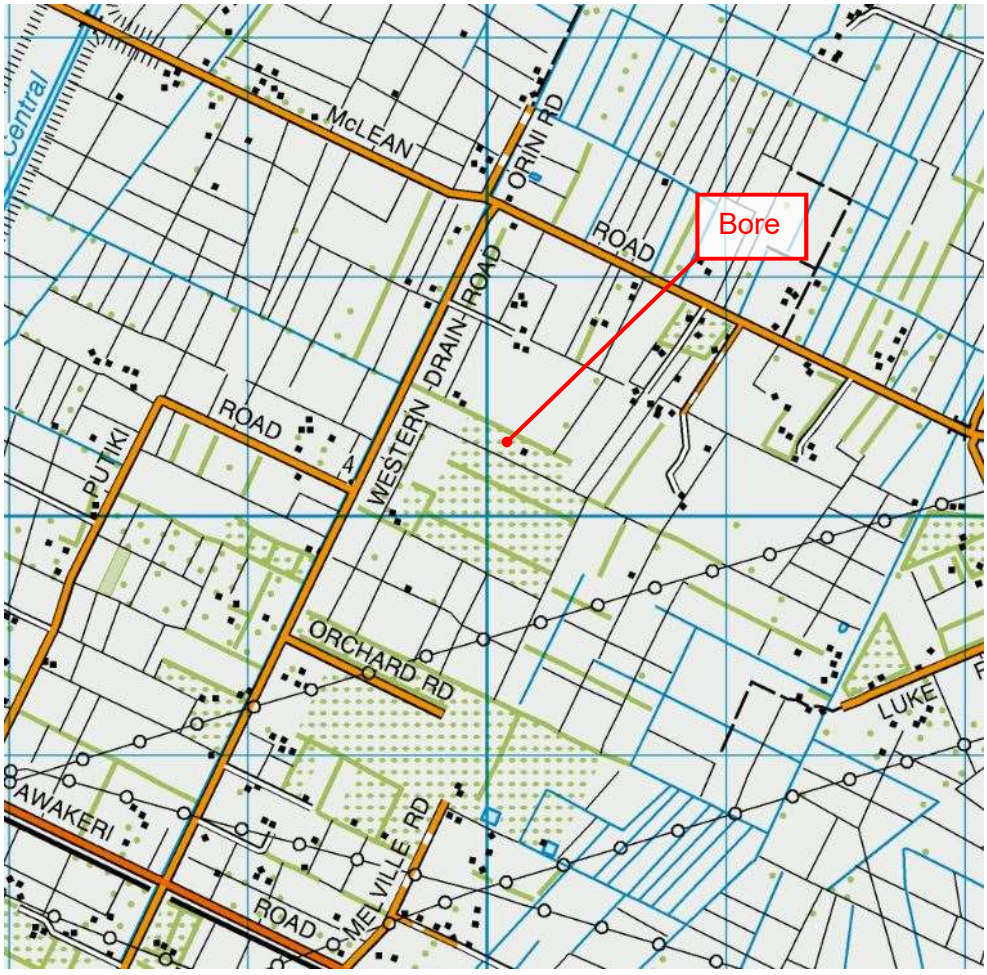
A and S ROSS, AWAKERI

100mm WATER BORE

PUMP TEST REPORT



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Contents

1 Executive Summary

An existing water bore on the property of A and S Ross, Awakeri has been subjected to a series of pump tests. The details of the bore and the results of the testing are as follows:

Bore Number	BN-10083
Date constructed	December 2000
Location	85 Western Drain Rd 37°58'15.42"S 176°52'17.36"E
Approx ground level	3m
Flow Tests Step Constant Discharge	N/A Test 1 – 30th April 2020 @ 14.4m^3/hr, 72hrs plus 24hrs recovery Test 2 – 12th May 2020 @ 14.4m^3/hr, 24hrs plus 24hrs recovery
Observation bores	BN-2514 (Test 1 only) screened 58m to 60m deep, 914m away
Hole diameter	100mm casing
Hole depth	76 metres
Cased to	73 metres
Aquifer type and depth	Pumice, small gravel Confined SWL = 0.15m bgl
Screen length	3 metres
Aquifer transmissivity, T	475m^2/day
Aquifer storativity, S	0.0016
Analysis Methods Step Constant Discharge Corrections	 N/A Thiess none

2 Introduction

An existing 100mm water bore drilled in December 2000 on A and S Ross, 85 Western Drain Rd, Awakeri has been subjected to a series of bore tests. A location plan showing adjacent bores is included in Appendix A along with a borelog.

