

UR1985-28

1985/28. Pump test at the Tasmania Golf Club, Barilla Bay

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Abstract

No indications of decreased output were noted in the pump tests undertaken on a bore at the Tasmania Golf Club and because of this there is a definite possibility that the output of the test will be maintained for relatively long periods.

Over the period of the test, salinity varied within a narrow range and although fairly high, the water may be useable, subject to advice, or it may be possible to mix the pumped water with better quality water. A high iron content could provide problems if not removed before use.

Some variation in output and quality may occur with longer pumping but use for a summer would probably be the cheapest method for determining this.

If a pump is installed, water levels should be closely monitored during use and again during winter to determine the amount of recharge.

INTRODUCTION

A water bore was installed by a private contracting firm at the Tasmania Golf Club, in an attempt to supplement their supply from a system of spear bores some two kilometres south of the golf course. The quality of water from the spear array deteriorates after extended pumping. It was known that the quality of the water in the newly installed deep bore on Club property was marginal for irrigation and a pump test was suggested to determine whether the quality changed with long term pumping and whether the pump rate indicated at the time the hole was drilled could be sustained in the longer term.

The details of the bore hole, as supplied by the private contractor, are:

Date drilled:	10.10.1984
Depth:	51.2 m
Diameter of hole:	200 mm, 0-9.1 m 187.5 mm, 9.1-51.2 m
Casing:	0-22.6 m - 200 mm steel 0-24.4 m - 150 mm steel
Depth water struck:	24.4 m, 38.7 m, 48.8 m
Output:	303 litres per minute
Drillers log (m):	
	0-0.3 topsoil
	0.3-9.1 clay
	9.1-51.2 sandstone

PUMP TEST PROCEDURE

A monopump was installed to 44 m depth and was initially powered by a tractor supplied by the Club. Two periods of pumping were undertaken using this system but in each case the test was terminated due to mechanical failure in the pulley system. The first test lasted 2½ days, with pumping at a rate of 174 l/min (2300 gallons per hour). The second test lasted

1/2-3/4 of a day when the pumping rate was 250 l/min. The results of the second pump test are rather irregular and little can be determined from them. A third test was conducted using a diesel motor supplied by the Department of Mines and this test lasted 6-3/4 days, pumping at a rate of 205 l/min without any mishap.

The drawdown with time for the various pumping periods is shown on the accompanying graphs. In the first two pumping periods, the water level appeared to stabilise after a time and this was thought to be due to two possible causes. The first was that it was likely that water from the upper water-bearing zone (about 24 m depth) was running over the terminals of the electrical water level measuring device, giving a false reading for the water level in the bore. The second possibility was that the water being pumped was seeping back underground and recirculating, despite the fact that the outlet was some 100 m away from the pump. For the final test, a narrow open-ended PVC tube was installed in the bore and water level measurements were made inside this tube. Drawdown continued in the bore until the end of the pump test.

PUMP TEST RESULTS

Examination of the pump test results from the graph plots indicates that there are no major changes in permeability of the sandstone aquifer over the area influenced by the pump test. As the time of pumping increases, there is an increase in the area of the aquifer that is influenced by the pumping. This is a favourable sign for a continuity of supply. However the sandstone is regarded as dominantly a fracture aquifer, with intergranular water having a smaller contribution directly to the output of the bore, i.e. although a large part of the water contained in the rock may be stored between the sand grains making up the sandstone, the main flow paths to supply bores are likely to be the joints and fractures that pass through the rock. Density of fracturing can be expected to vary from place to place throughout the rock, and with longer periods of pumping, areas within the aquifer with less or greater fracturing will be influenced by the pumping as the cone of depression in the water table surrounding the bore becomes larger.

