STUDY ON THE GROUNDWATER POTENTIAL EVALUATION AND MANAGEMENT PLAN FOR THE SOUTHEAST KALAHARI (STAMPRIET) ARTESIAN BASIN IN THE REPUBLIC OF NAMIBIA

Japan International Cooperation Agency
Pacific Consultants International

BOREHOLE FINAL REPORT

Borehole
J1-A (WW 39839)
Christiana

METZGER PM DRILLING
P.O.Box 11733
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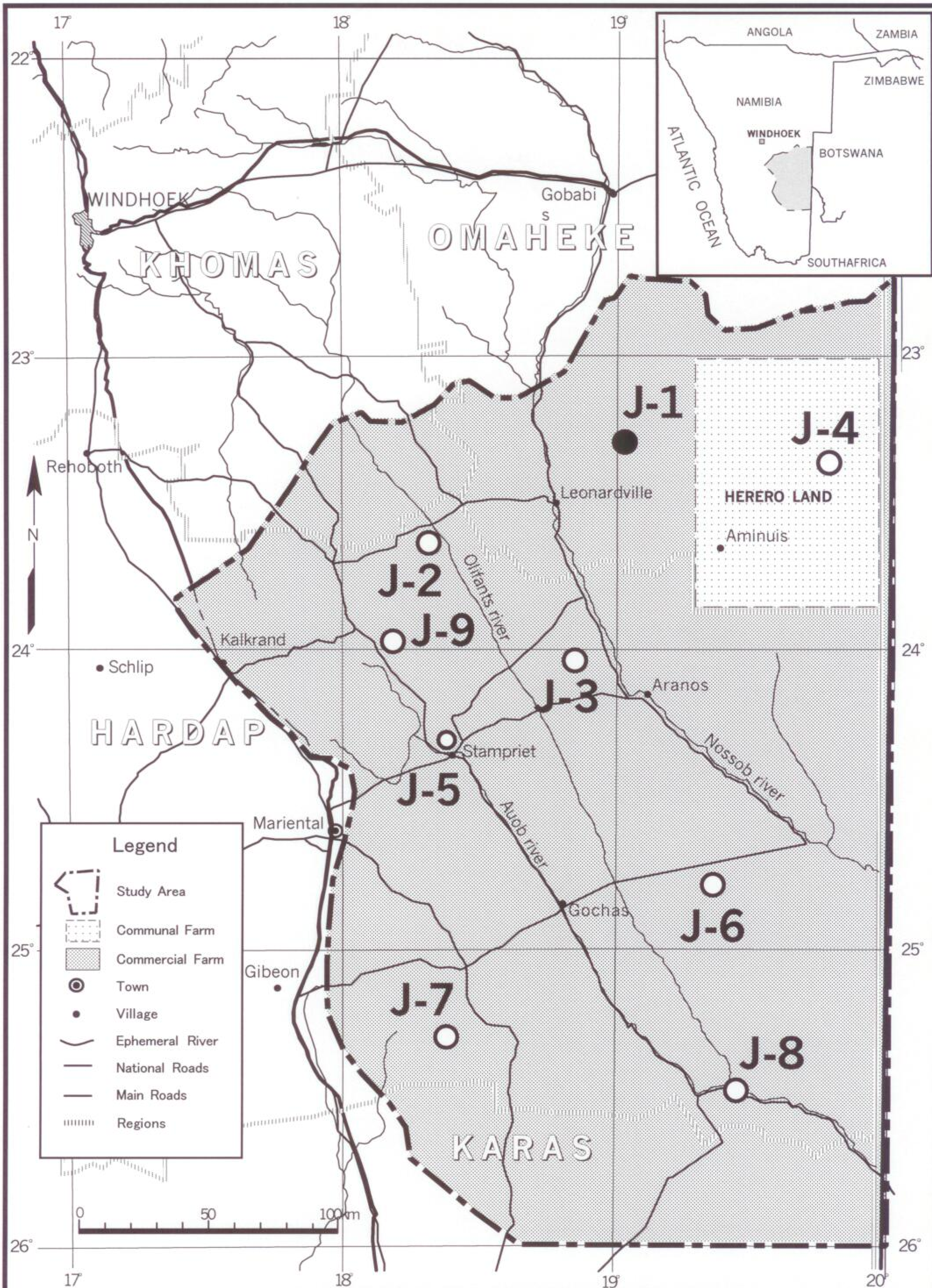
Namibia

Windhoek
October 2000



Location Map of Test Boreholes

THE STUDY ON THE GROUNDWATER IN THE STAMPRIET ARTESIAN BASIN | JICA

Contents per Chapter

1. Geological Borehole Log

GEOLOGICAL BOREHOLE LOG

Farm Christiana L 727 | **WW 39839**
Jica Reference : J - 1 - A | **S 23, 25415°**
Date completed : 29 April 2000 | **E 18, 98668°**
Collar elev.: 1330 m

Depth below surface (m)	Section (m)	Lithology	Stratigraphy
0 - 2	2	Yellowish brown **sand**, fine grained.	**KALAHARI**
2 - 4	2	Yellowish grey fine grained **sandstone**, calcareous / calcrete cemented.	
4 - 5	1	Light grey **sandstone**, biotite and muscuvite rich. Non-calcareous	**UPPER RIETMOND**
5 - 6	1	Pale reddish brown micaceous **sandstone**, laminated with yellowish brown oxidation on laminations	
6 - 7	1	Pale greenish yellow **sandstone**, fine grained, micaceous (muscovite), laminated.	
7 - 8	1	Pale greenish yellow micaceous (muscovite) **sandstone** with biotite on laminations. Interbedded thin white shale. Drill cuttings very coarse.	
8 - 9	1	Pale greenish yellow **sandstone** with calcareous horizons, interbedded with layers of reddish sandstone, calcrete cemented. Fracture planes with Fe-oxide staining	
9 - 12	3	Pale yellowish orange fine grained **sandstone**, calcareous	
12 - 13	1	Pale yellowish orange medium to fine grained calcareous **sandstone.**	
13 - 16	3	Pale yellowish orange medium to fine grained calcareous **sandstone**, laminated with thin biotite rich layers. A very hard horizon was intersected at 14,8 m.	
16 - 20	4	Red micaceous **sandstone**, slightly feldspathic, fine to medium grained. Minor inter-layered soft red shale towards 20 m.	
20 - 21	1	As above. Contact zone to a yellow shale with inter-layered micaceous sandstone. Calcitic vein filling.	
21 - 30	9	Yellow **shale**. Thin interbedded micaceous sandstone lenses and thin light grey shale horizons.	
30 - 35	5	Yellow **shale**, minor fine grained sandstone, micaceous with ferrous concretions at 31 m. Ferrous oxide vein filling at 35 m.	
35 - 36	1	Change to red **shale**. Horizons of laminated red sandstone.	**LOWER RIETMOND**
36 - 40,5	4,5	Red soft **shale**. Intercalated ferrugenous sandstone, very fine grained. Shale and sandstone calcareous in places.	
40,5 - 42	1,5	Purple **mudstone.** No cuttings of consolidated horizons in material retrieved. Calcareous.	

42 - 58	16	Soft, non-porous dark grey **mudstone**. Muscovite in horizons. At 47,5 m thin white mudstone with intercalated thin horizons of ferrous, very fine grained sandstone. At 51 m very thin horizon of siltstone, dark grey, partially ferruginous orange coloured: limonite staining.	
58 - 73	15	Dark grey to black **siltstone / shale**. At 58 m thin calcite filled veins and ferrous concretions. Thin very fine grained limonitic sandstone. Carbonaceous at places, esp. at 64 m.	
73 - 83,5	10,5	Grey **siltstone** with occasional ferrous concretions.	
83,5 - 96	12,5	(LOSS OF SAMPLES; SEE COMMENT):Very fine grained red **sandstone**, occasional calcareous cementing. Very well sorted rounded grains. Porous.	
96 - 101	5	As above, but poorly consolidated. Wash out expected.	
101 - 103	2	Light grey very fine **sandstone**, calcareous. Well sorted rounded grains. Porous.	**AUOB A 5**
103 - 109	6	Intercalated light grey **siltstone** and soft grey **shale**. (Shale evident as clay rich matrix in drill cuttings.)	
109 - 115	6	Light orange red **siltstone** / very fine grained **sandstone**, calcareous, well sorted and rounded quartz grains, very porous.	
115 - 116	1	As above, with colour changing to light grey.	
116 - 117	1	Light grey calcareous **siltstone**, interbedded with light grey **shale**.	
117 - 123	6	Grey **shale**, minor horizons of red shale.	
123 - 123,5	0,5	Grey **shale**: Fe - staining on laminations. At 123,5 m minor ferrous concretions.	**AUOB A 4**
123,5 - 129	5,5	Calcareous very fine-grained **sandstone**, light grey. Grains well rounded and well sorted. Porous. Between 128 and 129 m a thin layer of grey shale was intersected.	
129 - 131,5	2,5	Light grey very fine calcareous **sandstone**; muscovite in places. Well sorted. High porosity.	
131,5 - 135	3,5	Light grey **sandstone**, calcareous. Unsorted, grainsize very fine to coarse to small pebbles (0,2 - 5 mm). Mostly subrounded to subangular quartz. Muscovite in places. High porosity.	**AUOB A 3**
135 - 144	9	Light grey very fine **sandstone**, calcareous. Quartz grains rounded and well sorted. Muscovite in places. Occasional scattered pyrite.	
144 - 145	1	Light grey calcareous fine to very coarse unsorted **sandstone**, muscovite in sample.	
145 - 148	3	Grey **siltstone / shale.**	
148 - 155	7	Grey **shale**. Minor scattered pyrite.	
155 - 158	3	Light grey **shale**. Minor horizons of light grey siltstone.	**AUOB A 2**
158 - 171	13	Dark grey to black **shale**. Carbonaceous in places with disseminated small pyrite crystals.	
171 - 172	1	Grey very fine-grained calcareous **sandstone**, well	

