

The local name for the bore is No. 35

****

WATER QUALITY
EC = 1550 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 1152

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Pastoral
Map: Ranken SE 53 - 16
Grid Reference: 739530 E 7884399 N

****

RECOMMENDATIONS

Pumping Rate: 12 L/sec **Pump Setting: 95 m below Ground Level**

General recommendations are given on the reverse side. The aquifer and bore cannot sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **122.5** m
Completion Date: **05/08/1949**
Standing Water Level: **83.1** m on 26/07/1996

TESTING DETAILS

Test Date: **27/07/1996**
Test Rates: **7.0,10.0,14.0 & 8.8** L/sec
Test Duration: **1210 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 6.0	193 mm ID steel casing
0.0 - 98.1	143 mm ID steel casing
98.1 - 122.5	143 mm ID slotted steel casing

WARNING: Minimum internal bore diameter is 143 mm.

Notes: 1. Top of casing as constructed was **0.4** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on an extended step test at rates to 14 L/s for 20 hours and assumes hydrological conditions remain constant

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

The local name for the bore is No. 26

****

WATER QUALITY
EC = 788 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 2486

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Pastoral
Map: Ranken SE 53 - 16
Grid Reference: 658010 E 7893910 N

****

RECOMMENDATIONS

Pumping Rate: 1 L/sec **Pump Setting: 65 m below Ground Level**

General recommendations are given on the reverse side. The aquifer and bore can sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **69.1** m
Completion Date: **25/11/1960**
Standing Water Level: **61.5** m on 24/05/1996

TESTING DETAILS

Test Date: **25/05/1996**
Test Rates: **1,2,3 & 5** L/sec
Test Duration: **720 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 12.2	193 mm ID steel casing
0.0 - 74.6	143 mm ID steel casing
61.0 - 73.2	143 mm ID slotted steel casing
0.0 - 71.6	115 mm ID steel casing

WARNING: Minimum internal bore diameter is 115 mm.

Notes: 1. Top of casing as constructed was **0.3** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on an extended step test at rates up to 5 L/s for 12 hours and assumes hydrological conditions remain constant. The accuracy of the bore construction is suspect

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

The local name for the bore is No. 49

****

WATER QUALITY
EC = 1570 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 3125

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Pastoral
Map: Ranken SE 53 - 16
Grid Reference: 662200 E 7868000 N

****

RECOMMENDATIONS

Pumping Rate: 5 L/sec **Pump Setting: 55 m below Ground Level**

General recommendations are given on the reverse side. The aquifer and bore can sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **61.8** m
Completion Date:
Standing Water Level: **48.55** m on 27/05/1996

TESTING DETAILS

Test Date: **28/05/1996**
Test Rates: **2,4,6,8 & 10** L/sec
Test Duration: **720 minutes**

BORE CONSTRUCTION

Interval (m)	Description
	No details available

WARNING: Minimum internal bore diameter is 138 mm.

Notes: 1. Top of casing as constructed was **0.3** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on an extended step test at rates up to 10 L/s for 12 hours and assumes hydrological conditions remain constant.

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

The local name for the bore is No. 50

****

WATER QUALITY
EC = 1410 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 16243

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Domestic / pastoral
Map: Avon Downs SF 53 - 4
Grid Reference: 715320 E 7783130 N

****
RECOMMENDATIONS

Pumping Rate: 2 L/sec **Pump Setting: 95 m below Ground Level**

General recommendations are given on the reverse side. The aquifer and bore cannot sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****
COMPLETION DETAILS

Finished depth: **122** m
Completion Date: **1954**
Standing Water Level: **69.92** m on 19/07/1996

TESTING DETAILS

Test Date: **19/07/1996**
Test Rates: **0.5, 1.5 & 3.0** L/sec
Test Duration: **1260 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 122.0	143 mm ID steel casing

WARNING: Minimum internal bore diameter is 143 mm.

