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24 July 2002

Mr I Wiffin
Marlborough Logistics Limited
P O Box 29
SPRING CREEK

Dear Ian

RE: PRELIMINARY ASSESSMENT OF PUMPING TEST

You have asked us to provide a preliminary assessment of the pumping test that was undertaken on your proposed irrigation well earlier in July. This letter sets out our initial thoughts regarding the information you have sent us.

1. The Pumped Well

The driller's log for your well indicates that it is screened from 36.9 – 38.2 m, drawing water from strata which the driller has described as water bearing shingle and yellow clay. This water bearing zone is overlain by variable strata, although low permeability silt and clay are the dominant materials extending from near the ground surface to a depth of around 30 m. This lower permeability strata will confine the groundwater under pressure, as evidenced by the above ground artesian pressures that occur in the nearby wells.

The driller's report indicates that in August 1993 your well was test pumped at a rate of 9.5 L/s causing a drop in water level in the well casing of 3.15 m after 1.5 hours pumping.

During the most recent test, the well was pumped at 7.29 L/s for 48 hours, with a drop in water level of around 2.0 m. On the basis of this information, it is expected that your well can comfortably yield your desired abstraction of 540 m^3/day (equivalent to an average pumping rate of 6.25 L/s).

2. Pumping Test Data

In the July 2002 test you measured water levels in both the pumped well and four neighbouring wells, shown on the attached map (Figure 1). The change in water levels measured in the neighbouring wells from the start of pumping are shown in Figure 2. The grid lines along the horizontal time axis of this plot are set at intervals of 730 minutes. This is the period of the tide that was recorded at the Wairau Bar during the test. The data shows a marked tidal influence, particularly in wells 3 and 4 which are closest to the Opawa River, with a lesser effect on wells 2 and 5, which are further from the river. This tidal fluctuation is caused by the weight of the sea tide moving over the top of the confined aquifer and compressing the water within it. This is a well recognised effect that occurs throughout the coastal section of the Wairau Aquifer.

The fluctuations caused by the tidal variation complicate the water level record and make it difficult to determine the magnitude of drawdown in the neighbouring wells. A detailed analysis of the water level patterns is required to isolate the various effects. Such detailed analysis is beyond the scope of the preliminary review you have requested. However, based on the water levels pattern we expect that the following table gives a reasonable breakdown of the observed water levels.

Well No.	Owner	Distance from Pumped Well	Approximate Drawdown During Pumping Test	Distance from Opawa River	Approximate Magnitude of Tidal Fluctuation
1	Ian Wiffin	0	2.1	50	0.15
2	D A & P A Western	220	0.09	300	0.06
3	J Pendleton	350	0.08	400	0.15
4	S J & J F Murray	700	0.07	50	0.15
5	Grove Mill	750	0.08	600	0.07

3. Predicting Long Term Drawdown Effects

As a preliminary review, we have taken the data from the wells showing the largest drawdown effect and the smallest tidal influence to provide an initial approximation of the aquifer parameters for this area. Using Jacob's method, semi-log plots have been prepared in Figures 3, 4, and 5. The scatter in the data is large, because of the various interference effects on the water levels. However, as a first approximation, the analysis suggests the following aquifer parameters.

Well No.	Aquifer Parameters	
	Transmissivity	Storage Coefficient
1	Wiffen 3383	-
2	Western 3654	1.3×10^{-3}
5	Grove mill 3602	1.8×10^{-4}

The geometric mean of this spread of values gives a transmissivity of 3544 m^3/day and a storage coefficient of 5×10^{-4}. Using these values the following drawdowns are predicted for a 120 day irrigation season, pumping at 540 m^3/day.

Well No	Owner	Indicative Drawdown for Irrigation Season (540 m^3/day for 120 days)
2	D A & P A Western	0.15
3	J Pendleton	0.14
4	S J & J F Murray	0.12
5	Grove Mill	0.12

Therefore, based on the course of an irrigation season, neighbouring wells could experience a drawdown of around 0.12 – 0.15 m. This effect is small relative to the daily fluctuations caused by tidal loading (around 0.05 – 0.15 m) and the depth of the aquifer (35 – 40 m).