Almost two million litres of water were pumped during the longest period of pumping and as there was still a considerable depth of water left in the bore (the final drawdown was to 32.8 m, whereas the lowest water-bearing zone reported by the driller was at 48.8 m) it is likely that the bore could have been pumped for a much longer period at the same rate. By extrapolation of the data of the third pumping period to 100 000 minutes (about 70 days), the theoretical drawdown after this period would be about 38 m. If the pumping rate was boosted to 227 l/min the drawdown after 70 days pumping, by proportion, would be a little over 42 m and over such a period, some 22.5 million litres (5 million gallons) of water would be pumped. These are theoretical extensions of the pumping test and depend on uniform permeability around the bore but must be regarded as a reasonable prospect. In fact from the pump test this may be a reasonable amount of water to expect over a summer season. Only by pumping over such a period will this be definitely known. If extended periods of pumping (10-12 days) are followed by a few days of recovery for the bore, this should help to ensure the maintenance of the yield over a longer period.

WATER QUALITY

Water samples were collected during each period of pumping - three during the first period, one during the second and seven during the final

longer period of the test. Analyses undertaken by the Department of Mines laboratory in Launceston are given in Table 1. After the first three samples had been analysed it was noted that a heavy precipitate of iron oxide formed in the samples when left to stand. In later samples the amount of iron in the precipitate, as well as the amount in solution, was analysed.

Apart from at the beginning of the first test and a sample taken at the beginning of the second test, the total dissolved solids content (TDS) has been in the range of 2550 to 2660 mg/l. As with yield, quality may change (for better or worse) with longer pumping periods as larger areas are affected by the pumping, but for the period observed, salinity has remained fairly constant. Individual constituents have also remained constant. In the later samples where the precipitated iron was analysed, the iron content reaches considerable values. If the bore is established for production, the water would probably need to be aerated before use. A possible solution would be to allow the water to stand in a reservoir before use. Spraying the water into a reservoir may cause an undue increase in the salinity due to evaporation, particularly in hot weather.

CONCLUSIONS

Pump tests on the bore have shown that for the period of pumping, no significant sign of decreased output with time was observed. Projection of the data shows that it may be possible to pump the bore at a rate of about 227 l/min (3000 gallons per hour) for considerable periods, provided aquifer permeability variations are limited. A summer output of 22 million litres or more is a distinct possibility.

The quality of the water has varied over a narrow range during the tests. Advice should be sought on the suitability of water with this quality for use as an irrigation supply. The presence of sandy soil is a favourable sign for use of higher salinity water and application during cooler periods is an advantage. Because of the high iron content, aeration before application is likely to be necessary.

To obtain more definite information on permeability changes in the sandstone aquifer and salinity variations would require extensive (and costly) investigations. If the salinity is shown to be within useable limits (or it may be possible to mix the water with town water), long-term variations in output and salinity would best be determined by use over a summer. It should be ensured that the supply is replenished during the winter.

In the event that a pump is installed, a narrow pipe to measure water levels should be attached or installed at the same time. This will allow water use during the summer and recharge during the winter to be closely monitored.

[27 May 1985]

Table 1. CHEMICAL ANALYSES OF WATER COLLECTED DURING PUMP TESTS - TASMANIA GOLF CLUB

	1	2	3	4	5	6	7	8	9	10	11
pH	6.2	6.2	6.3	6.8	6.5	6.5	6.3	6.4	6.8	6.5	6.8
Conductivity ($\mu\text{S}/\text{cm}$)	4700	4400	4250	3300	3900	3900	4000	4150	4150	4200	4200
<i>Item (mg/l)</i>											
CO ₃	nil										
HCO ₃	130	115	115	91	81	81	81	81	83	83	83
Cl	1470	1350	1350	1330	1350	1350	1360	1380	1380	1390	1380
SO ₄	46	48	48	44	45	44	44	45	45	45	46
Ca	90	85	83	80	77	77	77	77	77	77	77
Mg	125	115	115	110	110	110	110	110	110	110	110
Fe	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Al	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
K	52	52	47	42	48	46	46	46	47	48	48
Na	690	660	640	650	660	650	650	650	660	660	660
TDS	2830	2630	2580	2790	2570	2550	2660	2560	2630	2650	2600
Hardness - permanent	630	590	580	580	580	580	580	580	580	580	580
- temporary	105	94	95	75	67	66	67	67	68	68	68
Alkalinity as CaCO ₃	105	94	95	75	67	66	67	67	68	68	68
Total iron				9.1	30	29	29	30	32	33	16

First pumping period - Sample 1 - 1630 hours, 15.2.85; Sample 2 - 0930, 16.2.85; Sample 3 - 0900, 17.2.85.