		sorted and rounded. Porous.	**AUOB A 1**
172 - 189	17	Alternating layers of grey **shale** and very fine grained **sandstone**. Sandstone calcareous in places. (MIXED SAMPLE)	
189 - 198	9	Light grey very fine slightly calcareous **sandstone** with minor intercalated light grey shale.	
198 - 208	10	Mainly light grey **shale**. Minority of drill cuttings with greenish yellow oxidation areas. Inter-layered minor light grey fine grained sandstone.	**MUKOROB**
208 - 236	28	Light grey **shale** with minor horizons of light grey mudstone inter-layered.	
236 - 245	9	Light grey **siltstone / mudstone / shale.** Drop-stones of purple and red quartzite, grey quartzite, fragments of limestone and dolomite. Rounded edges on quartzite chips indicate transported material. Drill cuttings coarse (+12 mm) --- TILLITE ?	**DWYKA**
245 - 253	8	As above , but very hard, drillcuttings fine (- 4 mm)	
253 - 256 EOH	3	Red to purple **quartzite**: minor red shale. Quartzite fine grained (Orthoquartzite ?)	**BASEMENT (NAMA ?)**

GENERAL COMMENTS:

1. The drilling method employed was " Mud rotary ". Shale is often ground to a fine powder and visible in the "cuttings" only as moist clay. This implies that "shale" might also be a mudstone.
2. As only a very low percentage of the collected drill cuttings are retained after washing, also the unwashed portion is collected in the sample tray and marked as such.
3. Shale and /or mudstone in the RIETMOND SHALE MEMBER is very soft and moist.
4. It was attempted to drill the AUOB MEMBER by the air-rotary method in order to collect water samples during drilling. Although a water sample was collected successfully, this proved not to be the desirable method as it is a very aggressive high energy drilling method and resulted in a total loss of drill cuttings and cavity formation with subsequent danger of collapse in these horizons.
5. Natural Gamma logging would suggest the boundary to the non-porous Mukorob Shale Member at 205 m. The boundary between **A 1** and the Mukorob is according to lithology interpreted to be at 198 m. (Interpretation by other geologists on site puts this boundary at 189 m.)

6. The carbonaceous shale between 165 m and 171 m apparently is hydrating, resulting in considerable washout and probably some collapse. The borehole had to be cleaned after geophysical surveying and before casing installation.
7. Gravel was emplaced around casing, as collapse was anticipated also in the section of **A 5** drilled by air rotary method.

This borehole was logged by F. Bockmühl on 16/04/2000.

2. Penetration Record

Penetration Record J1A	
Depth (m)	Pen. rate (min/m)
1	
5	
	2.25
	3
	5.5
10	4
	3.5
	5
	4
	3.5
15	12
	3.5
	4
	3
20	3.5
	4.25
	4
	5.25
	4
25	4.5
	5.25
	5
	5.75
	4.5
30	4
	5
	4
	5
	5.5
35	6.5
	5.3
	5.1
	5
	5.5
40	4.75
	5.4
	6
	4
	3.75
45	5.25
	4
	3.2
	2.45
	3
50	3.2
	3.6

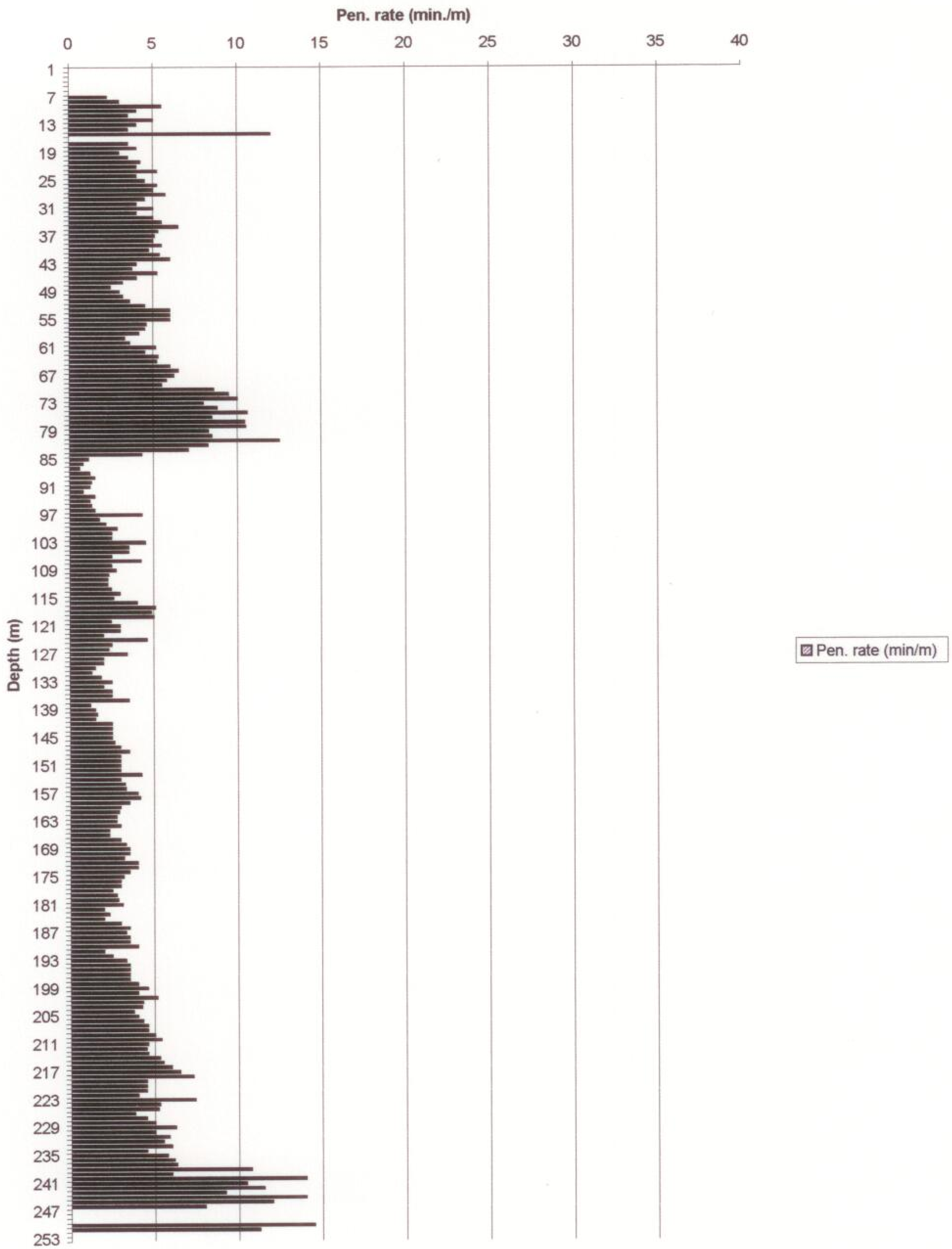
	4.5
	6
	6
55	6
	4.6
	4.5
	4.15
	3.3
60	3.6
	5.15
	4.5
	5.3
	5.2
65	6
	6.5
	6.25
	5.8
	5.5
70	8.6
	9.5
	10
	8
	8.8
75	10.6
	8.5
	10.45
	10.5
	8.3
80	8.5
	12.5
	8.25
	7.1
	4.3
85	1.1
	0.8
	0.6
	1.2
	1.5
90	1.3
	1.2
	0.8
	1.5
	1.2
95	1.3
	1.5
	4.3
	1.75
	2.15
100	2.8
	2.5
	2.5
	4.5
	3.5

105	3.5
	2.5
	4.25
	2.5
	2.75
110	2.3
	2.25
	2.25
	2.45
	3
115	2.6
	4
	5.1
	4.85
	5
120	2.45
	3
	3
	2
	4.6
125	2.5
	2.3
	3.4
	2
	2
130	1.5
	1.3
	1.85
	2.5
	2
135	2.5
	2.5
	3.5
	1.2
	1.5
140	1.6
	1.5
	2.5
	2.5
	2.5
145	2.5
	2.65
	3
	3.5
	3
150	3
	3
	3
	4.25
	3
155	3.25
	3.3
	4