Notes: 1. Top of casing as constructed was **0.3** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****
COMMENTS

The above recommendations are based on an extended step test at rates up to 3 L/s for 21 hours and assumes hydrological conditions remain constant. Construction details are incomplete

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

The local name for the bore is No. 86

****
WATER QUALITY
EC = 2090 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 21899

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Pastoral
Map: Ranken SE 53 - 16
Grid Reference: 701610 E 7793010 N

****

RECOMMENDATIONS

Pumping Rate: 12 L/sec **Pump Setting: 80 m below Ground Level**

General recommendations are given on the reverse side. The aquifer and bore cannot sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **152** m
Completion Date: **22/10/1982**
Standing Water Level: **67.65** m on 12/07/1996

TESTING DETAILS

Test Date: **13/07/1996**
Test Rates: **5,10,12 & 15** L/sec
Test Duration: **480 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 6.0	193 mm ID steel casing
0.0 - 145.0	143 mm ID steel casing
145.0 - 152.0	143 mm ID slotted steel casing

WARNING: Minimum internal bore diameter is 143 mm.

Notes: 1. Top of casing as constructed was **0.3** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on an extended step test at rates up to 15 L/s for 8 hours and assumes hydrological conditions remain constant.

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

The local name for the bore is No. 18

****

WATER QUALITY
EC = 1800 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 30667

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Pastoral
Map: Ranken SE 53 - 16
Grid Reference: 767680 E 7884750 N

****

RECOMMENDATIONS

Pumping Rate: 3 L/sec **Pump Setting: 112 m below Ground Level**

General recommendations are given on the reverse side. The aquifer and bore can sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **141.7** m
Completion Date: **25/10/1973**
Standing Water Level: **87.55** m on 22/07/1996

TESTING DETAILS

Test Date: **22/07/1996**
Test Rates: **1.6,3.0,4.0 & 6.0** L/sec
Test Duration: **450 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 109.8	143 mm ID steel casing
109.8 - 115.8	143 mm ID slotted steel casing

WARNING: Minimum internal bore diameter is 143 mm.

Notes: 1. Top of casing as constructed was **0.1** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on an extended step test at rates up to 6 L/s for 7½ hours and assumes hydrological conditions remain constant.

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

The local name for the bore is New No. 77

****

WATER QUALITY
EC = 1730 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 30852

Bore Location: Alexandria Station
Client: Barkly/Gulf Landcare
Intended Use: Investigation
Map: Ranken SE 53 - 16
Grid Reference: 727110 E 7896030 N

****
RECOMMENDATIONS

Pumping Rate: 0.6 L/sec **Pump Setting: 107 m below Ground Level.**

General recommendations are given on the reverse side. The aquifer and bore cannot sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****
COMPLETION DETAILS

Finished depth: **200.7** m
Completion Date: **01/11/1996**
Standing Water Level: **77.8** m on 09/10/1997

TESTING DETAILS

Test Date: **09/10/1997**
Test Rates: **0.6,0.8 & 1.0** L/sec
Test Duration: **380 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 5.8	203 mm ID steel casing
0.0 - 110.3	152 mm steel casing
110.3 - 116.8	152 mm slotted steel casing
116.8 - 119.8	152 mm ID steel casing

WARNING: Minimum internal bore diameter is 152 mm.

Notes: 1. Top of casing as constructed was **0.7** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****
COMMENTS

The above recommendations are based on an extended step test at rates up to 1 L/s for 380 minutes and assumes hydrological conditions remain constant.

Provision to monitor water levels and obtain water samples while pumping shoud be incorporated on this bore.

****
WATER QUALITY
EC = 2660 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 31193

Bore Location: Alroy Station
Client: Barkly/Gulf Landcare
Intended Use: Investigation
Map: Alroy SE 53 - 15
Grid Reference: 612200 E 7866140 N

****
RECOMMENDATIONS

Pumping Rate: 5 L/sec **Pump Setting: 50 m below Ground Level.**

General recommendations are given on the reverse side. The aquifer and bore can sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****
COMPLETION DETAILS

Finished depth: **63** m
Completion Date: **01/09/1997**
Standing Water Level: **37.2** m on 16/09/1997

TESTING DETAILS

Test Date: **17/09/1997**
Test Rates: **2 & 5** L/sec
Test Duration: **480 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 5.5	203 mm ID steel casing
0.0 - 54.0	100 mm ID PVC casing
54.0 - 60.0	100 mm ID slotted PVC casing
60.0 - 63.0	100 mm ID PVC casing

WARNING: Minimum internal bore diameter is 100 mm.