Second pumping period - Sample 4 - 0945, 18.2.85 (beginning of test).

Third pumping period - Sample 5 - 29.3.85; Sample 6 - 30.3.85; Sample 7 - 31.3.85; Sample 8 - 2.4.85;
Sample 9 - 3.4.85; Sample 10 - 4.4.85; Sample 11 - 15.4.85.

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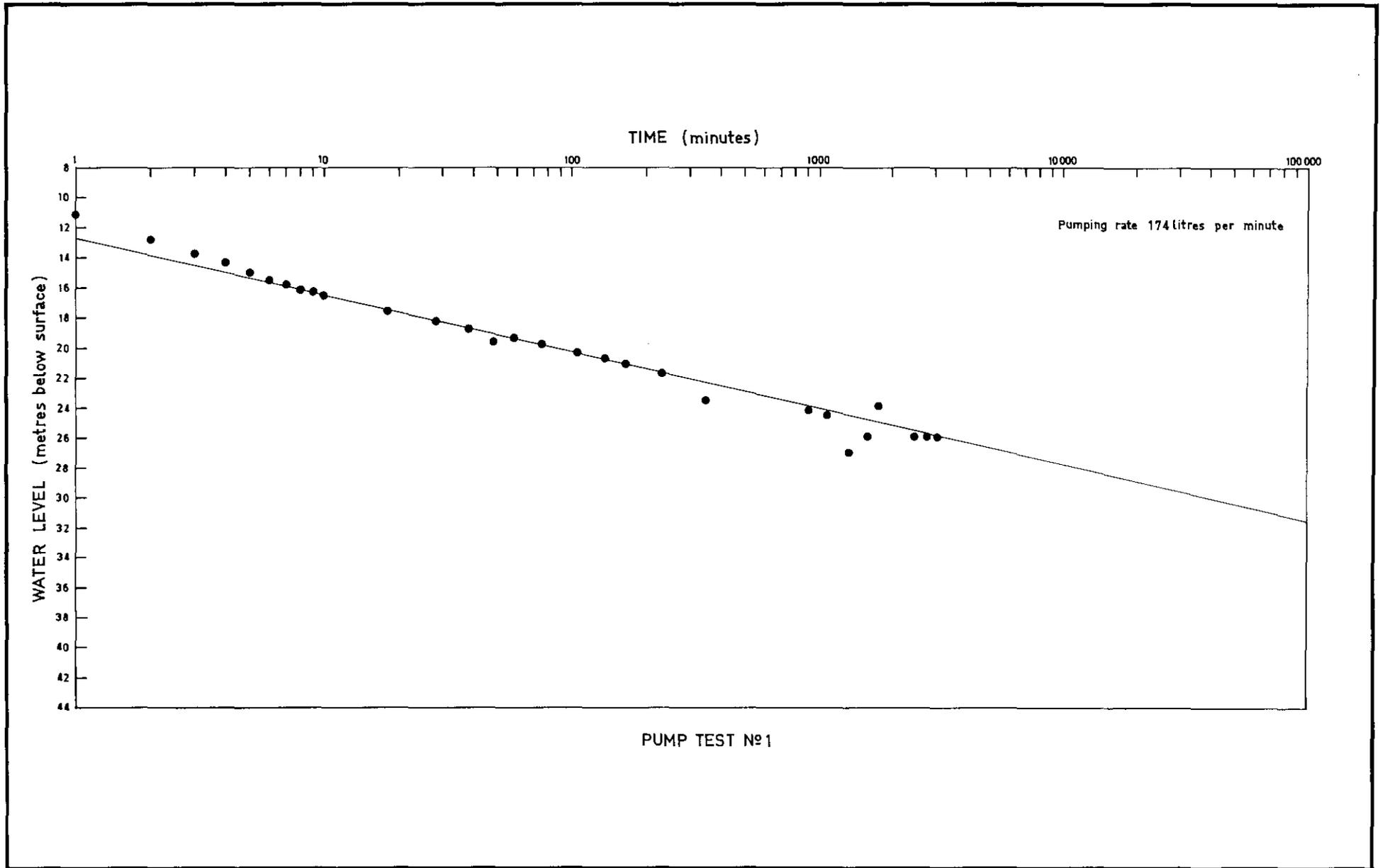


Figure 1.

