Permitted Activity Water Takes – Comparison of Options (Version 2)

Technical Report to Support Policy Development

March 2010

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1. Introduction

This document is an **update** to the original report Permitted Activity Water Takes – Comparison of Options - Technical report to support policy development, completed in November 2009. This version has been completed as an update for the Proposed One Plan Hearing Panel and **should be the primary reference on this topic**.

Changes that have been made since completion of the original document include corrections to some of the calculations and removal of Department of Conservation (DoC) land from the "properties-based" calculations. More detail on this is provided in Section 1.1.

Rule 15-1 of the Proposed One Plan (POP) sets out a recommendation for volumes of water to be abstracted as a permitted activity (i.e. not requiring resource consent).

The recommendation is as follows:

- 30 m^3/day per property* where the water is required for an individual's reasonable domestic needs and/or the needs of an individual's animals for drinking water;
- 15 m^3/day per property* where the water is for any other use.

Submitters on the POP have indicated that there are other ways in which non-consented take volume(s) could be determined. We have explored some options using two case study catchments, the Upper Manawatu (upstream of the Manawatu at Hopelands flow recorder) and the Mangatainoka. The results are presented in this document.

Several different methodologies have been explored. These include allocating the water:

(a) as set out in the current proposed Rule 15-1 of the POP, using the number of properties in each catchment (Scenarios 1 & 2);
(b) on a per hectare basis using known land use and average stocking rates (Scenarios 3 & 4) (including an 'expansion' scenario for dairy land use (from 17% to 25% in the Upper Manawatu) (Scenarios 5 & 6);
(c) for the whole catchment at:
    (i) at the daily volume required for drinking by dairy stock (Scenario 7);
    (ii) at the daily volume required for drinking by dairy stock and shed washdown (Scenario 8);
    (iii) at the daily volume required for sheep and beef (Scenario 9); and
    (iv) 200 L/ha (Scenario 10).
(d) as a scaled allocation per property according to property size (Scenarios 11,12 ,13 and 18);
(e) on a per property basis using known land use and average stocking rates, based on the POP submission by Gerard Willis on behalf of Fonterra. The submission for Fonterra outlined permitted activity volumes as shown below. These were recommended to be over and above stockwater requirements. Scenarios were completed for the permitted activity volumes alone (Scenario 14), and with stock drinking water included (Scenario 15). The details of this submission are below:

(i) 15 cubic metres per day (calculated on a net take basis) of water from properties in use for market gardening, cropping, intensive sheep and beef farming; or the keeping of pigs or poultry (either indoors or free range).

(ii) 1 cubic metre per day (calculated on a net take basis) for every 5 hectares of land in use for dairy farming up to a maximum of 30 cubic metres per day; or

(iii) 5 cubic metres of water per day (calculated on a net take basis) from all properties greater than 4 hectares and not in use for market gardening, cropping, intensive sheep and beef farming; the keeping of pigs or poultry (either indoors or free range).or dairy farming; or

(iv) 1.5 cubic metres of water per day (calculated on a net take basis) from all properties less than 4 ha in size and not in one of the uses described under subsection (i) above.

(f) Federated Farmers has suggested a further scenario (Scenario 15) as a part of its submissions to the Hearing Panel following the Hearing. This is outlined as:
"The taking and use of surface water pursuant to s14(2) and s14(3)(a): That water be allocated on a per hectare basis up to a maximum of 40 m^3 per day for properties 50 ha or greater as outlined below"

Property size (ha)								
	0-0.5	0.5-1	1-4	4-10	10-30	30-50	50-100	>100
Water Allocated m^3	0.2	0.4	2	4	12	20	30	40

An additional scenario that adds stock drinking water allowance to Scenario 15 has been added for comparison (Scenario 16).

The results from each methodology or scenario have been compared to the POP recommended core allocation limits to determine what proportion of the available water would need to be assigned to non-consented takes under each methodology.

1.1 How many properties?

Before analysis on any of the property-based methods could begin, the number of individual properties in each of the case study catchments needed to be determined. This information does not exist in any current GIS coverage, and some background work was required to generate a layer that could be used in the analysis. The following outlines the steps taken to do this.

The regional land parcel cadastre (Regional Core Record System or CRS) was used to determine the number of individual properties that are in the Upper Manawatu and Mangatainoka catchments. Because this data is based on land parcels rather than properties, the data had to be processed to provide a count of properties within each catchment. A property that crossed the boundary of a study catchment was included if more than 50% of the area was within the catchment.

ArcMap 9.2 software was used to determine the number of properties in the catchment, in six steps.

Step 1: Dissolve Regional CRS by Valuation Number and Owner Name.

Step 2: Select all parcels that intersect the Upper Manawatu and Mangatainoka catchments and export to new layer.