In order to both understand the potential yield of the aquifer and to apply for resource consents from the Bay of Plenty Bay Regional Council these tests have been analysed and reported herein.

3 Geology, Bore Construction and Locality

The bore log supplied by the driller shows layers of clays, silts, sands and gravels down to 78 metres. The pumice and gravels between 73m and 76m deep were chosen as the target aquifer. The aquifer is semi-confined by 54 metres of silt and pumice.

The SWL in the target aquifer was 0.15m below ground when the hole was tested.

4 Regional Geohydrology

Sheet 5 of the NZ Geological Map Series shows mixture of young alluvial and fluvial silt and sand deposits overlying probably sandstone or Matahina ignimbrite. The bore log is consistent with this.

There are two shallower aquifers in the younger deposits both heavily utilised and described by (Geological and Nuclear Sciences, 2010). The GNS report assesses these aquifers as if they are surface catchment controlled which is reasonable. However the aquifer penetrated by the Ross bore is not limited by surface morphology but rather extends quite some distance under the surface catchment boundaries. Hence the available and allocated water is not reported by the Regional Council (Bay of Plenty Regional Council, 2016).

The confined aquifer will be recharged from the higher land to the south rather than from direct rainfall.

5 Test Procedure

5.1 Test 1

A 72 hour constant flow test at 4.0 litres/sec was started on 1st May.

A bore, BN-2514, 914 metres to the north north-east was monitored. This bore is screened over an interval of 58m to 60m deep

5.2 Test 2

Because the water level monitor in the pumped bore was not set deep enough a 24 hour constant flow test at 4.0 litres/sec was started on the 12th May and no other bores were monitored.

Figure 1 Locations of Production Bore and Monitor and Reference Bores

6 Results from Step Test

No step-test undertaken

7 Results from Constant Flow Tests

The results from the constant discharge tests are in Appendix C.

7.1 Test 1 – 72 hours

7.1.1 Response from Pumped Bore

The water level monitor was not set deep enough so no water levels from the pumped bore were obtained.

7.1.2 Response from Monitor Bore

Figure 2 below plots the water level in the monitor bore, BN-2514, over the 72 hours. No response was recorded.

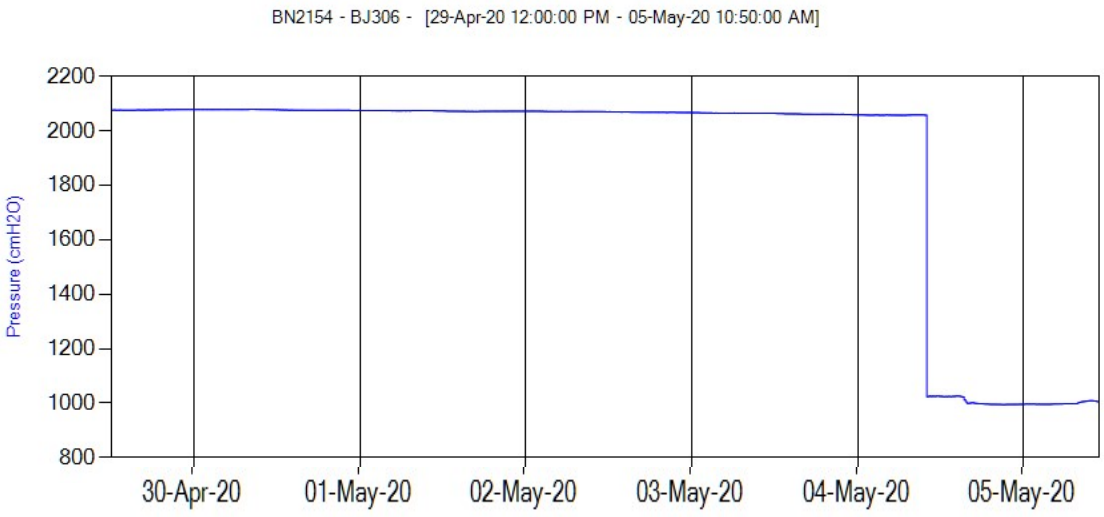


Figure 2 Water Level in Monitor Bore BN-2514 during Test 1

If it was tapping the same aquifer as the pumped bore theoretically it should have drawn-down between 6cm and 40cm using a range of transmissivity and storativity values. As BN-2514 is screened over an interval of 2 metres 15 metres higher than the pumped bore it is concluded it is screened in a shallower aquifer.