Notes: 1. Top of casing as constructed was **0.6** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****
COMMENTS

The above recommendations are based on a step and constant rate test at rates up to 5 L/s for 480 minutes and assumes hydrological conditions remain constant.

****
WATER QUALITY
EC = 2660 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 31194

Bore Location: Alroy Station
Client: Barkly/Gulf Landcare
Intended Use: Investigation
Map: Alroy SE 53 - 15
Grid Reference: 627220 E 7873950 N

****
RECOMMENDATIONS

Pumping Rate: 15 L/sec **Pump Setting: 50 m below Ground Level.**

General recommendations are given on the reverse side. The aquifer and bore can sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****
COMPLETION DETAILS

Finished depth: **178** m
Completion Date: **03/10/1997**
Standing Water Level: **41.25** m on 18/09/1997

TESTING DETAILS

Test Date: **18/09/1997**
Test Rates: **10,15 & 20** L/sec
Test Duration: **480 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 35.0	203 mm ID steel casing
0.0 - 68.9	152 mm ID steel casing
68.9 - 178.4	Open hole

WARNING: Minimum internal bore diameter is 152 mm.

Notes: 1. Top of casing as constructed was **0.7** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****
COMMENTS

The above recommendations are based on a step and constant rate test at rates up to 20 L/s for 480 minutes and assumes hydrological conditions remain constant.

****
WATER QUALITY
EC = 5640 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 31197

Bore Location: Mittiebah Station
Client: Barkly/Gulf Landcare
Intended Use: Investigation
Map: Mount Drummond SE 53 - 12
Grid Reference: 690780 E 7925770 N

****

RECOMMENDATIONS

Pumping Rate: 6 L/sec **Pump Setting: 45 m below Ground Level.**

General recommendations are given on the reverse side. The aquifer and bore cannot sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **156** m
Completion Date: **16/09/1997**
Standing Water Level: **26.37** m on 22/09/1997

TESTING DETAILS

Test Date: **23/09/1997**
Test Rates: **3,6 & 9** L/sec
Test Duration: **480 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 4.5	203 mm ID steel casing
0.0 - 47.5	158 mm ID steel casing
47.5 - 52.0	158 mm ID slotted steel casing
52.0 - 58.0	158 mm ID steel casing
58.0 - 156.0	Open hole

WARNING: Minimum internal bore diameter is 158 mm.

Notes: 1. Top of casing as constructed was **0.6** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on a step and constant rate test at rates up to 6 L/s for 480 minutes and assumes hydrological conditions remain constant.

****

WATER QUALITY

EC = 833 uS/cm

Prepared by: I Matthews

WATER RESOURCES DIVISION

DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

TEST REPORT - BORE RN. 31198

Bore Location: Anthony Lagoon Station
Client: Barkly/Gulf Landcare
Intended Use: Investigation
Map: Brunette Downs SE 53 - 11
Grid Reference: 548280 E 7986290 N

****

RECOMMENDATIONS

Pumping Rate: 10 L/sec **Pump Setting: 70 m below Ground Level.**

General recommendations are given on the reverse side. The aquifer and bore can sustain higher pumping rates with deeper pump settings or for short periods. Further advice can be obtained from:

Water Resources Branch, Nth Stuart Highway, ALICE SPRINGS, NT., 0870

(In all correspondence please refer to bore's RN number)

****

COMPLETION DETAILS

Finished depth: **106.9** m
Completion Date: **09/10/1997**
Standing Water Level: **50.16** m on 20/10/1997

TESTING DETAILS

Test Date: **21/10/1997**
Test Rates: **3,6,9,12 & 15** L/sec
Test Duration: **420 minutes**

BORE CONSTRUCTION

Interval (m)	Description
0.0 - 6.6	203 mm ID steel casing
0.0 - 75.0	154 mm ID steel casing
75.0 - 81.0	154 mm ID slotted steel casing
81.0 - 106.9	Open hole

WARNING: Minimum internal bore diameter is 154 mm.

Notes: 1. Top of casing as constructed was **0.5** m above ground level.
2. All depths are measured from natural ground level.
3. Test rates are not necessarily indicative of sustainable long term pumping rates.

****

COMMENTS

The above recommendations are based on a step and constant rate test at rates up to 12 L/s for 420 minutes and assumes hydrological conditions remain constant.

