

Wakatipu Basin Aquifers
Update of rainfall recharge analysis based on
aquifer boundary refinement

June 2017



Report writer: Rebecca Morris, Resource Scientist – Groundwater

Subject: Wakatipu Basin Aquifers: Update of rainfall recharge analysis based on aquifer boundary refinement

Date: June 2017

Table of Contents

1.	Introduction	1
2.	Rainfall Recharge Assessment.....	2
2.1.	Morven Aquifer.....	2
2.2.	Upper Mid-Mill Creek	3
3.	Conclusion	5
Appendix A	6

List of Figures

Figure 2.1	Climate stations used for modelling and dividing line for recharge zones.....	2
Figure 2.2	Morven Aquifer boundary as per 2014 investigation / Figure 3: Refined.....	3
Figure 2.3	Upper mid-mill creek aquifer boundary and Landcare soil class map as per the.....	3
Figure 2.4	Refined Upper mid-mill creek aquifer boundary and Landcare soil class map	4
Figure 2.5	Refined Upper mid-mill creek aquifer boundary and soil class from the S-map.....	4

List of Tables

Table 1.1	Area of the aquifers in the Wakatipu Basin.....	1
Table 3.1	Revised MALs for the Wakatipu Basin Aquifers	5

1. Introduction

The nominated aquifer boundaries set out in the 2014 Wakatipu Basin groundwater report (blue book) followed the topographic map. RSU have since refined the aquifer boundaries to better match the boundaries to physical boundaries. The boundaries were refined by using a combination of the GNS 250k geological map, 10 m Digital Elevation Model topography map and aerial photography.

The refinement has changed the area of the aquifers which may alter the amount of rainfall recharge received, subsequently changing the proposed Maximum Allocation Limit (MAL). RSU have modelled the rainfall recharge over the refined boundaries to compare the difference in MAL.

The area of the aquifers is presented in Table 1.1 below.

Table 1.1 Area of the aquifers in the Wakatipu Basin

Aquifer	Blue Book Aquifer Area (ha)	Refined Aquifer Area (ha)	Area difference (ha)	% difference
Arrow-Bush Ribbon Aquifer*	13.6	39.8	26.2	66%
Frankton Flats Aquifer	468.0	475.1	7.0	1%
Mid Mill Creek Aquifer	217.0	224.0	7.0	3%
Ladies Mile Aquifer ⁺	520.3	532.1	11.8	2%
Morven Aquifer	183.7	242.9	59.3	24%
Speargrass-Hawthorn Aquifer	397.1	397.0	-0.1	0
Upper Mill Creek Aquifer	598.1	987.8	389.7	39%

*Alluvial Ribbon Aquifer

⁺ Previously named Windemeer Aquifer in the 2014 Wakatipu Basin groundwater report.

The blue book area and the refined area of the Frankton Flats Aquifer, Ladies Mile Aquifer, Mid-Mill Creek Aquifer and Speargrass-Hawthorn Aquifer are very similar, differing in size by 3% or less. Any increase in MAL in these aquifers would be considered within the margin of error. Therefore, the MAL for these aquifers has not been re-assessed. Whilst the area for the Arrow-Bush Ribbon Aquifer has increased by 66%, this has been nominated as a 2C aquifer and will be managed as surface water. Therefore, this aquifer was not included in this recharge assessment.

The refinement of the area for Upper Mill Creek and Morven Aquifers has increased the area of the aquifers quite significantly (24 - 39%). Therefore, the rainfall recharge has been reassessed for these aquifers. The methodology and results are presented below.

2. Rainfall Recharge Assessment

Details of the rainfall recharge modelling carried out during the 2014 investigation are set out in section 4.1 of the Wakatipu Basin Aquifer report (ORC, 2014). In summary, 10 soil hydrogeological classes were used for the recharge modelling which were provided by Landcare Research. Rainfall from three Arrowtown sites were used for aquifers located in the northern part of the basin. Rainfall from the Queenstown Aero Automatic Weather Station was used for aquifers in the southern portion of the basin (Figure 2.1).