	4.15
	3.5
160	3
	2.9
	2.75
	2.75
	3
165	2.3
	2.3
	3
	3.3
	3.5
170	3.5
	3.2
	4
	4
	3.5
175	3.15
	3
	3
	2.5
	2.75
180	2.85
	3.1
	2
	2.3
	2
185	3
	3.5
	3.3
	3.5
	3.5
190	4
	2
	2.5
	3.3
	3.5
195	3.5
	3.5
	3.5
	4
	4.6
200	4
	5.15
	4.3
	4.25
	3.75
205	4
	4.3
	4.6
	4.6
	5
210	5.4

	4.6
	4.5
	4.6
	5.3
215	5.5
	6
	6.5
	7.3
	4.5
220	4.5
	4.5
	4
	7.4
	5.3
225	5.2
	3.8
	4.5
	5
	6.25
230	5
	5.85
	5.5
	6
	4.5
235	5.75
	6.15
	6.3
	10.75
	6
240	14
	10.45
	11.5
	9.2
	14
245	12
	8
250	14.5
	11.25
	7.5
255	7.3

Penetration Record J 1 A



3. Mud Rotary Drilling Log

THE STUDY ON THE GROUNDWATER POTENTIAL EVALUATION AND MANAGEMENT PLAN IN THE SOUTHEAST KALAHARI (STAMPRIET) ARTESIAN BASIN

MUD ROTARY DRILLING LOG

JICA REFERENCE: J 1 A   LOCALITY: Christiana   WW 39839   DATE: 11 to 16 April 2000

TIME	DEPTH mbgl	MARSH FUNNEL TEST 1000 ml (sec)	MARSH FUNNEL TEST 500 ml (sec)	E. C. mS/cm	DENSITY	pH	TEMPERATURE ° C	COMMENT
08:42	8	37						
14:50	*15*	*30*		*9.48*				*E.C. of water used for drillfluid: 5.8 mS/cm*
15:11	19.5	30		8.25				
16:16	29	31		7.73				
17:54	42	31		7.87				End of day 11/04/00
06:24	42	32		7.46				Start of day 12/04/00
07:56	60	31		7.22				
08:08	62.5	40		7.62				
10:57	81.5	34		7.30				
13:30	84	31.76 *29.68*		7.38 *6.93*			28.7 *23.9*	Drillfluid before logging *Water for d-fluid before logging*
10:40	84							Start on 15/04/00
12:45	96			7.72				
13:25	109	30		5.74				
16:09	150	31		5.80				
19:00	198	40		5.89				End of day 15/04/00
07:45	200	40		5.82				First measurement 16/04/00
14:47	256	35		6.05				
15:55		33		5.95			25.8	Drillfluid before logging

		29		*6.24*			*24.3*	*Water for d-fluid before logging*

GENERAL REMARKS:

1. This borehole was logged geophysically at a depths of 84 m and 256 m (final depth).
2. Drilling diameter was 12 ¼ " for the initial logging, and 9 7/8"for the final logging.
3. After casing installation and full hole cementing to a depth of 83.54 m , drilling at 9 7/8 " ∅ was completed to a depth of 256 m.
4. Parameters of both the drillfluid and the water used for the mixing of the drillfluid were recorded from filtered samples.
5. To determine the electrical resistivity of the samples as Ω.m, the E.C., expressed as S/m should be inversed (1/x).

4. Geophysical Log and Casing Design

5. Borehole Development Data

THE STUDY ON THE GROUNDWATER POTENTIAL EVALUATION AND MANAGEMENT PLAN IN THE SOUTHEAST KALAHARI (STAMPRIET) ARTESIAN BASIN

BOREHOLE DEVELOPMENT DATA

JICA REFERENCE: J 1 A LOCALITY: Christiana L 727 WW 39839 DATE: 01/05/2000 (starting)

TIME (actual)	P.I.D. (mbsu)	½ 90° V-Notch (mm)	Yield (m^3/h)	E.C. (mS/m)	Remarks
14:55	120				Start with low airflow – percolating water in gravel
15:20					Increase airflow
15:45		38 - 46		105	Water very full of drill fluid, surging. Fluctuate air volume in order to continuously surge water into gravel pack.
16:05		42		88	Water milky, increase airflow
16:25	120	46		88	
16:30					Shut down airflow
17:00					Start airflow, increasing slowly
17:45		50		90	
18:00	120	56		88	
21:15		58		88	
11:30		62		88	
04:10		60		88	Shut down airflow
06:00	120	66	2.7	87	Start air flow. Water full of drill fluids.
07:00		65		87	
08:00		64	2.5	86	Water murky. Decide to lower P.I.D to below screens. Add STPP
13:40	180				Start to airlift with very low air-flow.
13:53					Increase air-flow slightly.
14:03		80	4.68	568	High E.C. value due to STPP added to gravel.

TIME (actual)	P.I.D. (mbsu)	½ 90° V-Notch (mm)	Yield (m^3/h)	E.C. (mS/m)	Remarks
14:17					Increase air-flow slightly.
14:24		80	4.68	91	
14:39		82	4.9	88	
15:00		81		87	
15:33		80	4.68	86	
15:51		82		86	
16:10		82	4.9	86	
16:13					Close airflow: surging
17:04	180				Start very low airflow, will be increased slowly
17:45		75	3.85	86	
18:37		79	4.5	85	
19:45		78		85	
20:23		89	6	85	
20:57		80	4.68	85	
21:00	180				Increase air volume
21:15		81	4.8	85	
22:00	180	82		85	
23:50		82		85	Water clear
24:00					Airflow reduced to percolate water in gravel pack
06:00	180				Open airflow very slightly, water percolating Date **02/05/00**
06:34					Increase airflow
06:54		80	4.68	86	Water again dirty
07:10					Increase airflow
07:38		84	5.1	86	
08:00					Cut off airflow
09:00	180				Start very low airflow

TIME (actual)	P.I.D. (mbsu)	½ 90° V-Notch (mm)	Yield (m^3/h)	E.C. (mS/m)	Remarks
09:26		85	5.4	85	Water very milky
10:02	180	83		84	
11:00		82	4.85	84	
11:56		83		84	Water cloudy
12:00					Cut off airflow
13:00	180				Start very low airflow, to be increased regularly
13:22		86	5.5	84	Empty V-Notch from sand & mud
13:47		86		85	Water clear: no sand or silt
14:02		86	5.5	84	
15:01		81		84	
15:55		82	4.85	84	Water clear
16:00					Cut off airflow to allow recovery
17:00					Start very low airflow
17:30	180	81		86	Water very milky
18:00	180	80	4.68	85	Water milky
18:47		81		84	
19:11		82	4.85	85	Water slightly cloudy
19:56		82		84	
20:00					Cut off airflow
21:00					Start airflow
21:39	180	88	5.85	85	Water milky
23:05		79	4.6	85	
24:00		81	4.7	85	
01:31		81		84	
03:16		83	5	85	
04:05		83		85	
05:41		83		84	

TIME (actual)	P.I.D. (mbsu)	½ 90° V-Notch (mm)	Yield (m^3/h)	E.C. (mS/m)	Remarks
07:00	180	86	5.5	84	Water clear
07:58		83		84	
08:15					Water clean, no sand or silt
08:58		83		84	
09:54		83	5	84	
10:00					Switch off air, start recovery measurements.

Additional Information:

1. Developing was also done by Cable Tool on 28 April 2000 -- 9 hours plunging and bailing down to185 m.
2. Developing was also done by Cable Tool on 29 April 2000 – 11 hours plunging and bailing.

RECOVERY DATA

Borehole J 1 A WW 39839 Date 3 May 2000

Time (actual)	Recovery Time (min)	Water Level (mbsu)		Time (actual)	Recovery Time (min)	Water Level (mbsu)
10:01	1	60.58		10:35	35	
	2	59.58			40	
	3	59.28			50	
	4	59.08		11:00	60	
	5	58.80			75	
	7	58.57			90	
10:10	10	58.40			105	
	15	58.15		12:00	120	
	20	58.02			150	
10:25	25	57.88		13:00	180	
	30	57.76		13:30	210	

Time (actual)	Recovery Time (min)	Water Level (mbsu)
14:00	240	56.99
	300	56.87
16:00	360	56.83
	420	56.74
	480	56.71
	600	56.67
22:00	720	56.05
02:00	960	56.56
06:00	1200	56.51
10:00	1440	56.50

Remarks: Draw down during airlift pumping due to the depth of the water level, resulting in only limited yield, is not indicative of the capacity of the borehole. For the design of the pumping rates during the Step Drawdown Tests it is therefore necessary to conduct a short provisional test with a submersible pump.