Step 3: Rating information held by Horizons provided information on contiguous land parcels by Valuation Number. A table of these, with Primary and Secondary Valuation Numbers, was used and a table join was made between the Secondary Number and the Valuation Number in the CRS, to determine where the contiguous land parcels were.

Step 4: The contiguous parcels were then merged together based on the Primary Valuation Number from the table. However, only a small number of properties have been identified as contiguous through the rating process.

Step 5: In order to define the rest of the properties, the data was sorted by landowner, then parcels with the same landowner were merged together if the parcels were adjacent to each other. This included parcels separated by roads or streams.

Step 6: DoC land was removed from the calculation in both catchments, and one other property in the Mangatainoka catchment was removed because it had been included due to an error in the CRS polygon layer.

The final number of properties in the Upper Manawatu was 4,315 and in the Mangatainoka catchment, 2,278.

1.2 Stocking rates and water requirements per hectare

Background information on stocking rates and water requirements was an important component of the analysis of the proposed 'permitted take' allocation methods. The information used, and its associated references, are set out below.

1.2.1 Average stocking rate

(a) Dairy:

For the Upper Manawatu catchment, the average stocking rate used was **3.06 cows/hectare (cows/ha)**. This was based on the Clothier *et al*. (2007) report Farm Strategies for Contaminant Management (Appendix Four, page 64).

For the Mangatainoka catchment, the average stocking rate used was **2.8 cows/ha** (Dr Alec Mackay, *pers. comm.,* 9 Nov 2009; see Appendix One).

(b) Sheep and beef:

For the Upper Manawatu catchment, the average stocking rate used was 10 stock units/ha (10 SU/ha), with a sheep to beef ratio of 70:30 (Appendix 4, page 62-63 Clothier *et al*., 2007). Stocking rate was converted to animals per hectare using the stock unit factors used at the national level by MAF and the MWI Economic Service since 1992[1]. This conversion was done by dividing the number of beef stock units by 5.5, as set out by the above reference, to give the number of animals. For sheep, one stock unit is equal to one animal, so no conversion was required.

This results in a stocking rate of 7 sheep and 0.5 beef cattle per hectare for the average sheep and beef farm in the Upper Manawatu catchment.

For the Mangatainoka catchment, the average stocking rate used was 9.5 SU/ha, with a ratio of 65:35 sheep to beef (Dr Alec Mackay, *pers. comm*., Nov 2009; see Appendix One). Using the MAF stocking rate factors, as described above, this gave a stocking rate of 6.2 sheep and 0.6 beef cattle for the Mangatainoka catchment.

Stocking rate, **as used in the text and tables that follow, refers to the number of individual animals per hectare and has been applied on a 'whole farm' basis.**

1.2.2 Water use requirements

The water use requirement used in the analysis of all of methods was Peak Daily Demand (PDD) as recommended by Aquas Consultants (2007). PDD for a milking dairy cow is 70 L/cow/day, and an additional 70 L/cow/day is provided for washdown; sheep require up to 4.5 L/sheep/day; and beef cattle have a PDD of 55 L/animal/day. This information is summarised in Appendix Two of this document.

Tables 1 and 2 set out the peak daily water demand for the Upper Manawatu and the Mangatainoka catchments based on the stocking rates and water requirements as described above.

Note: all totals for water use in the following tables are rounded to the nearest whole number.

Table 1. Average stocking rates per sector in the Upper Manawatu catchment and calculation of peak daily water requirement per hectare for each sector.

	Dairy herd drinking requirements	Dairy herd drinking plus shed washdown requirements	Mixed sheep and beef farm drinking water requirements*		Mixed sheep and beef farm total drinking water requirements
			sheep	beef	
Average stocking rate per hectare	3.06	3.06	7	0.5	¾
Litres per animal per day	70	140	4.5	55	¾
Litres per hectare per day	214.2	428.4	31.5	30	62

* figures for single stock-type farms were not available for the Upper Manawatu catchment

[1] http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/best-management-practices/reassessment-of-the-stock-management-system/re-assessment-of-stock-unit-system03.htm#A%20History%20of%20the%20Stock%20Unit%20System

Table 2. Average stocking rates per sector in the Mangatainoka catchment and calculation of peak daily water requirement per hectare for each sector.

	Dairy herd drinking requirements	Dairy herd drinking plus shed washdown requirements	Sheep farm drinking water requirements	Beef farm drinking water requirements	Mixed sheep and beef farm drinking water requirements		Mixed sheep and beef farm total drinking water requirements
Average stocking rate per hectare	2.8	2.8	9.5	2.2	6.2	0.6	
Litres per animal per day	70	140	4.5	55	4.5	55	
Litres per hectare per day	196	392	43	121	28	33	61

2. Analysis of the various methodologies

A number of 'permitted water take' scenarios were run to allow comparison of the likely results. These scenarios are listed below, with the tables that contain the respective outputs.

