



Province of
British Columbia

Ministry of Environment,
Lands and Parks

BC
Environment

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Date: November 27, 1996

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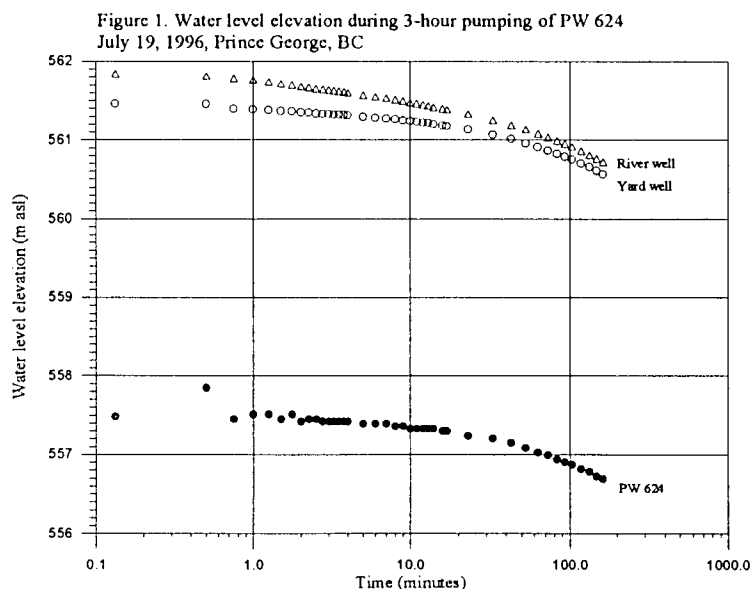
Bob Radloff, P. Eng
Manager, Environmental Services
City of Prince George
1100 Patricia Boulevard
Prince George, BC V2L 3V9

Re: PW624

Dear Bob Radloff, P. Eng.:

As requested I have reviewed the data of the 3-hour pumping test for PW 624, and International Water Supply Ltd. (IWS)'s report on the pumping test of PW 605. I apologize for not responding earlier as I had other work at the time.

The water level data for the July 19, 1996 pumping test of PW 624 are plotted in Figure 1. The graph shows that water levels in the wells did not stabilize during the test. The water levels in the Fraser and Nechako rivers were likely declining during the same period. However, the declining well water levels are probably caused by pumping and not by declining river stage. The decline in the well water levels likely indicates that the cone of depression was still expanding after three hours of pumping.



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In Figure 8 of the IWS report, water levels did not stabilize until after about 1,000 minutes of pumping at 805 L/s (10,625 Igpm). Stabilization of the pumping water level generally indicates that a source of recharge has been intercepted (ie. the river). It may be that stabilization of water levels may not occur in PW 624 until at roughly the same length of time (at a similar pumping rate).

In the IWS report, the percentage of water originating from the Nechako River was apparently estimated based on the following formulas (refer to page 11 of the IWS report):

$$Q_{\text{river}} = Q_{\text{pumped}} - Q_{\text{ambient groundwater flow}} \quad (1)$$

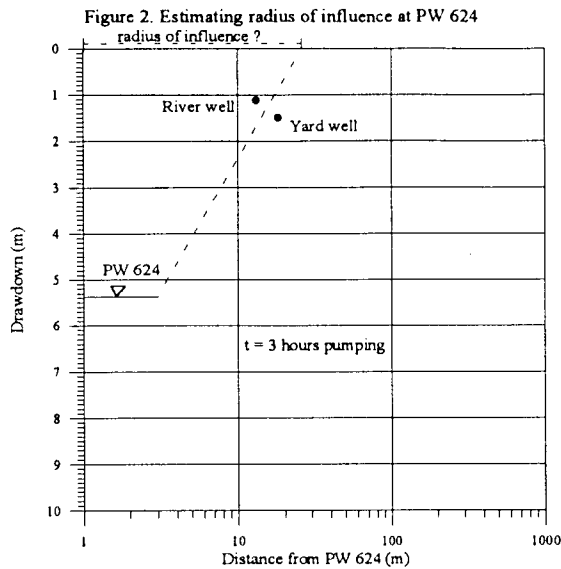
where Q_{river} is the flow originating from the river, Q_{pumped} is the total pumping rate, and $Q_{\text{ambient groundwater flow}}$ is the ambient groundwater flow entering the area of the collector well's radius of influence. $Q_{\text{ambient groundwater flow}}$ is estimated by:

$$Q_{\text{ambient groundwater flow}} = 2rTi \quad (2)$$

where "r" is the radius of influence (estimated from a plot of drawdown in the different observation wells versus distance of the wells to the collector well - Figure 9 of the IWS report), "T" is the transmissivity of the aquifer (determined from the slope of the semi-log graph of the drawdown in water level over time - Figure 8 of the IWS report) and "i" is the ambient hydraulic gradient in the area based on non-pumping groundwater level elevations in wells upstream and downstream of the collector well.

The formulas used in the IWS report provide a first-approximation of the percentage of water originating from the river. If these formulas are to be used to estimate the percentage of water originating from the Fraser River for PW 624, the transmissivity, hydraulic gradient and radius of influence need to be approximated. Transmissivity may be obtained from initial long-term pumping tests for PW 624, if they exist. Hydraulic gradient is estimated by measuring non-pumping water level elevations in three or more nearby observation wells, or in some cases assumed to be roughly equal to the river gradient.

The radius of influence for PW 624 is estimated by plotting the drawdown in nearby observation wells, once stabilization has occurred, against distance away from PW 624. This parameter is difficult to measure accurately. The drawdown data from the Yard and River wells from the recent pumping test appear to be insufficient in estimating "r" (see Figure 2). The River well, which is closer to PW 624 than the Yard well actually experienced less drawdown than the Yard well, indicating that the cone of depression was not symmetrical.



You may wish to check your historic files to see if long-duration pumping test data are available for PW 624 when it was initially constructed. Information from these long-duration pumping tests may allow parameters, such as the well's radius of influence, to be calculated to estimate the percentage of water originating from the river using equations (1) and (2) above. If this information can not be found, a pumping test may need to be conducted to obtain the information. The design of such a test should be done under the supervision of a groundwater engineer.

I hope these comments are of some use. Please contact me to discuss any aspects of this memo for clarification (250-356-5062 or mwei@wtr.env.gov.bc.ca).

Sincerely,

MW

Mike Wei
Sr. Groundwater Hydrologist
Groundwater Section