5103 A

5 cm

1/1

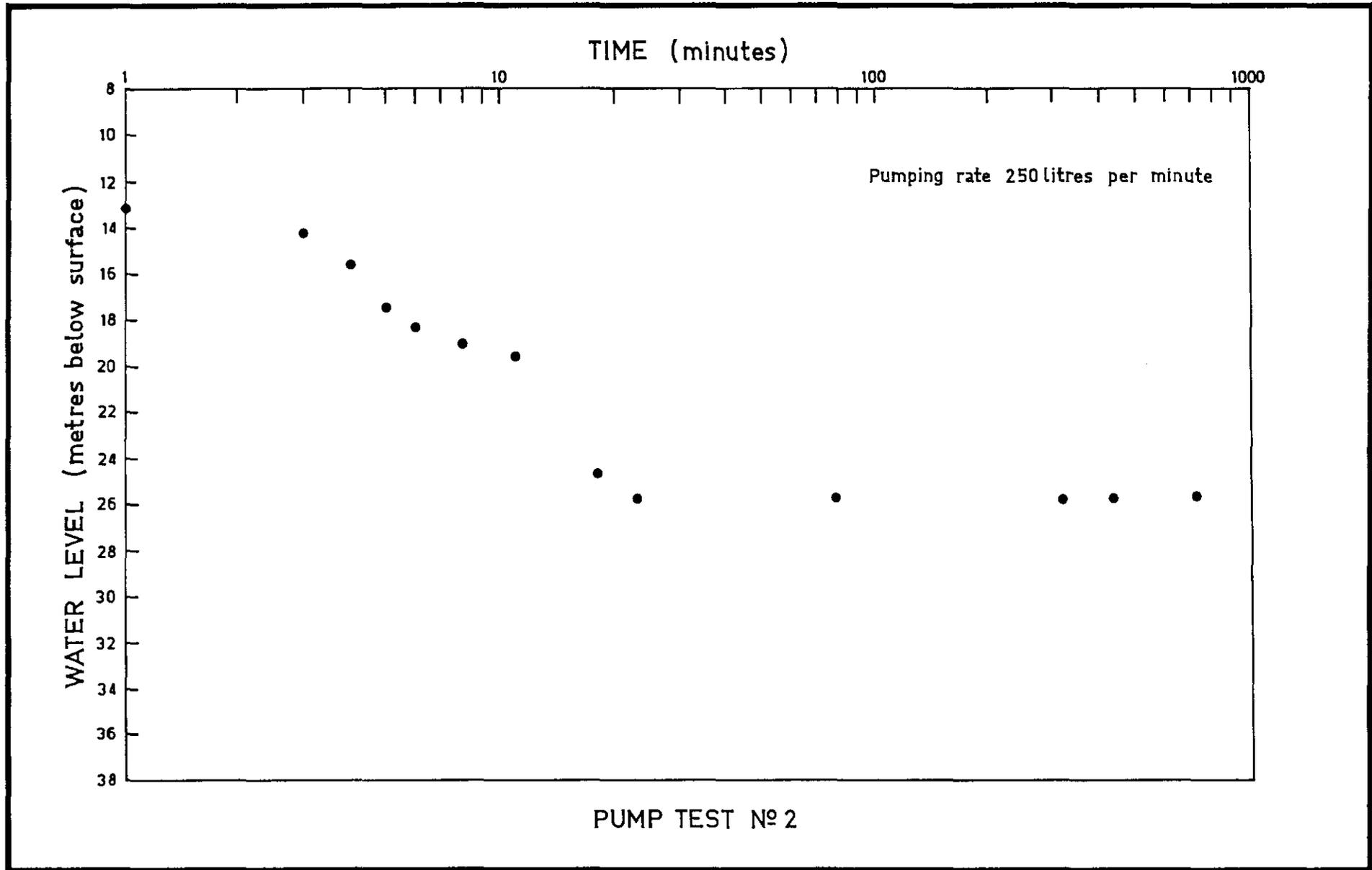


Figure 2.