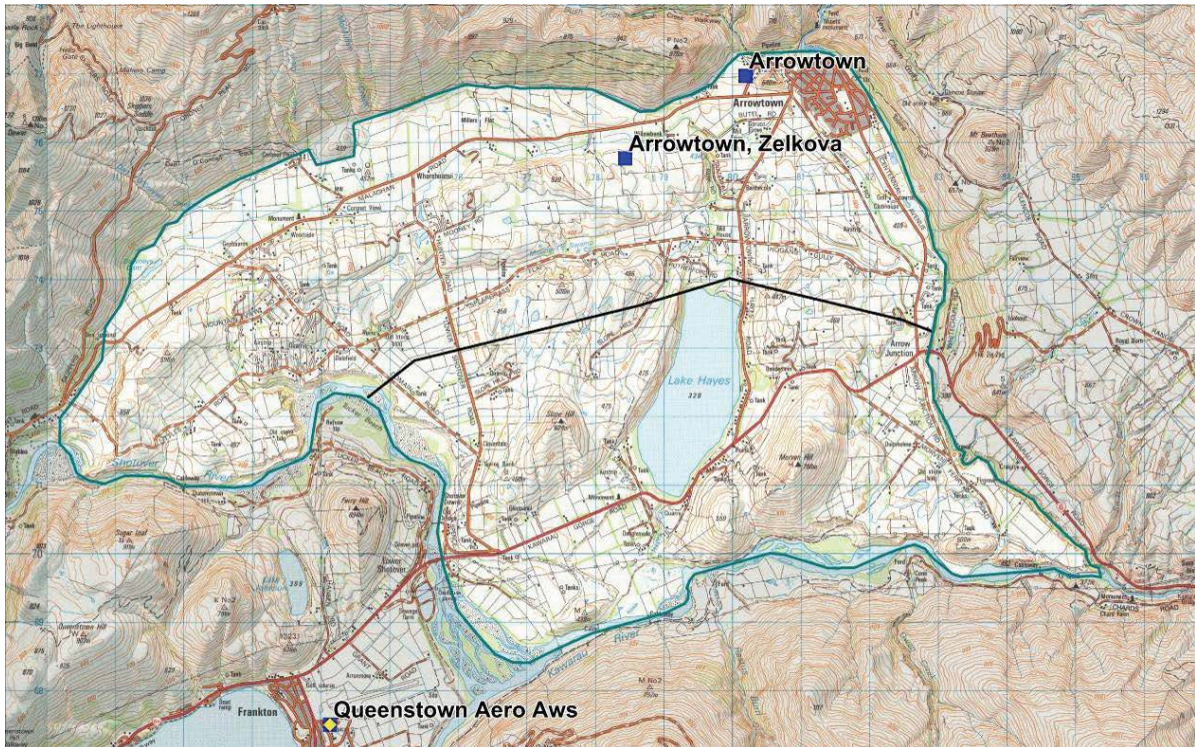


Figure 2.1 Climate stations used for modelling and dividing line for recharge zones

2.1. Morven Aquifer

The area of each soil class was re-calculated based on the increased area during refinement. The new area was then applied to the rainfall recharge model. The area increased by 25% and resulted in an increased rainfall recharge of 27%. The mean annual recharge for the refined Moven Aquifer is now considered to be 0.37 Mm³/yr (up from 0.27 Mm³/yr). Comparison of the aquifer boundaries and soil class extent is presented below in Figure 2.2. Soil class legend is located in Appendix A.