7.2 Test 2 – 24 hours

7.2.1 Response from Pumped Bore

In Figure 3 drawdown in the pumped bore is plotted against log time and in Figure 4 residual drawdown during the recovery period is plotted against log t/t'.

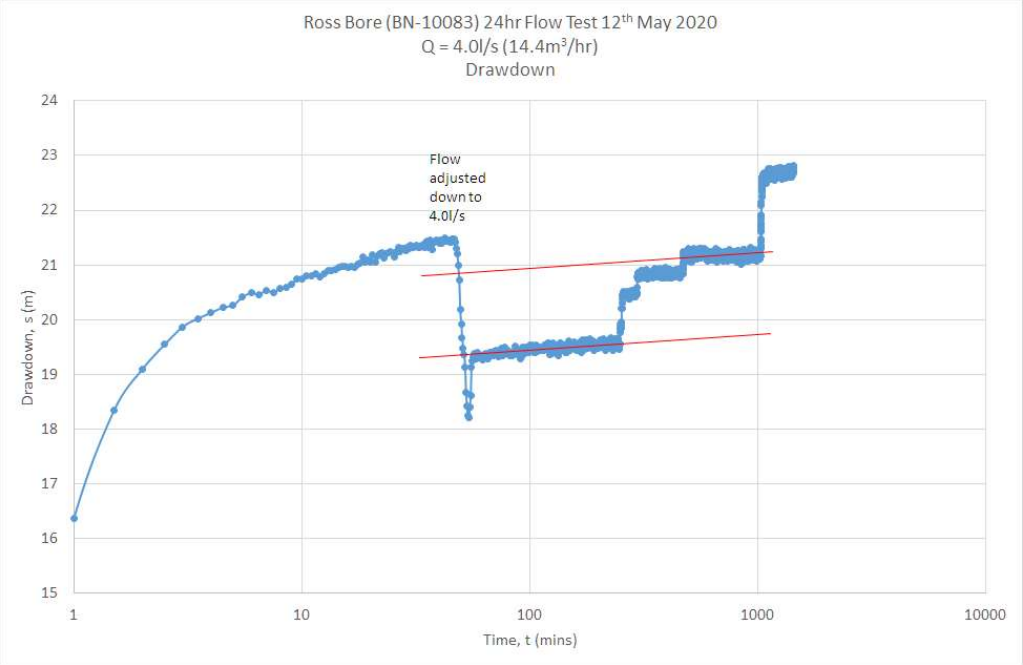


Figure 3 Drawdown in the Pumped Bore

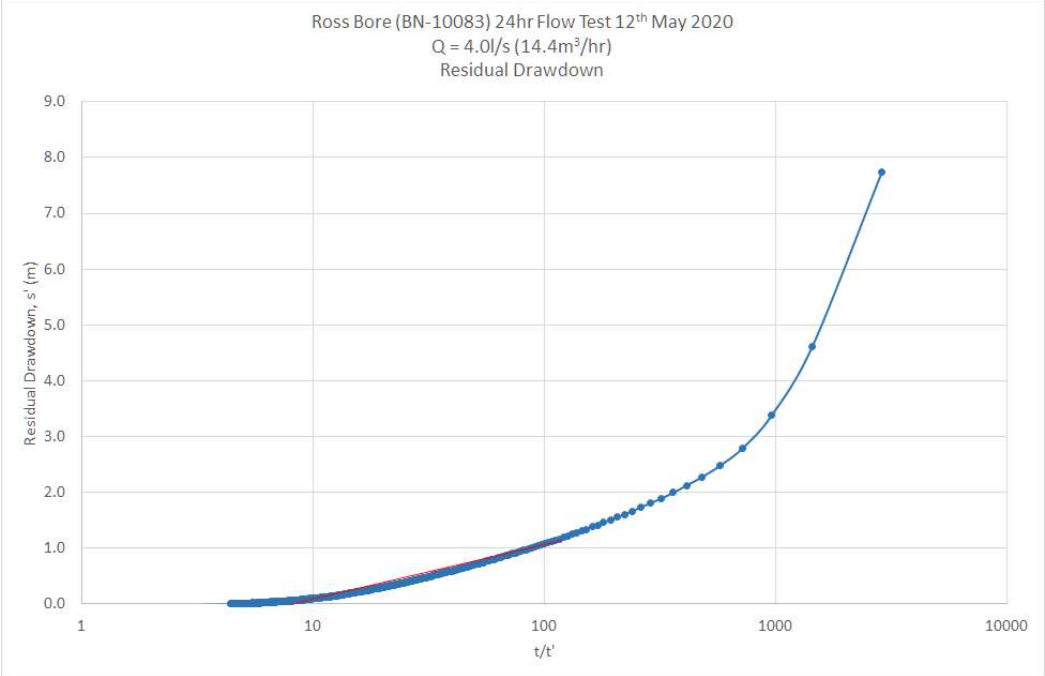


Figure 4 Residual Drawdown in the Pumped Bore during the Recovery Period

From Figure 3 transmissivity of the aquifer near the pumped bore is estimated to be 211m^2/day and from Figure 4, 63m^2/day.