5 cm

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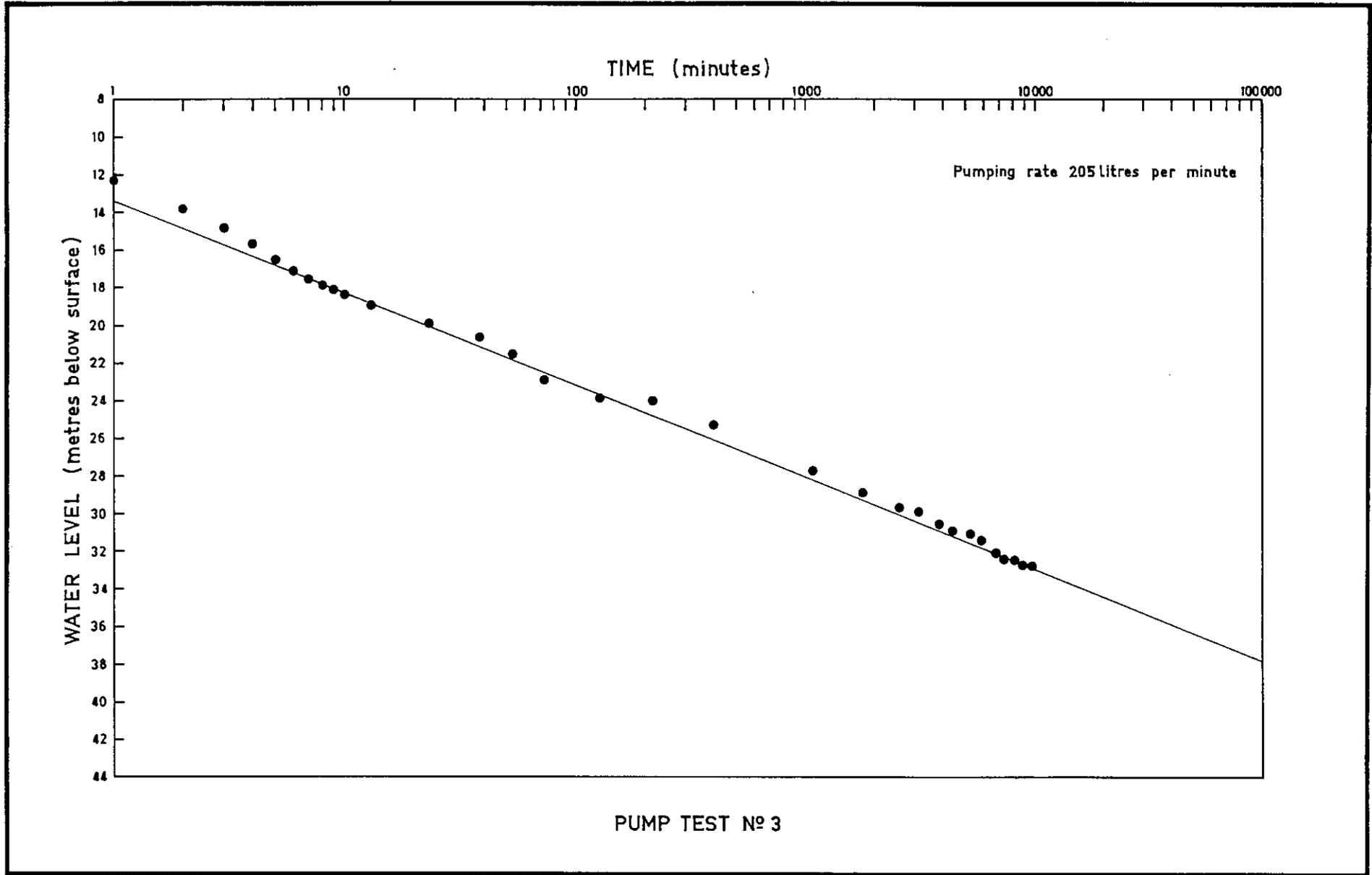


Figure 3.

5 cm

5103 C

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