Scenario 1	at 15 m^3/day per property	Table 3
Scenario 2	at 30 m^3/day per property	Table 3
Scenario 3	on a per hectare, by sector, basis using estimated land and average stocking rates (stock drinking water only for dairy and mixed sheep and beef)	Table 4 and Table 5
Scenario 4	on a per hectare, by sector, basis using estimated land and average stocking rates (stock drinking water plus dairy shed washdown water for dairy; and mixed sheep and beef)	Table 4 and Table 5
Scenario 5	on a per hectare, by sector, basis using estimated land and average stocking rates (stock drinking water only for dairy and mixed sheep and beef) under a 'dairy expansion' scenario for the Upper Manawatu	Table 6
Scenario 6	on a per hectare, by sector, basis using estimated land and average stocking rates (stock drinking water plus dairy shed washdown water for dairy; and mixed sheep and beef) under a 'dairy expansion' scenario for the Upper Manawatu	Table 6
Scenario 7	total water requirements for the whole of the Upper Manawatu and Mangatainoka catchments at the daily volume required for dairy stock drinking water	Table 7
Scenario 8	total water requirements for the whole of the Upper Manawatu and Mangatainoka catchments at the daily volume required for dairy stock drinking and dairy shed washdown	Table 7
Scenario 9	total water requirements for the whole of the Upper Manawatu and Mangatainoka catchments at the daily volume required for sheep and beef	Table 7
Scenario 10	total water requirements for the whole of the Upper Manawatu and Mangatainoka catchments at 200 L/ha	Table 7
Scenario 11	200 L/ha/day except properties greater than 50 ha which were allocated 15 m^3/day	Table 9 and Table 10
Scenario 12	400 L/ha/day except properties greater than 50 ha which were allocated 30 m^3/day	Table 11 and Table 12
Scenario 13	200 L/ha/day except properties greater than 50 ha which were allocated 15 m^3/day plus an additional 1.5 m^3/day per property for domestic purposes	Table 13 and Table 14
Scenario 14	as per Fonterra's submission to the POP – excluding stock drinking water	Table15 and Table 16
Scenario 15	as per Fonterra's submission to the POP – including stock drinking water	Table15 and Table 16
Scenario 16	as per Federated Farmers' submission to the POP – excluding stock drinking water	Table 17 and Table 18

Scenario 17	as per Federated Farmers' submission to the POP – including stock drinking water	Table 17 and Table 18
Scenario 18	200 L/ha/day except properties greater than 50 ha which were allocated 30m^3/day	Table 19 and Table 20

2.1 Notified proposed rule

The currently proposed permitted activity rule recommends an allocation of:

- 30 m^3/day per property where the water is required for an individual's reasonable domestic needs and/or the needs of an individual's animals for drinking water;
- 15 m^3/day per property where the water is for any other use.

Analysis was done to determine how much water would actually be required to meet these recommendations in the two case study catchments. The assumption was made that a permitted activity allocation would be made to every property in the catchment. This represents an academic, literal translation of the permitted activity rule, if every property used its full entitlement under the rule.

Table 3 sets out the results of the analysis. The total water requirement in the Upper Manawatu catchment, under the proposed scenario, is 129,450 m^3/day at an allocation of 30 m^3/day per property. This is 154% of the proposed core allocation limit for the Upper Manawatu catchment.

The permitted activity allocation in the Mangatainoka catchment would be 68,340 m^3/day, or 259% of the proposed core allocation limit for the catchment.

Table 3. Calculated permitted activity volume(s) required in the Upper Manawatu and Mangatainoka catchments compared with the recommended core allocation limit for each of the catchments (Scenarios 1 and 2).

	Upper Manawatu		Mangatainoka	
	Scenario 1	*Scenario 2*	*Scenario 1*	*Scenario 2*
	15 m^3/day per property	30 m^3/day per property	15 m^3/day per property	30 m^3/day per property
No. of properties	4,315	4,315	2,278	2,278
Permitted activity allocation (m^3/day)	64,725	129,450	34,170	68,340
Recommended core allocation limit (m^3/day)	83,808	83,808	26,352	26,352
Percentage of recommended core allocation limit required for permitted activity	77	154	130	259

2.2 On a per hectare basis using known land use and average stocking rates

Estimated land use was taken from Clark & Roygard (2008) using the regional classification for the Upper Manawatu and the Mangatainoka catchments. The area under each land use was then multiplied by the L/ha required for each sector (Table 2). The results of this analysis are set out in Table 4 for the Upper Manawatu catchment and Table 5 for the Mangatainoka catchment.