7.2.2 Response from Monitor Bore

No bores were monitored during Test 2. Instead reliance is placed on a previous test on a bore 375 metres away, BN-10993, which used the Ross bore as a monitor bore. The test on bore BN-10993 is described and analysed in (Everitt, 2005).

8 Aquifer Characteristics

To predict effects at distance of pumping the Ross bore, transmissivity T is estimated at 470m^2/day and storativity S at 0.0016 (Everitt, 2005).

9 Proposed Demands

The applicant wishes to irrigate and frost protect 6.3 hectares of kiwifruit. The maximum irrigation demand is 2,205m^3/week at an average of 315m^3/day. During the most severe peak of the irrigation season the bore will be pumped at a rate of 14.4m^3/hr for 153 hours per week or at an average of 22 hours per day. The Bay of Plenty Regional Council has supplied the 80% probability of exceedance annual irrigation volume – 31,199m^3 (Appendix D SPASMO).

The frost protection demand is 945m^3/day based on a pulsed system protecting half the orchard at a time with 30m^3/hr per hectare. The bore is capable of producing 346m^3/day pumping for 24 hours; therefore storage will be required. To assess the capacity of the bore and the aquifer to provide water for frost protection it is assumed conservatively there might be frost 3 days in a row 5 times per year. Therefore for each 3-day frost the demand from the bore is 2,835m^3 and which will require the bore to be pumped for 196 hours (8.1 days). The total demand in a year for frost protection water is 14,175m^3.

10 Predicted Drawdowns

10.1 Pumped Bore

During a 120 day irrigation season, the predicted drawdown in the pumped bore is estimated using the Hazen formula thus:

$$s_{(120\ days\ x\ 22\ hrs)} = F_{(n=120,\ p=0.9)}\ \Delta s + s_{22hrs}$$

$$= 2 \times 0.3m + 22m$$

$$\approx 23m$$

During frost protection, extrapolating the line in Figure 3 out to 196 hours, predicts an estimated drawdown of 23 metres. This is bore above the screen.

10.2 Drawdown in the Aquifer at a Distance

Analysis has been undertaken using the Theis method in spreadsheet form as developed by Bruce Hunt of the University of Canterbury. Aquifer parameters are those estimated in Section 8 above. Modelled drawdown curves are extrapolated out as necessary and when intermittent pumping occurs, recovery is included in the analysis by super-position.

At the end of the irrigation season, in Bore BN-10993 397 metres away from the production bore there will be less than 0.5m of drawdown.

At the end of 8 days of pumping to replenish the frost storage, in the same location, the drawdown will be similar.

10.3 Drawdown in Upper Aquifers

Due to the confined nature of the aquifer as indicated by the borelog and no response during Test 1 in bore BN-2514 there is not expected to be any drawdown in the upper aquifers.

10.4 Drawdown in Surface Waters

There are no nearby surface waters except farm drains. If there were, for the same reasons as above, there is not expected to be any drawdown in surface waters.

11 Limitations of Conclusions

The preceding analyses are based on assumptions such as a homogenous and isotropic aquifer, an infinitely sized aquifer with no boundary conditions and complete penetration of the aquifer by the bore. As these are gross approximations in some instances, the predicted drawdowns contain uncertainty, particularly as time of pumping and pumping rate increases.