As we have discussed, the analysis presented here has a degree of uncertainty associated with it because of the significant water level fluctuations that occurred during the test. However, we believe the information is a useful ballpark indication of the aquifer response to your proposed irrigation abstraction.

We trust you find these comments helpful and please feel free to contact us if you wish to discuss any of our findings.

Yours sincerely

PATTLE DELAMORE PARTNERS LIMITED

P.F. Callander

Peter F Callander

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Figure 1 - Location of Wiffin Aquifer Test Wells

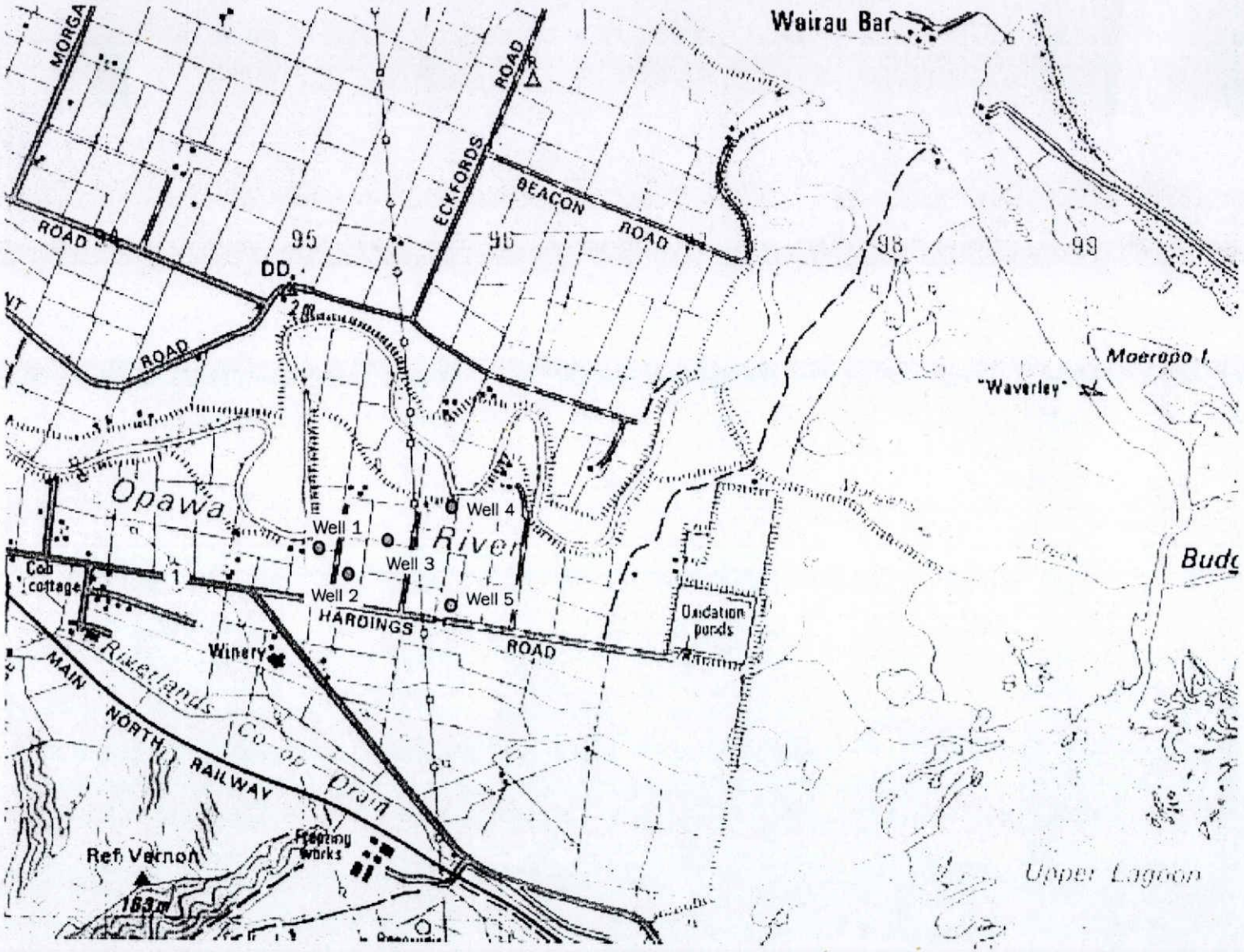

Figure 2 – Change in Water Level in Neighbouring Wells

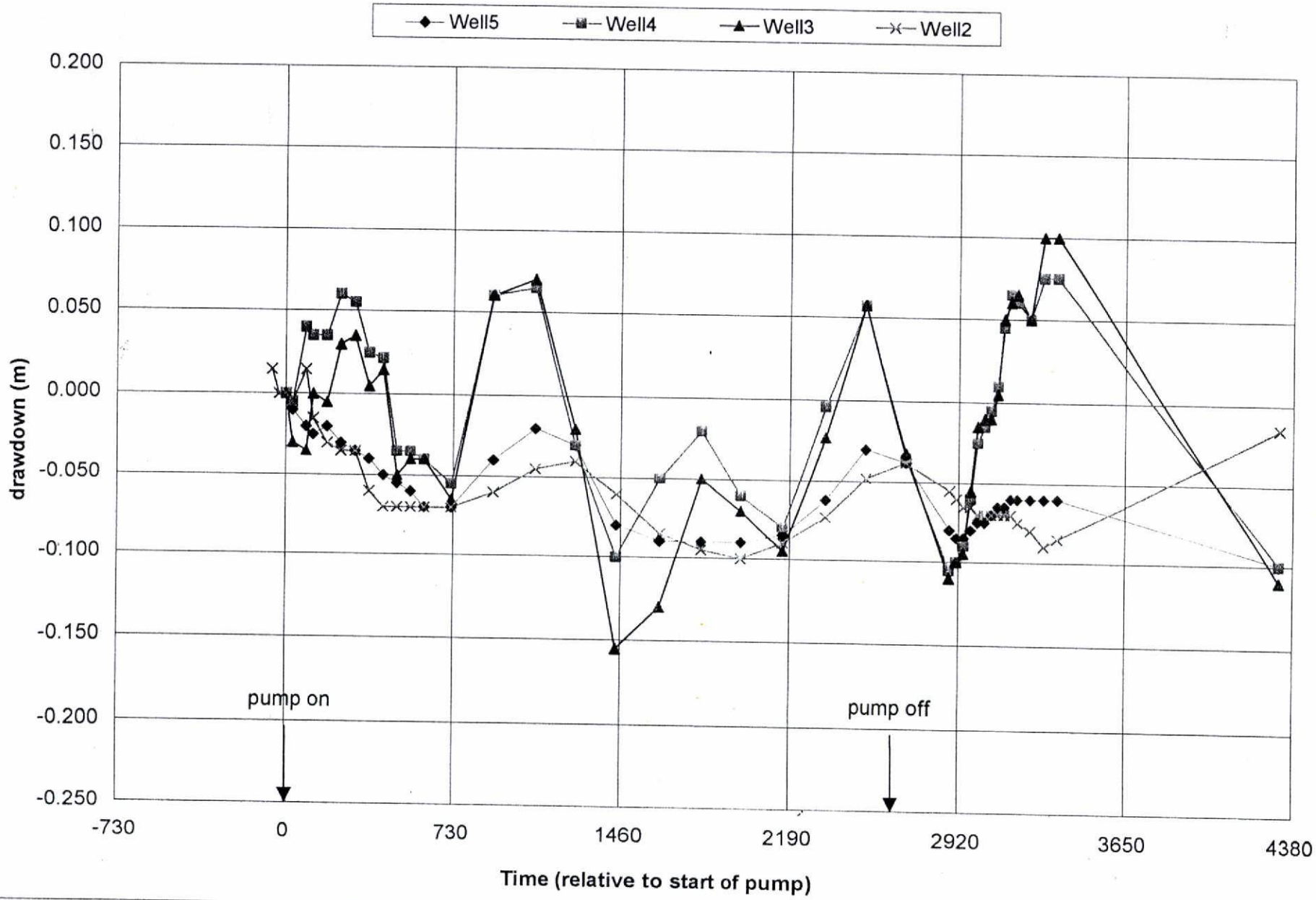

Figure 3 – Jacob's Method of Analysis for Pumping Well (Well 1)

