SUSTAINABLE WATER TAKES IN THE MT WELLINGTON-MT SMART AQUIFER

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Aim

The Southpark Group (Southpark) operate a wellfield of six boreholes (Northern wellfield) in the north of their property. In response to increasing demand, Southpark are now seeking to change the condition of their current consent. The new application would retain the existing daily maximum rate of 3000 m^3/d but would see the annual rate increased to1,098,000 m^3/yr from 603,000 m^3/yr. Approximately 450m southwest of the Northern wellfield is the nearest abstraction, Carter Holt Harvey Penrose Mill (CHH), which holds a consent to take up to 2000 m^3/day and up to 675,250 m^3/yr. The Southpark and CHH sites are located within a shallow unconfined basalt aquifer where flow is predominately through the fractures, joints, cavities and rubbly or scoraiacous zones. The average thickness is greater under the Northern wellfield (approx. 12m) than the CHH site (approx. 4.5m), and, owing to the proximity of the Mangere Inlet, the piezometric gradient is low (approx. 0.006 m/m at 158.2°TN). Auckland Council (AC) has estimated a total recharge to the system of 15,300 m^3/d from which 15% is required as throughflow to prevent saline intrusion at the coast, leaving approximately 7,800 m^3/d available once the current consented abstractions have been removed. Nevertheless, there is concern the increase in take at Southpark, during dry weather conditions, will adversely affect the CHH take, which lies cross-gradient and is situated closer to the edge of the aquifer.

Method

Due to the heterogeneous nature of the basalt aquifer, theoretical analyses are insufficient in accurately determining the hydrogeological parameters; consequently, it is important to have a pump test carried out over a sustained period and a high flow rate to correctly assess the influence pumping at Southpark has at CHH. A 20 day pump test was, therefore, conducted with the Southpark wellfield pumping at a combined rate of approximately 3000 m^3/d between April and May 2010.

Results

As expected in a heterogeneous aquifer, variable drawdown trends were observed in different directions from the Northern wellfield, indicating that theoretical calculations cannot accurately represent the boundary conditions created by the fractures and cavities in the basalt which will have a significant effect on the aquifer response to Southpark pumping. Despite the test being carried out during dry weather conditions the analysis was complicated by two main issues: 1. the flow meters on two of the Southpark wells stopped shortly after the pump test started, and on the fifth day of pumping the flow was interrupted briefly before resuming at a reduced, unmeasured rate; 2. as there were no monitoring bores available in the vicinity of the CHH take, the only data available is from the CHH pumping bore, which varies its flow rate with an automatic control valve to maintain a maximum drawdown of 2m. On first inspection, Figure 1 suggests Southpark pumping has a noticeable effect on the CHH flow. A closer study, however, indicates the CHH flow rate began to decrease 1 to 2 days prior to the start of pumping at Southpark. Furthermore, Figure 1 shows the CHH pumping rate response to recharge is less sensitive than the groundwater level response seen in the Simpson Reserve and the Angle Street bores; possibly due to the characteristics of the

CHH pumping system. This attenuated response shows it is difficult to directly relate the CHH pumping rate behaviour with pumping at Southpark.

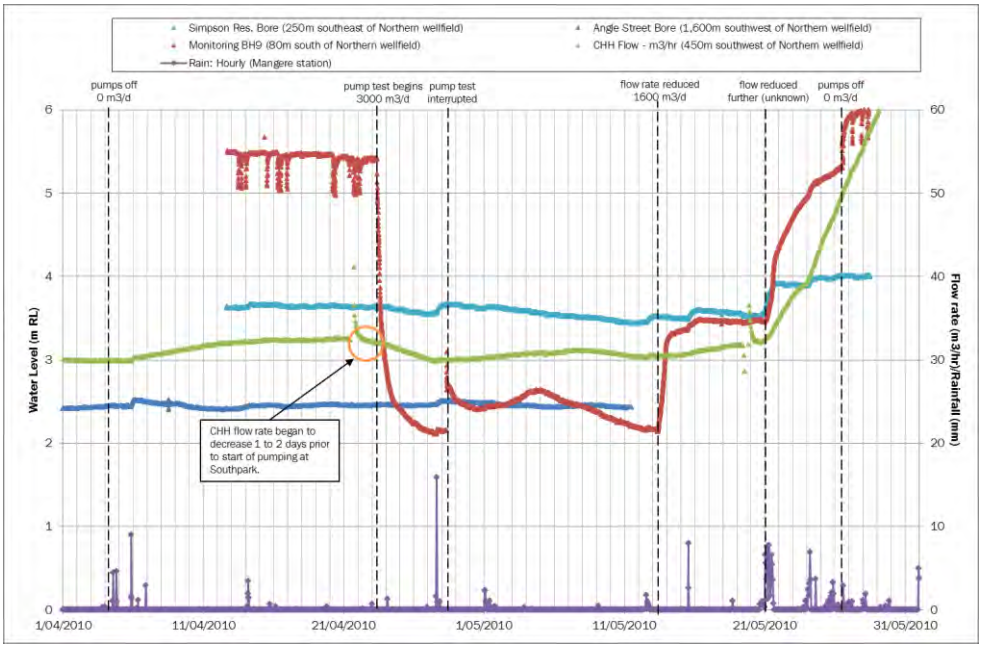

Figure 1. CHH and Southpark response to rainfall and pumping

Conclusion

As the demand placed on water resources increases, it is important that it be sustainably exploited to its full capacity. As theoretical predictions can be misleading in forecasting interference effects, it is crucial that the boundary conditions controlling the interaction between takes are tested thoroughly. In a heterogeneous aquifer, this is best achieved through a sustained pump test in dry weather conditions, properly monitored.

The position of the take bores within an aquifer is also an important consideration. The Mt Wellington-Mt Smart aquifer has 7,800 m^3/d available to take, more than twice the 3000 m^3/d requested by Southpark. However, unlike Southpark's wellfield which is located in a deep part of the aquifer, CHH's access to this resource is limited because of its position closer to the edge of the aquifer where the basalt is thinner. This makes the CHH supply very sensitive to interference drawdown effects even though the resource has surplus capacity. As the effect of Southpark pumping on CHH flow is not fully conclusive, Southpark and CHH must now agree an alternative plan. Possible solutions being considered include Southpark reducing their take during dry conditions or Southpark pumping from bores located in the south of their property down gradient of CHH.

References

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