****

WATER QUALITY
EC = 3570 uS/cm

Prepared by: I Matthews

RECOMMENDATIONS FOR FINISHING, OPERATING AND PROTECTING GROUNDWATER BORES

Attention to the following points will ensure a long and safe life for the bore supply and help prevent pollution of the groundwater resource.

1. Construct a concrete apron around the bore head to prevent surface flow, seepage and waste from entering the bore.

2. Seal the space between the casing and pump equipment to prevent entry of vermin, dirt and pollutants.

3. Maintain pumping equipment in good order to prevent pollution. Prevent spillage of fuel and oil on the ground around the bore. Store fertiliser and other chemicals at least 50 m away.

4. Keep stock away from the bore head. Discourage domestic activity at the bore. The first tap on the pipeline should be more than 5 m from the bore head.

5. Pumping the bore at higher than recommended rates may fork the bore leading to instability or pump maintenance problems. Seek the professional advice of a groundwater engineer or hydrogeologist before exceeding the recommended pumping rate.

6. If the bore is no longer required, the casing is to be removed or securely capped and the bore backfilled with clayey material. A cement plug may be required in some instances.

IN ADDITION, please ensure that the BORE IDENTIFICATION TAG is retained securely at all times. The registered bore number is Water Resources Division's only reference to the scientific and engineering data on this bore, and hence important to WRD's further advice to bore owners.

BORE LOCATION MAP

APPENDIX H

PRODUCTION BORE WORK-OVERS

Bore work-overs (as a preliminary to test pumping) and station bore equipment inventory and comments

No. 32 RN 1142: None necessary.

No. 29 RN 1143: Diesel and oil bailed from the bore with help of detergent. Concrete slab is above casing; engine mount allows funelling of oil and diesel into bore; diesel return line on Lister motor missing. Station pump- equipped with Southern Cross PD01 helical rotor.

No. 35 RN 1147: Station pump - equipped with Mono 620 on 66 mm column; intake at 80.9 m. bgl. A 2 m length of pump shaft was installed to replace a worn section.

No. 26 RN 1152: Station pump - equipped with a re-conditioned Mono 620 on 66 mm column; intake set at 97.5 m bgl. A re-conditioned Mono head was fitted.

No. 49 RN 2486: None necessary. Station pump - equipped with Mono 620 on 66 mm column; intake set at 66.5 m bgl.

No. 50 RN 3125: New bolts were put on the stuffing box. The top shaft was freed from rust seizure. Diesel was bailed out of the bore. 1 m of rust was bailed from the bottom of the casing then TD measured at 61.8 m bgl. The station pump's (Southern Cross helical rotor on 66 mm column) intake was re-set from 58 m to 61.7 m bgl.

No. 86 RN 16243: Station pump - equipped with a re-conditioned Mono 620 on 50 mm column; intake set at 94.4 m bgl. Pump stator was rusty and replaced with a new one. Two 3 m lengths of rusted column were replaced with a 6.5 m length of 50 mm NB GWP.

No. 18 RN 21899: Station pump - equipped with a Mono 620 on 50 mm column; intake at 93.8 m bgl. One length of rusted column was removed and pump re-set at 87.6 m bgl.

No. 77 RN 30667: Station pump - equipped with re-conditioned Mono 620 on 50 mm column; intake at 112.8 m bgl. Diesel and oil bailed from the bore along with pieces of rubber stabilisers. Blockage of rubber was encountered at 112.8 m and pushed to the bottom, broken up and bailed along with rust and sand. TD measured at 147.3 m bgl. Watery oil & diesel, plant and insect material were pumped from the bore during preliminary stage of test-pumping. Station pump was re-run and the supply improved from 0.8 L/s to 1.4 L/s. (Bore was pump-tested a month later).

No. 66 RN 28448: NB This bore was not test-pumped but a water sample taken by request from Station Manager (see Table 2). Oil, rust and sand was bailed from the bore. Bore was duo-piped with 25 mm NB air-jet inside 80 mm NB GWP eductor pipe; the pipe was noted to be "bouncing" on rubber (probably centralisers); a spear was run but nothing fished out of the bore. Bailer was re-run and collected more sand. TD pre-clean-out 91.9 m; TD post-clean-out 92.7 m bgl.

[i] All chemical concentrations given in milligrammes per litre (mg/L) unless otherwise indicated.