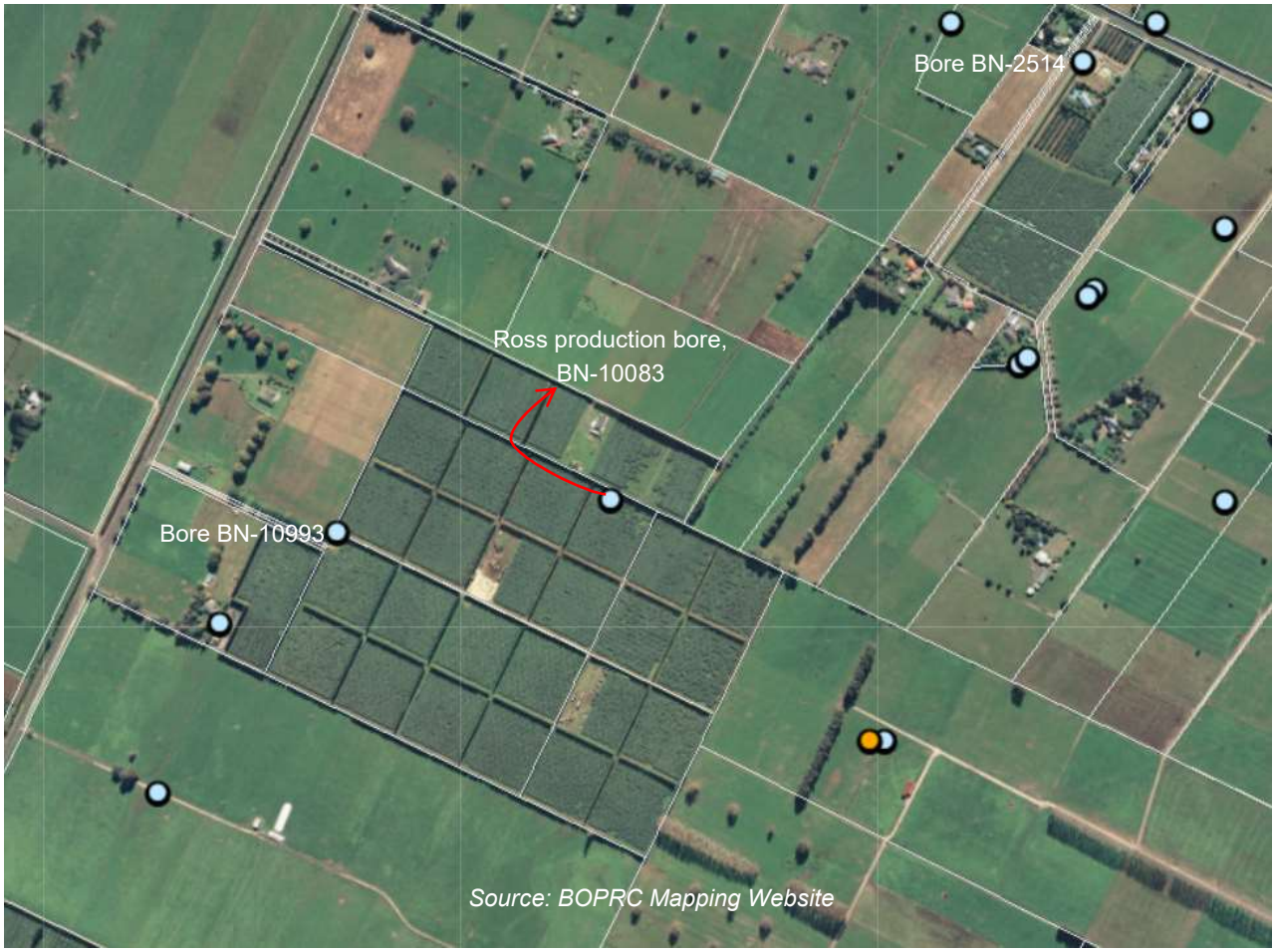
12 References

Bay of Plenty Regional Council. (2016). *Assessment of Water Availability and Estimates of Current Allocation Levels.* Whakatane: BoPRC.

Everitt, S. C. (2005). *J and C Schlepers Awakeri 300mm Water Bore Pump Test Report.* Whakatane: Waterline.

Geological and Nuclear Sciences. (2010). *Groundwater Resource Investigations of the Rangitaiki Plains Stage 1.* Taupo: GNS.

Appendix A Locality Diagram and Borelog



Borelog

Well Report

Well Number: 10083 Surname: Van Bommel Initials: J

Company Name:

Comments:

3.5 ppm iron

Geological Log:

0	5	Silt, sand, pumice
5	7	Peat
7	11	Sand
11	18	Sand, small gravel
18	64	Silt, pumice, some shell
64	65	Grey silt
65	69	Blue gravel
69	72	Grey silt, some pumice
72	77	Green silt, pumice, small gravel
77	78	Grey/green silt

Appendix B Step-Test Data and Results

Not applicable

Appendix C Constant Discharge Test

Data available electronically upon request.

Appendix D SPASMO Calculation