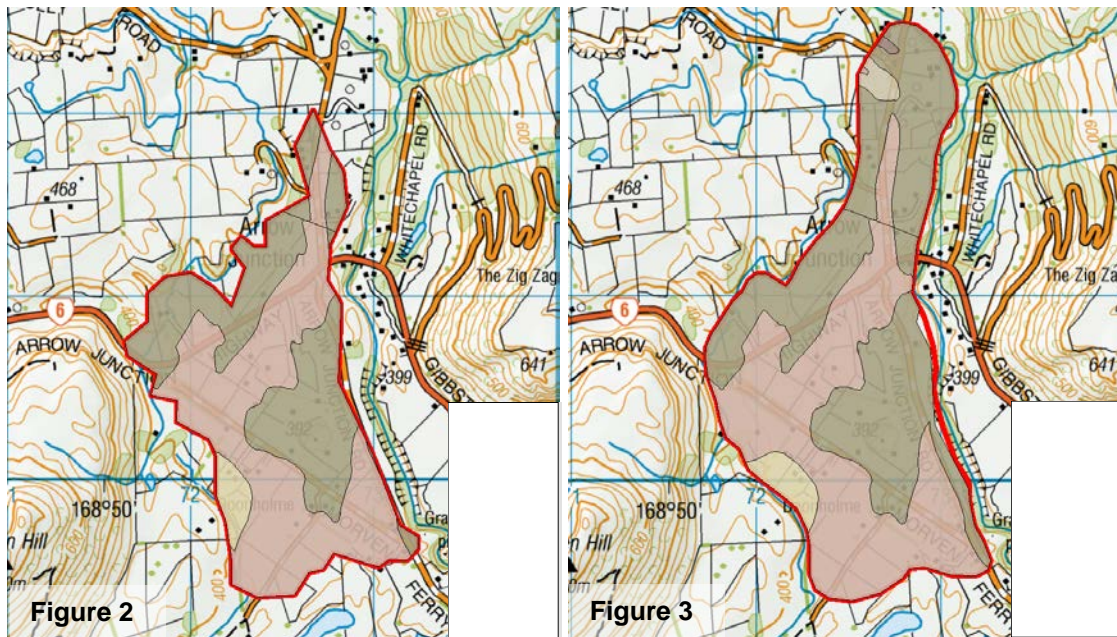


Figure 2.2 Morven Aquifer boundary as per 2014 investigation / **Figure 3:** Refined Morven Aquifer boundary

2.2. Upper Mid-Mill Creek

The area of each soil class was re-calculated based on the increased area during refinement. The Landcare soil map that was used in the 2014 report did not cover the entire extent of the refined boundary. Therefore, the S-map was used (note: the S-map is an updated digital soil map for New Zealand, created by Landcare Research). The soil class in the S-map was matched to the soil class in the Landcare map. The new area was then applied to the rainfall recharge model. The increased area of 39% resulted in an increased rainfall recharge of 24%. The mean annual recharge for the refined Upper Mid-Mill Creek Aquifer is now considered to be 1.57 Mm³/yr (up from 1.19 Mm³/yr). Comparison of the aquifer boundaries and soil class extent is presented below in Figure 2.3, Figure 2.4, Figure 2.5. Soil Class Legend is located in Appendix A.

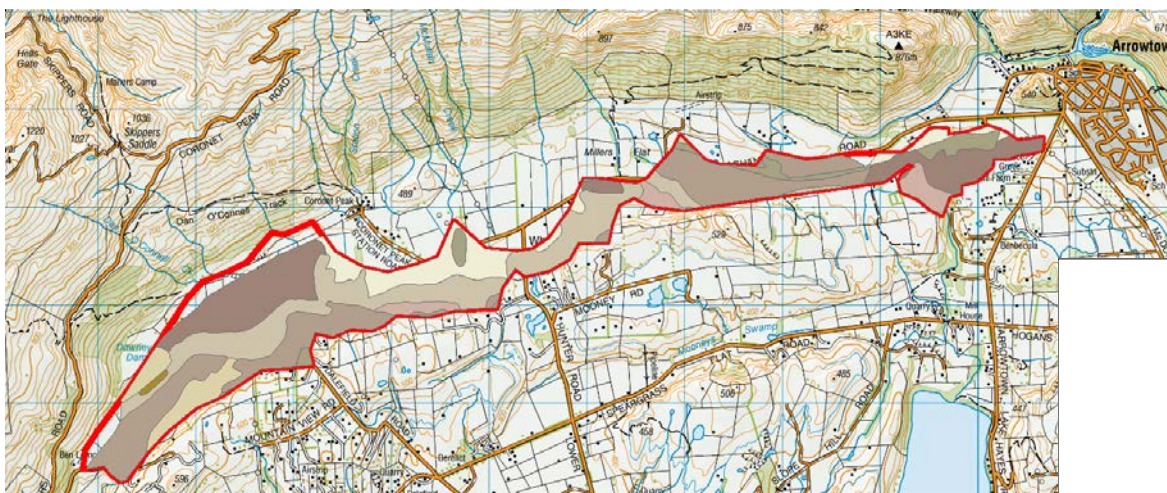


Figure 2.3 Upper mid-mill creek aquifer boundary and Landcare soil class map as per the