6. Evaluation of Pumping Test

1. PUMPING TEST ANALYSIS

J1-A (WW39839) - Pumping well

2318BD-35- Observation well

1.1. Well Efficiency (Annex 1)

Well Efficiency was analysed by making use of the Jacob method for draw down data. The well efficiencies at the range of pumping rates are summarised in **Table 2** below.

Table 1: Borehole efficiency at various pumping rates

Borehole number	Step	Abstraction Rate $[m^3/h]$	Draw Down* [m]	Borehole Efficiency [%]
J1-A	1	3.7	2.69	53.4
	2	6.23	8.26	48.3
	3	9	9.85	43.7
	4	12.1	15.4	39.5
	5	15	19.8	36.3

* at cut-of time Δt, after which well bore storage has no affect on the well performance

Data on the linear and non-linear well losses and skin factors as well as the efficient well radius are presented in **Annex 1.**

1.2. Constant Discharge Test Analysis (Annex 2 - 5)

The draw down curve indicates leaky conditions. Hantush model for leaky aquifers was used to simulate and verify the actual data and analysis approach. Simulation parameters used in simulation were obtained from the analysis of the pumping test graphs. Storativity was estimated due to the fact that none of the 2 observation boreholes are open or located in the tested aquifer.

Table 2: Aquifer Parameters calculated for J1-A; Auob sandstone

Borehole number	Analysis Method	T	s	k	S	Simulation model	Comments
		$[m^2/day]$	[m]	[cm/sec]	[-]		
J1-A	Walton-Hantush - draw down	25,2	75	3.9×10^{-4}	$*1 \times 10^{-5}$	Hantush	Poor correlation between pumping rates and water level e.g. water level rises during abstraction.
	Walton-Hantush - recovery	25,3	75	3.9×10^{-4}	$*1 \times 10^{-5}$		

For leaky aquifers, the Walton Hantush analysis method with draw down and recovery data was once again used to calculate the hydraulic conductivity of the aquifer and the aquitard **(Annex 2 & 3)**.

The abstraction has no real influence on the observation borehole due to its distance from the abstraction borehole (see radius of influence R). Because the observation borehole was pumped during the constant discharge test, the data is not reliable for evaluation.

The radius of influence (R) was estimated after SICHARDT (1928) using the equation:

$R = 3000 \times s \times K_f^{1/2}$

$R = 3000 \times 11.2 \times 1.97 \times 10^{-3} = \underline{66\ m}$

where

R = Radius of influence

s = Draw down in abstraction borehole at end of pumping

K_f = Permeability of the aquifer

The equation is approximately correct for unconfined aquifers. In case of a confined aquifer the radius of influence most probably larger and the 66 m are considered to be the minimum value.

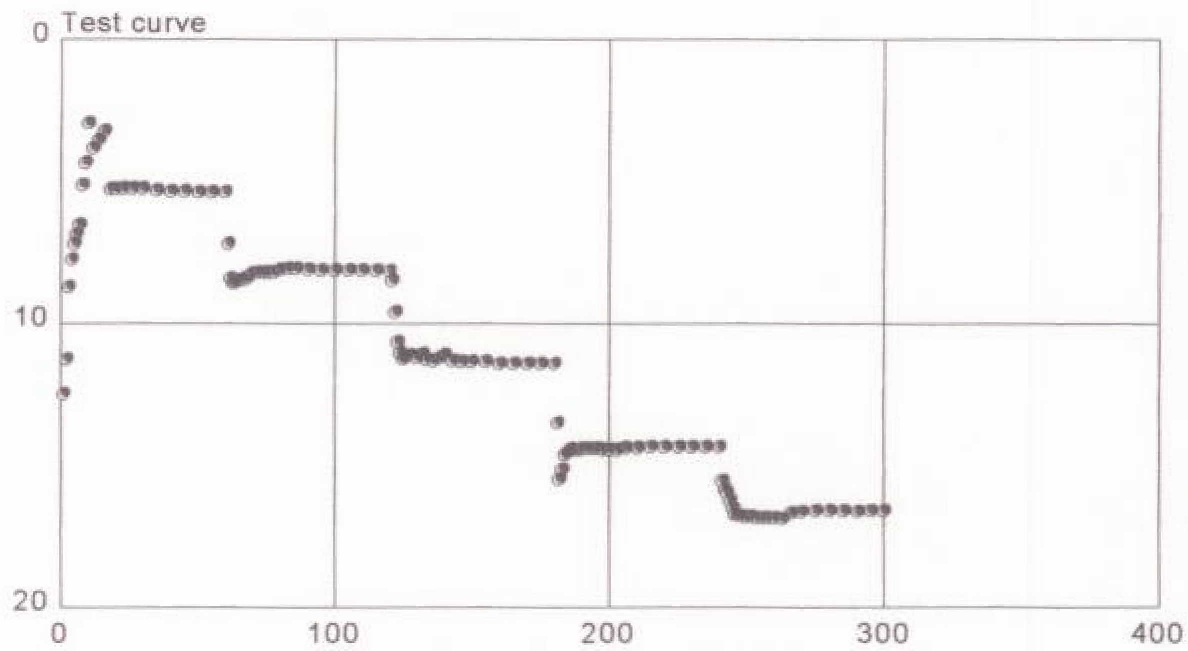
A proper evaluation of R (and storativity S) will only be possible once reliable data from observation wells, penetrating the same aquifer as the pumped well, are available.