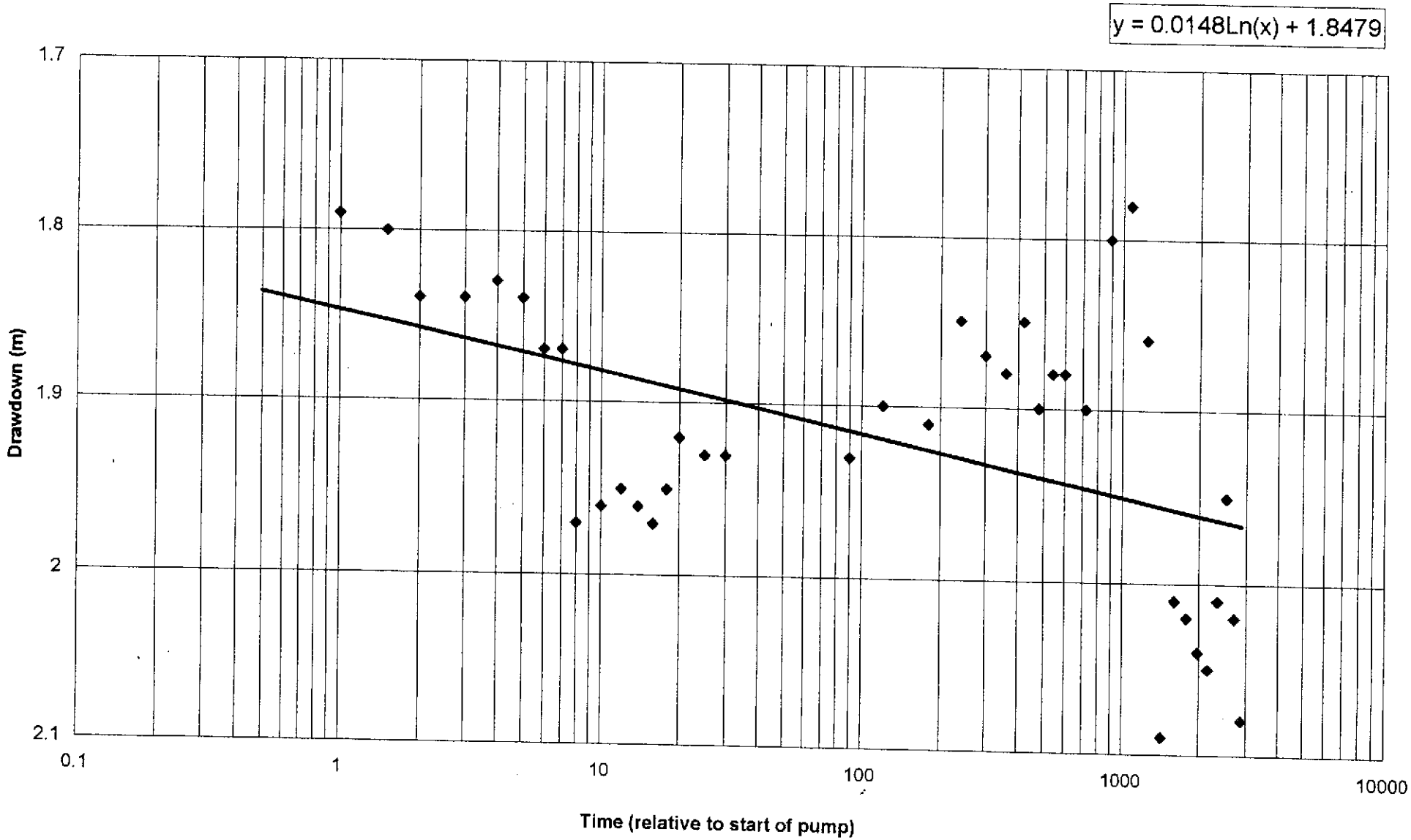

Figure 4 – Jacob's Method of Analysis for Well 2