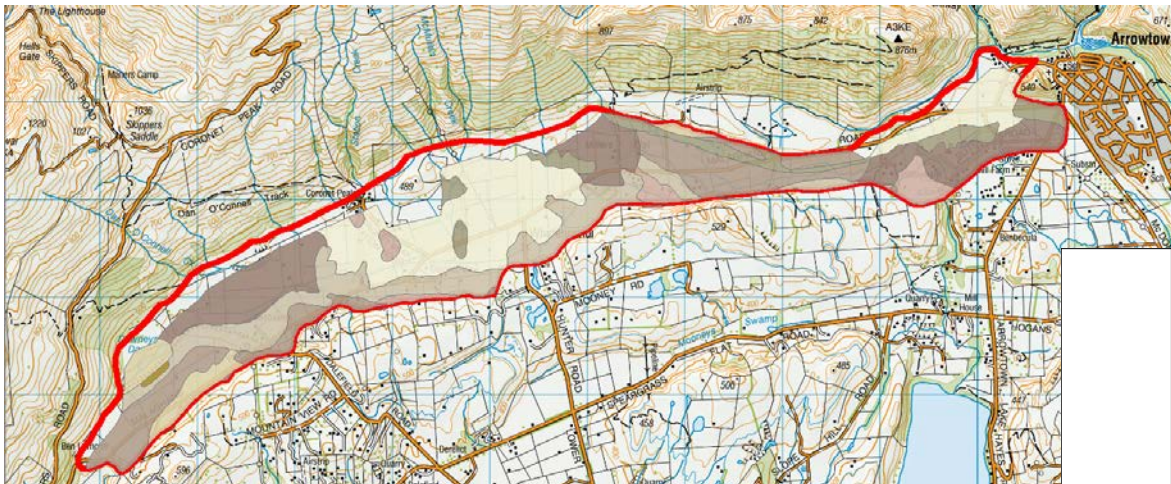
2014 investigation

Figure 2.4 Refined Upper mid-mill creek aquifer boundary and Landcare soil class map

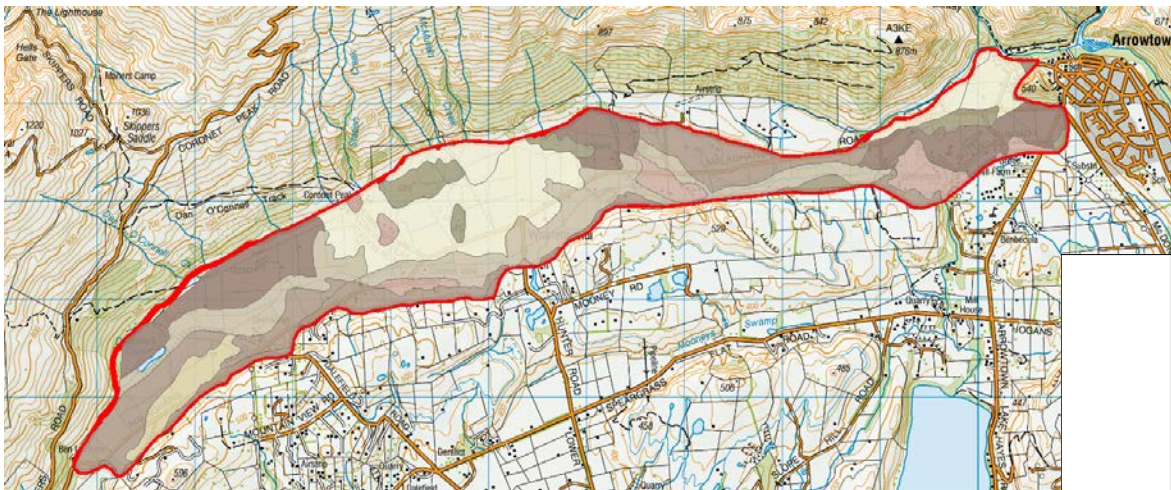


Figure 2.5 Refined Upper mid-mill creek aquifer boundary and soil class from the S-map

3. Conclusion

The boundary refinement of the aquifers has increased the area of the mapped aquifers. A rainfall recharge assessment has been carried out on two of the aquifers within the Wakatipu Basin that had a significant change in area. The revised proposed MALs are presented below in Table 3.1.

Table 3.1 Revised MALs for the Wakatipu Basin Aquifers

Aquifer	Mean annual recharge (Rainfall LSR) (Mm ³ /yr)	Mean annual recharge (surface water) (Mm ³ /yr)	50% of mean annual recharge (Mm ³ /yr)
Arrow-Bush Ribbon Aquifer	-	-	-
Frankton Flats Aquifer	0.42	-	0.21
Ladies Mile Aquifer	0.48	-	0.24
Mid Mill Creek Aquifer	0.39	0.63	0.51
Morven Aquifer	0.37	-	0.185
Speargrass-Hawthorn Aquifer	0.46	-	0.23
Upper Mill Creek Aquifer	1.57	-	0.79

Bold denotes edited MAR and MAL value from the (ORC, 2014) report.

Appendix A

Soil Class Legend:

Soil Code	Interpretation	Assigned Soil Class
Pg2fU	Pigburn shallow fine sandy loam undulating	3
Gd1sU	Gladbrook moderately deep sandy loam undulating	4
Wp1s/aU	Wakatipu moderately deep sandy loam on sand undulating	5
Pr0zG	Paerau deep silt loam gently undulating	6
Wp2sR	Wakatipu shallow sandy loam rolling	7
Bl2fH	Blackstone shallow fine sandy loam hilly	10
Gd0sU	Gladbrook deep sandy loam undulating	12