Groundwater Study in the Stampriet Artesian Basin

Evaluation of Test Pumping Data

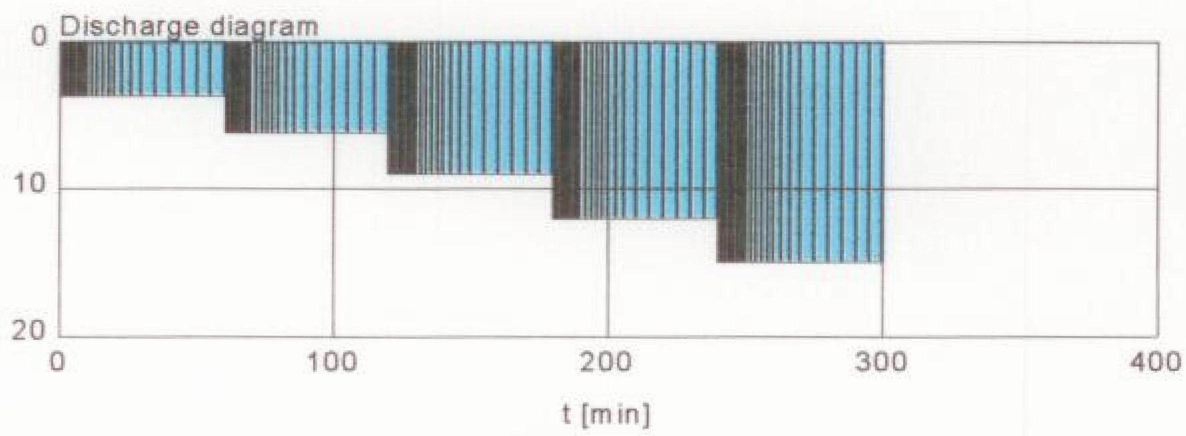
Step test analysis

Pumped well J1-A



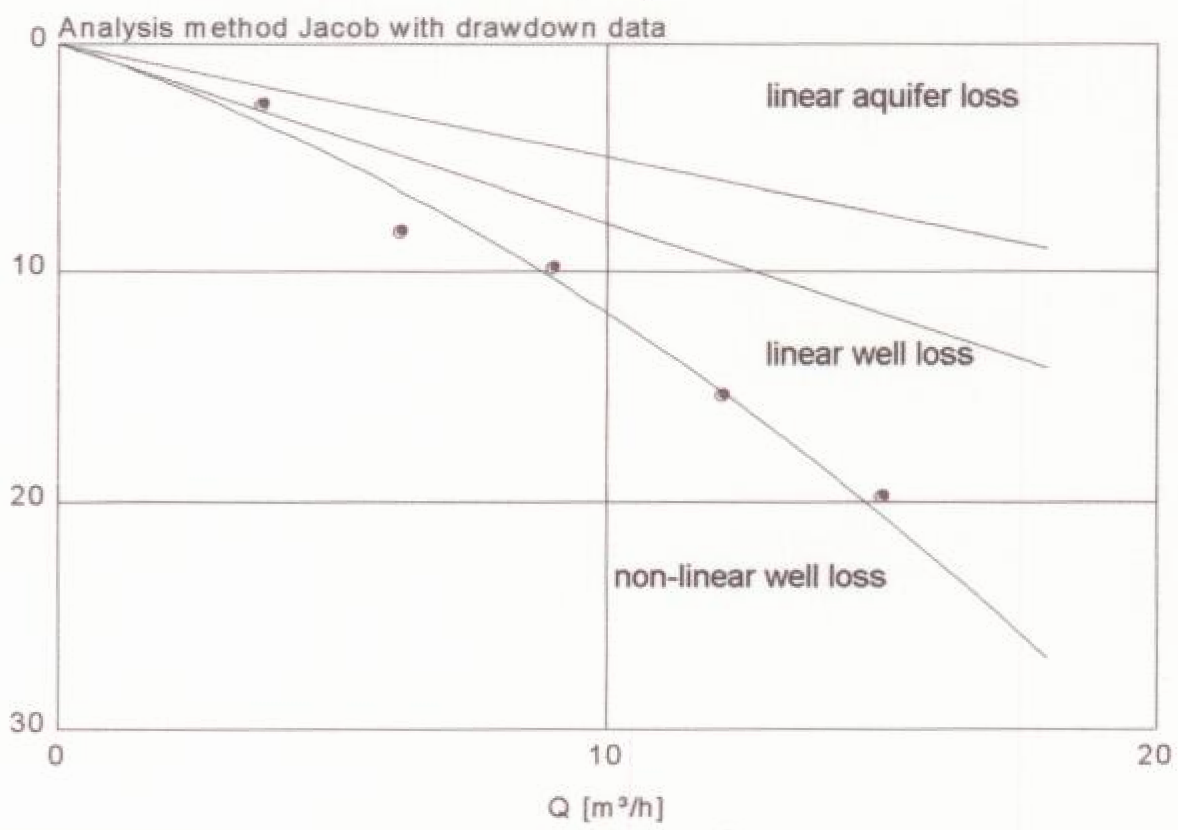
Borehole, well & aquifer

Drilled:	
Latitude:	
Longitude:	
Elevation:	1100 [m]
Depth:	256 [m]
Stick up:	0.00 [m]
Bh. radius:	0.125 [m]
Casing radius:	0.081 [m]
RWL:	57.11 [m]
max.drawdown:	16.85 [m]
Aq.type:	confined
Aq.thickness:	75.00 [m]
Stratigraphy:	Auob Sandstone
Lithology:	Sandstone



Test running

Start:	05/06/2000 13:56:44
Dis.dur.:	300 [min]
Av.dis.:	9.2 [m³/h]
Max.dis.:	15 [m³/h]
Min.dis.:	3.7 [m³/h]
Total dis.:	46 [m³]
Crew:	Metzger_PM
Supervisior:	PCI



Results

Well performance:

s: $(B1+B2)*Q+C*Q^2$

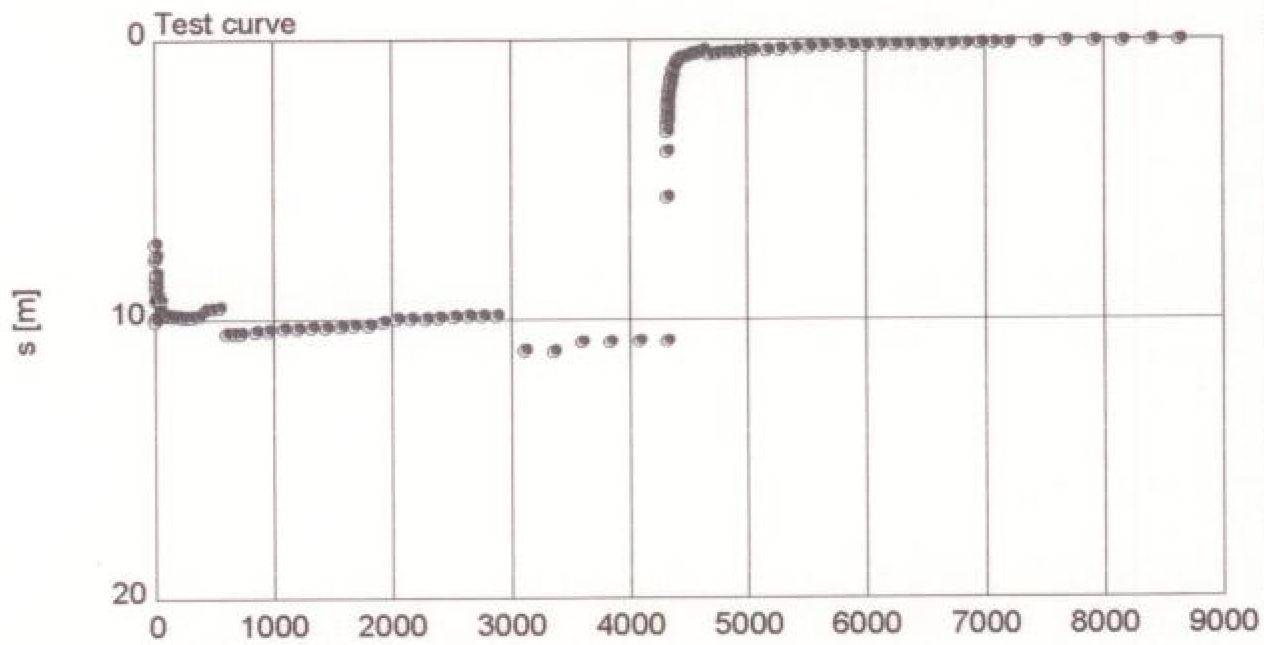
Linear aquifer loss B1:	0.50
Linear well loss B2:	0.29
Non-linear well loss C:	3.9E-2

	Q [m³/h]	s [m]	Eff [%]
Step 1:	3.70	2.69	53.4
Step 2:	6.23	8.26	48.3
Step 3:	9.00	9.85	43.7
Step 4:	12.1	15.4	39.5
Step 5:	15.0	19.8	36.3

Linear skin factor:	1.83 [-]
Non-linear skin factor:	5.88 [d/m²]
Effective well radius:	5.1E-4 [m]