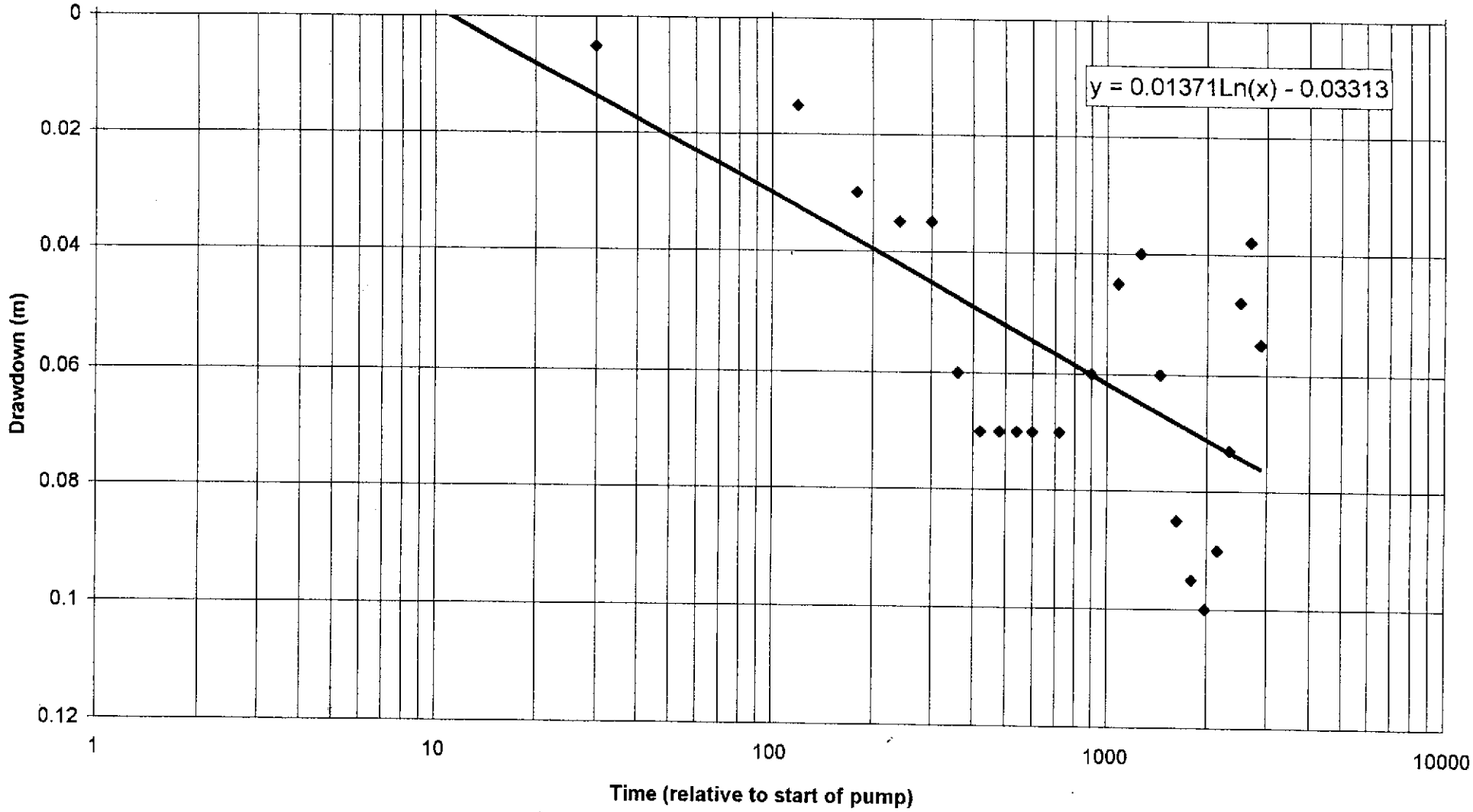

Figure 5 – Jacob's Method of Analysis for Well 5