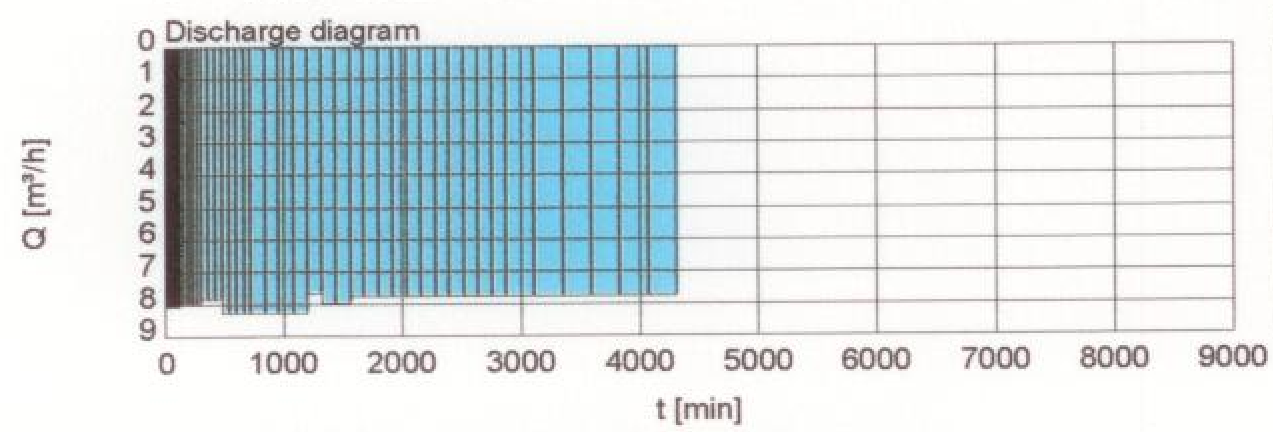
Test pumping analysis

Pumped well J1-A



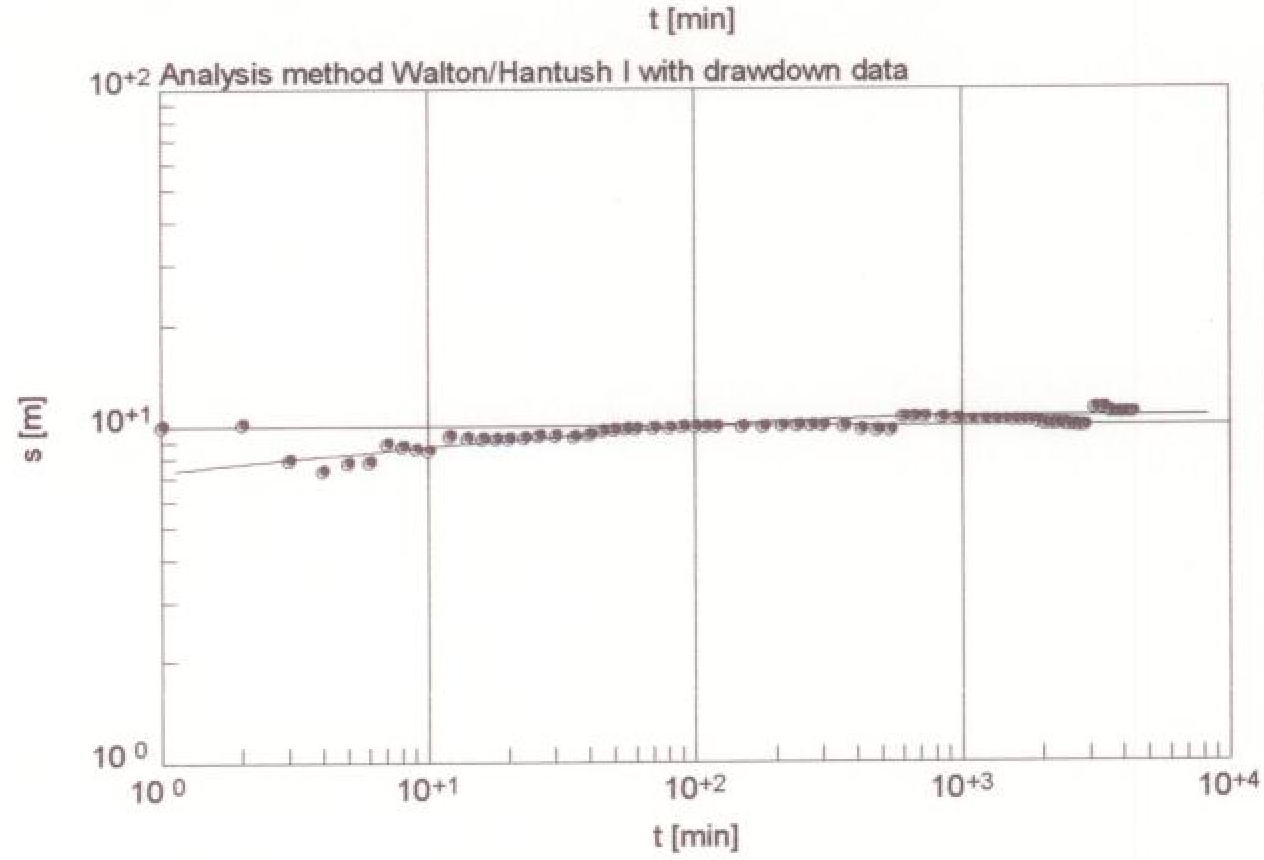
Borehole, well & aquifer

Drilled:	
Latitude:	
Longitude:	
Elevation:	1100 [m]
Depth:	256 [m]
Stick up:	0.00 [m]
Bh. radius:	0.125 [m]
Casing radius:	0.081 [m]
RWL:	58.07 [m]
max.drawdown:	16.85 [m]
Aq.type:	confined
Aq.thickness:	75.00 [m]
Stratigraphy:	Auob Sandstone
Lithology:	Sandstone



Test running

Start:	05/06/2000 14:20:39
Dis.dur.:	4320 [min]
Av.dis.:	7.91 [m³/h]
Max.dis.:	8.3 [m³/h]
Min.dis.:	7.7 [m³/h]
Total dis.:	570 [m³]
Crew:	Metzger_PM
Supervisior:	PCI



Results

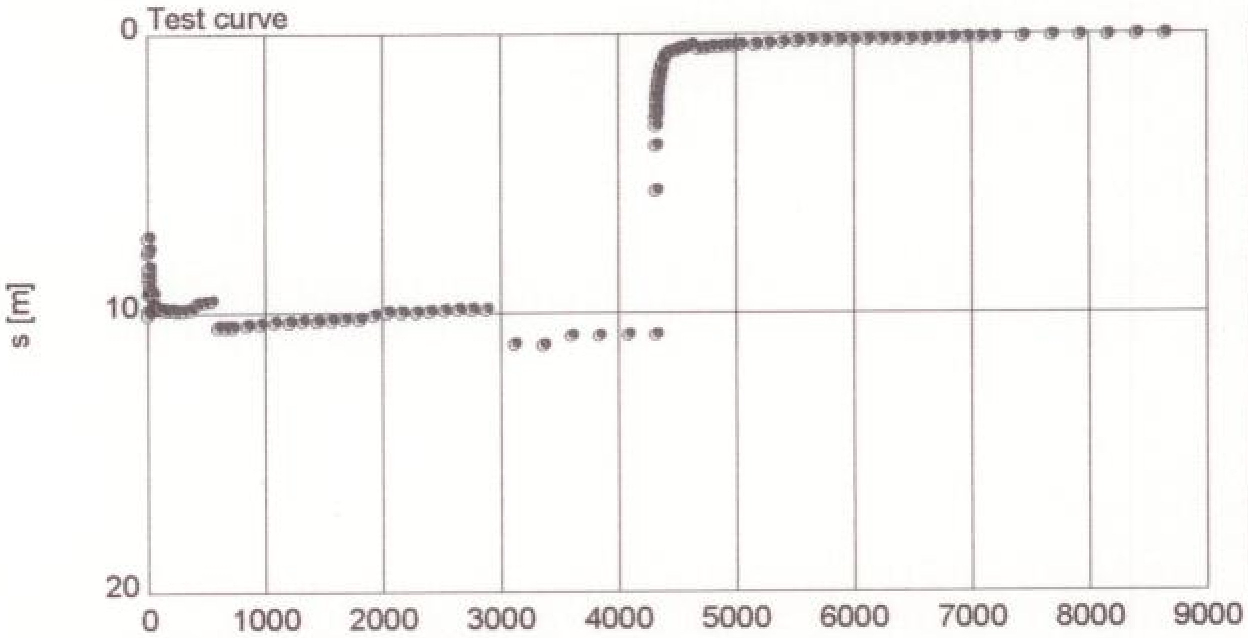
Match parameter:	
Q:	7.91 [m³/h]
t:	100 [min]
s:	5.53 [m]
1/u:	3.6E7 [-]
W(u,r/B):	9.24 [-]
Aquifer parameter:	
T:	25.2 [m²/d]
k:	0.337 [m/d]
Boundary parameter:	
B:	800 [m]
m´:	50 [m]
k´:	0.00197 [m/d]

Groundwater Study in the Stampriet Artesian Basin

Evaluation of Test Pumping Data

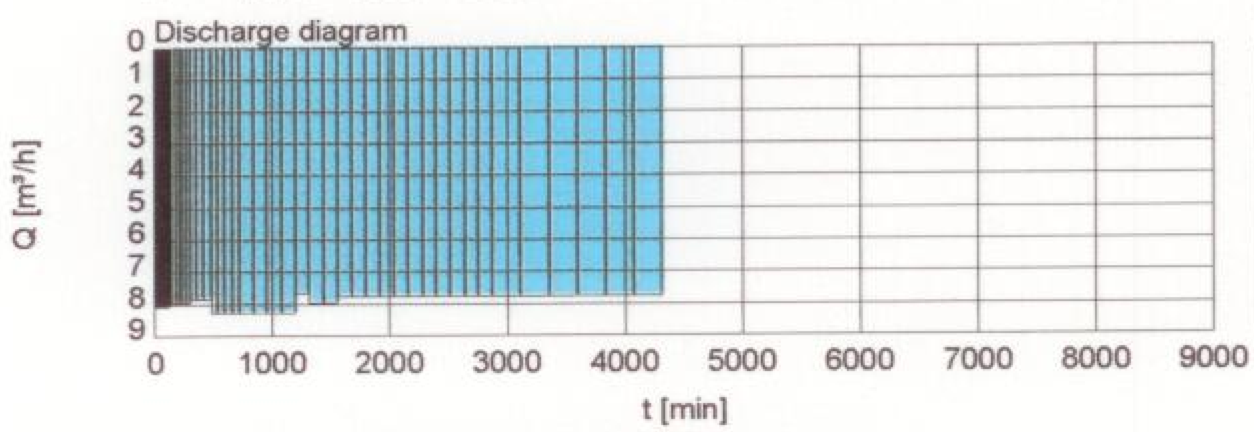
Test pumping analysis

Pumped well J1-A



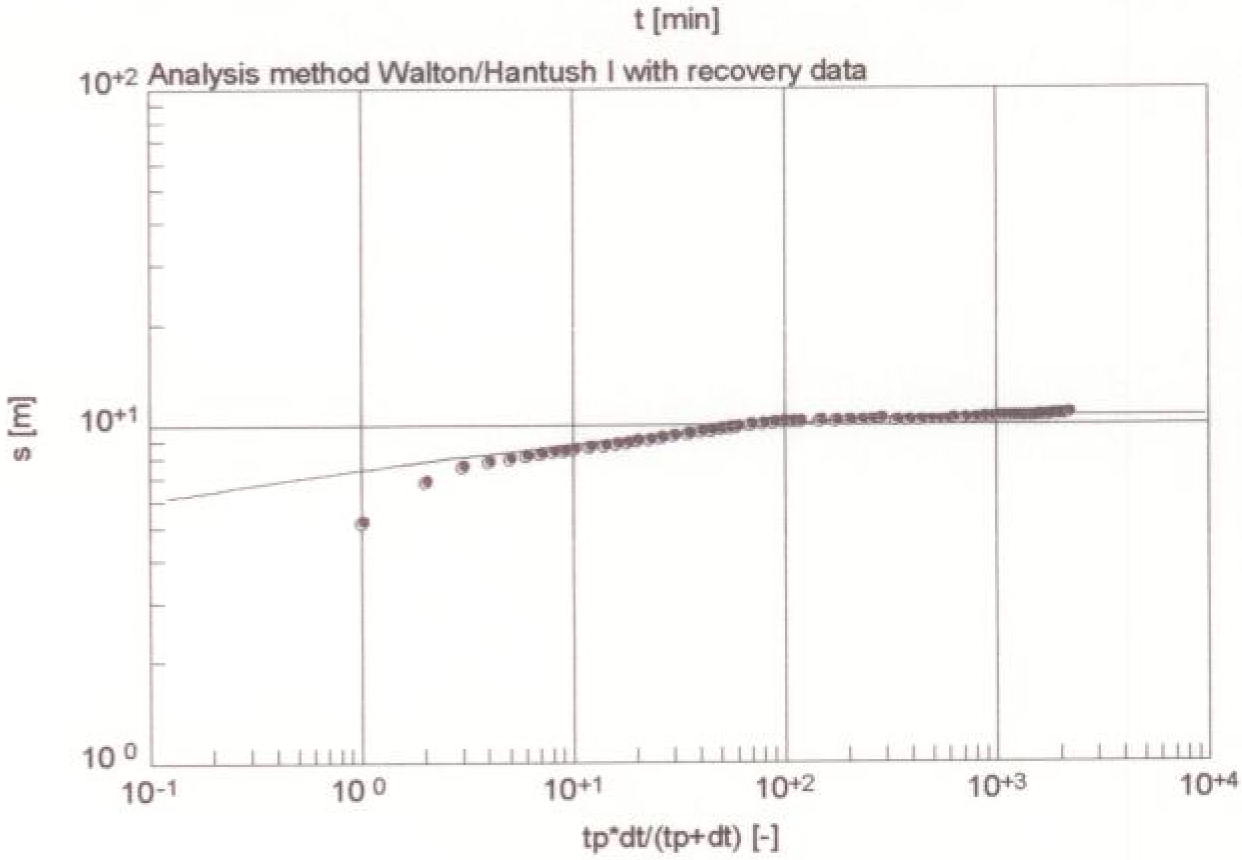
Borehole, well & aquifer

Drilled:	
Latitude:	
Longitude:	
Elevation:	1100 [m]
Depth:	256 [m]
Stick up:	0.00 [m]
Bh. radius:	0.125 [m]
Casing radius:	0.081 [m]
RWL:	58.07 [m]
max.drawdown:	11.16 [m]
Aq.type:	confined
Aq.thickness:	75.00 [m]
Stratigraphy:	Auob Sandstone
Lithology:	Sandstone



Test running

Start:	05/06/2000 14:20:39
Dis.dur.:	4320 [min]
Av.dis.:	7.91 [m³/h]
Max.dis.:	8.3 [m³/h]
Min.dis.:	7.7 [m³/h]
Total dis.:	570 [m³]
Crew:	Metzger_PM
Supervisior:	PCI



Results

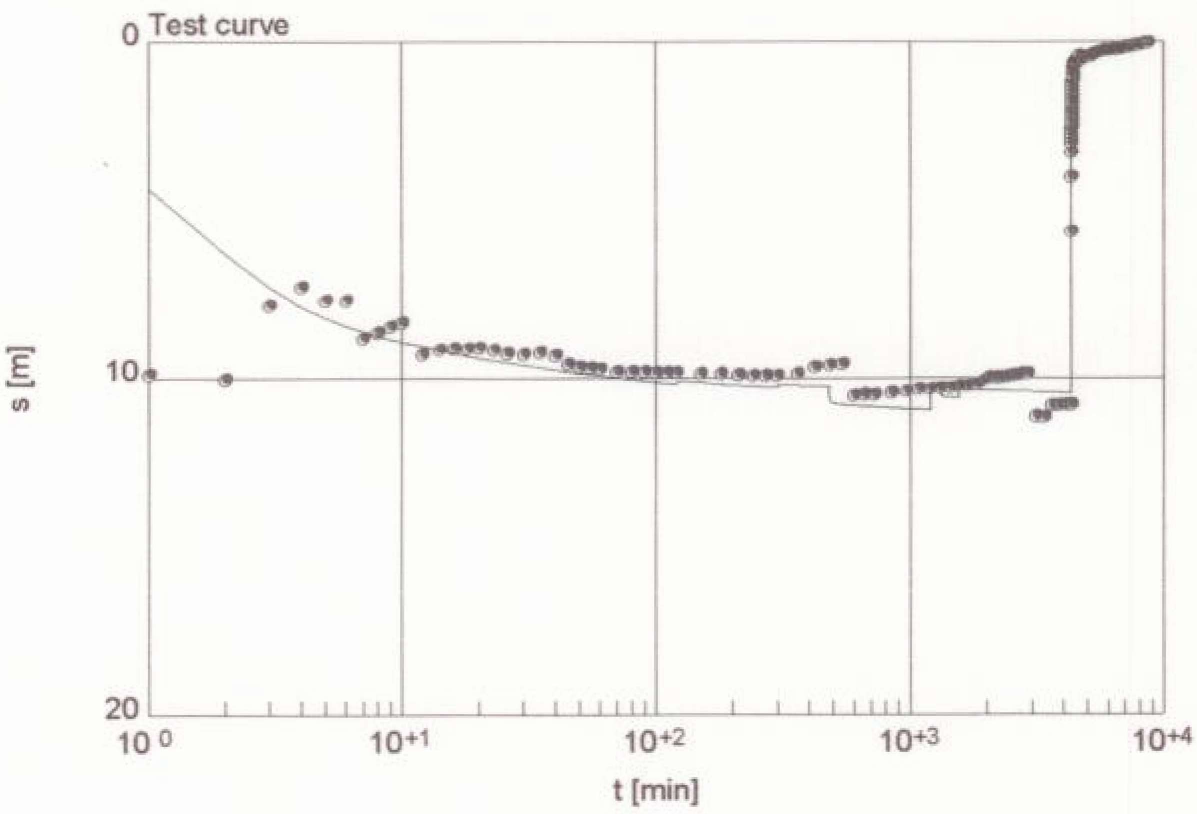
Match parameter:	
Q:	7.91 [m³/h]
t:	148 [min]
s:	6.21 [m]
1/u:	6.11E7 [-]
W(u,r/B):	10.4 [-]
Aquifer parameter:	
T:	25.3 [m²/d]
k:	0.338 [m/d]
Boundary parameter:	
B:	800 [m]
m':	50 [m]
k':	0.00198 [m/d]

Groundwater Study in the Stampriet Artesian Basin

Evaluation of Test Pumping Data

Test pumping diagnosis

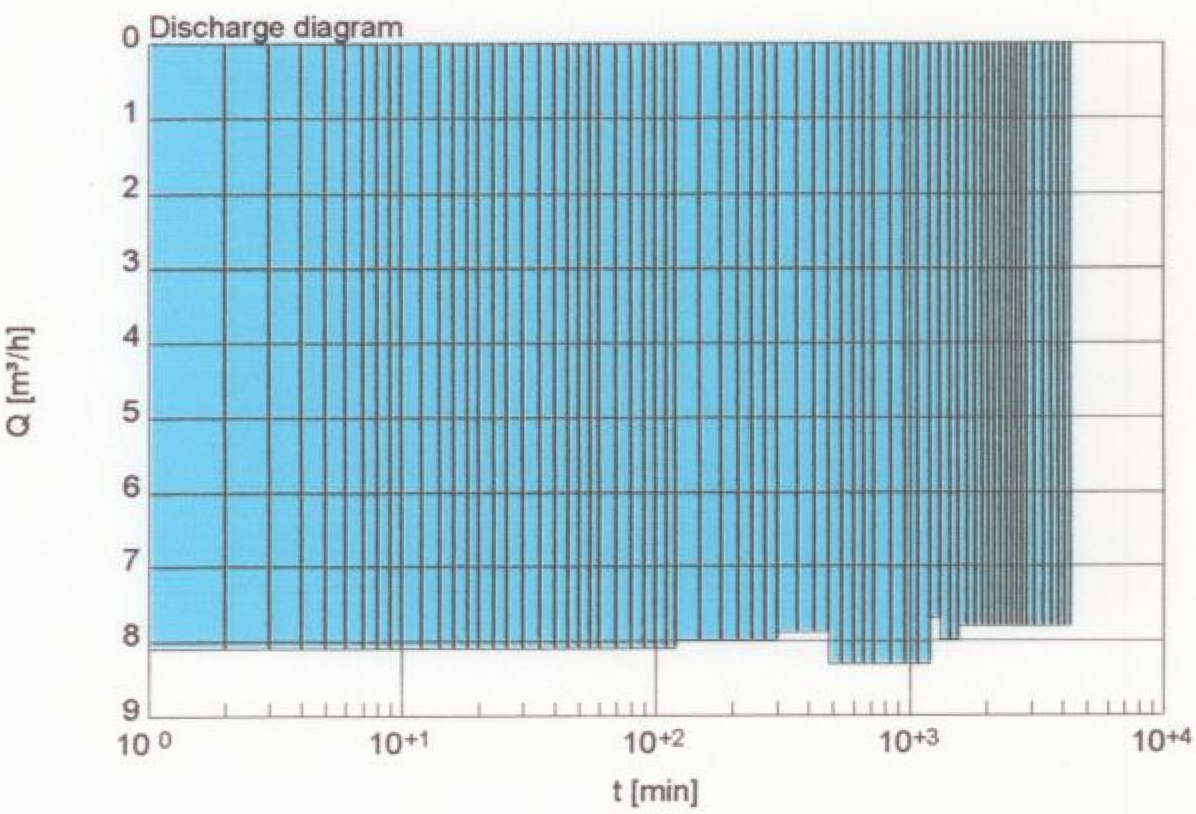
Pumped well J1-A



Remarks

Simulation of actual draw down using the Hantush model for leaky conditions.

Poor correlation between pumping rates and water level e.g. water level rises during abstraction.



Discharge info

Dis.dur.:4320 [min]
tcorr: 4397 [min]

Av.dis.: 7.91 [m³/h]
max.dis.:8.30 [m³/h]
min.dis.:7.70 [m³/h]
Qn: 7.80 [m³/h]

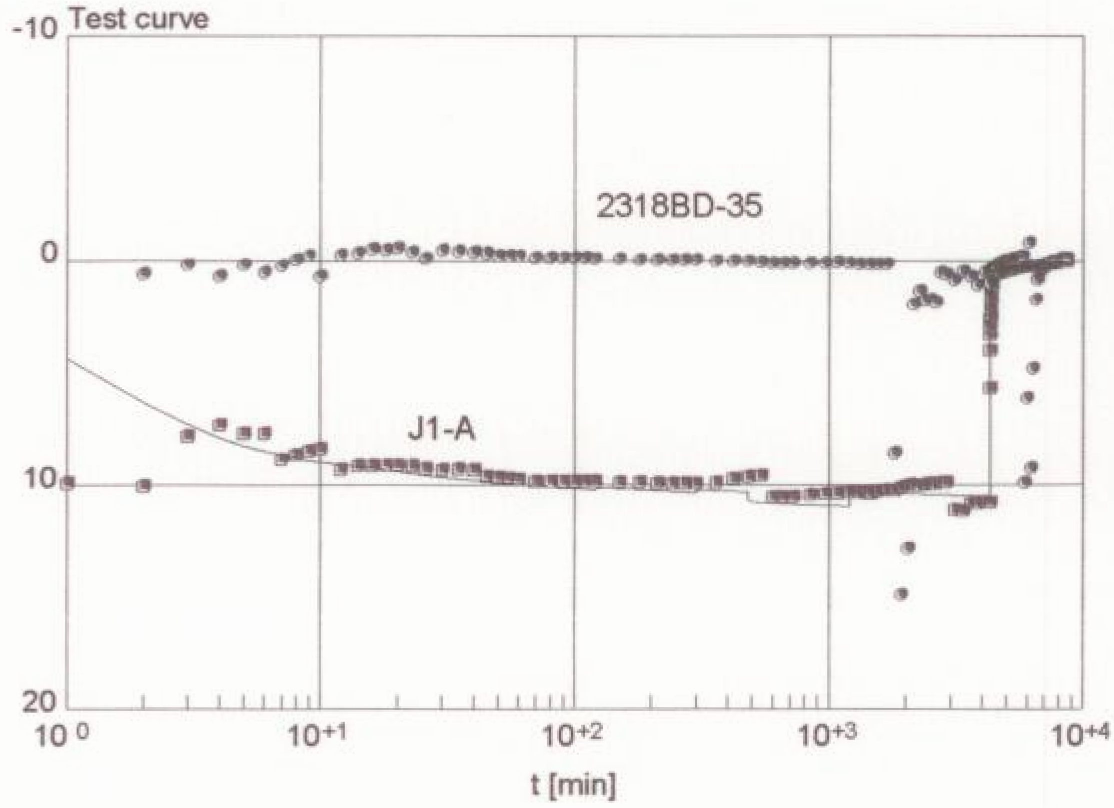
Dis.sum: 570 [m³]

Groundwater Study in the Stampriet Artesian Basin

Evaluation of Test Pumping Data

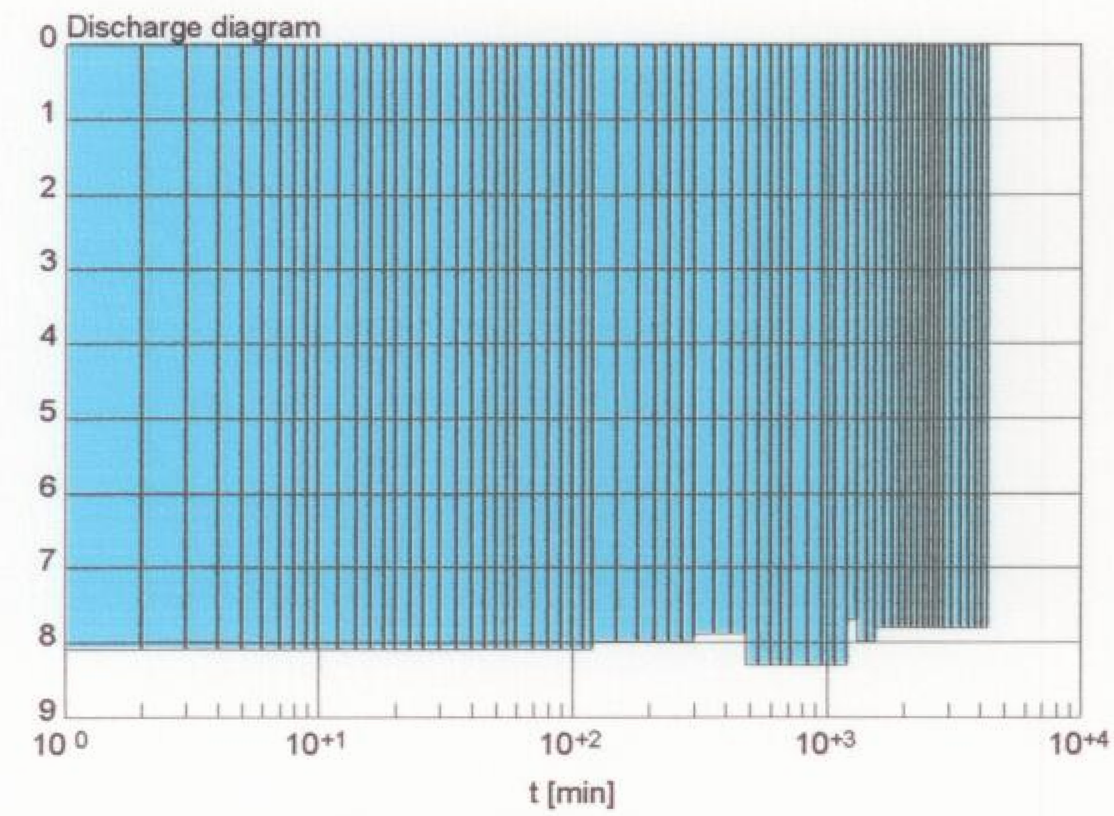
Test pumping diagnosis

Pumped well J1-A



Remarks

Abstraction have no real influence on the observation borehole due to its distance from the abstraction borehole. Should avoid pumping from observation borehole during entire test. Due to the pumping of the observation borehole, the data is not reliable for evaluation.



Discharge info

Dis.dur.:4320 [min]
tcorr: 4397 [min]

Av.dis.: 7.91 [m³/h]
max.dis.:8.30 [m³/h]
min.dis.:7.70 [m³/h]
Qn: 7.80 [m³/h]

Dis.sum: 570 [m³]

Distance to observation borehole: 2318BD-35 = 400 m

7. Water Level Recorder Installation

THE STUDY ON THE GROUNDWATER POTENTIAL EVALUATION AND MANAGEMENT PLAN IN THE SOUTHEAST KALAHARI (STAMPRIET) ARTESIAN BASIN

INSTALLATION OF SEBA FLOATERS

JICA REFERENCE: J 1 A LOCALITY: Christiana L727 WW 39839

1. **Serial Number of floater**:	4560
2. **Date installed**:	17/06/00
3. **Rest Water Level when installed**:	not recorded
4. **Distance from stick-up to logger:**	53 m
5. **Distance from logger to water level**:	not recorded
6. **Cut off**:	53.0 m (0.91 + 52.01)