In the Upper Manawatu catchment, the total water requirement, under this scenario, is 13,897 m^3/day. This is 17% of the proposed core allocation limit for this catchment (83,808 m^3/day).

This scenario produces a total water requirement of 6,412 m^3/day in the Mangatainoka catchment. This is 24% of the core allocation limit of 26,352 m^3/day.

The scenario that includes dairy washdown water is probably the closest approximation of the actual situation at the time of writing.

Table 4. Water requirement per sector in the Upper Manawatu catchment compared with the core allocation volume for each of the catchments (Scenarios 3 and 4).

				Scenario 3	*Scenario 4*
	Dairy herd drinking requirements	Dairy herd drinking plus shed washdown requirements	Mixed sheep and beef farm drinking water requirements	Total dairy plus sheep and beef (stock drinking water only)	Total dairy (inc. wash-down) plus sheep and beef
No. of hectares[2]	20,139	20,139	85,677	105,816	105,816
Volume required per day (L)	4,313,735	8,627,470	5,269,122	9,582,858	13,896,593
Volume required per day (m^3)	4,314	8,627	5,269	9,583	13,897
Core allocation limit (m^3/day)	83,808	83,808	83,808	83,808	83,808
Percentage of recommended core allocation limit required for permitted activity	5	10	6	11	17

[2] Clark and Roygard, 2008

Table 5. Water requirement per sector in the Mangatainoka catchment compared with the core allocation volume for each of the catchments (Scenarios 3 and 4),

				Scenario 3	*Scenario 4*
	Dairy herd drinking requirements	Dairy herd drinking plus shed wash-down requirements	Mixed sheep and beef farm drinking water requirements	Total dairy plus sheep and beef (stock drinking water only)	Total dairy (inc. wash-down) plus sheep and beef
No. of hectares[3]	13,162	13,162	20,525	33,686	33,686
Volume required per day (L)	2,579,732	5,159,465	1,252,768	3,832,501	6,412,233
Volume required per day (m^3)	2,580	5,159	1,253	3,833	6,412
Core allocation limit (m^3/day)	26,352	26,352	26,352	26,352	26,352
Percentage of recommended core allocation limit required for permitted activity	10	20	5	15	24

2.2.1 Expansion of Dairy from 17% to 25% of the Land Area in the Upper Manawatu catchment

This case is based on a modelled 'dairy expansion' scenario presented in Clothier *et al*. (2007) in which the dairy land use in the Upper Manawatu catchment increased from 17% (current situation) to 25%.

This scenario results in a total water requirement of 18,126 m^3/day, an increase of 4,229 m^3/day from the scenario presented in Table 5 above.

Table 6. Water requirement per sector in the Upper Manawatu catchment with dairy expansion to 25% of the catchment compared with the core allocation volume for each of the catchments (Scenarios 5 & 6)

				Scenario 5	*Scenario 6*
	Dairy herd drinking requirements	Dairy herd drinking plus shed wash-down requirements	Mixed sheep and beef farm drinking water requirements	Total dairy plus sheep and beef	Total dairy (inc. wash-down) plus sheep and beef
No. of hectares[4]	31,667	31,667	74,148	105,816	105,816
Volume required per day (L)	6,783,130	13,566,271	45,601,215	21,353,271	28,136,412
Volume required per day (m^3)	6,783	13,566,271	4,560	11,343	18,126
Core allocation limit (m^3/day)	83,808	83,808	83,808	83,808	83,808
Percentage of recommended core allocation limit required for permitted activity	8	16	5	14	22

[3] Clark and Roygard, 2008
[4] Clark and Roygard, 2008

Whole catchment at set volumes per hectare

This scenario analyses total water requirements for the whole of the Upper Manawatu and Mangatainoka catchments under the follow allocations:

a. at the daily volume required for dairy stock drinking (Scenario 7);
b. at the daily volume required for dairy stock drinking and washdown (Scenario 8);
c. at the daily volume required for sheep and beef (Scenario 9);
d. 200 L/ha (Scenario 10).

The results are set out in Table 7.

Table 7. Water requirements in the Upper Manawatu and Mangatainoka catchments with the whole catchment under each land use.

	Upper Manawatu				Mangatainoka			
	Scenario 7	*Scenario 8*	*Scenario 9*	*Scenario 10*	*Scenario 7*	*Scenario 8*	*Scenario 9*	*Scenario 10*
	Dairy herd drinking requirements	Dairy herd drinking plus shed washdown requirements	Mixed sheep and beef farm drinking water requirements	200 L/ha	Dairy herd drinking requirements	Dairy herd drinking plus shed washdown requirements	Mixed sheep and beef farm drinking water requirements	200 L/ha
No. of hectares[5]	126,669	126,669	126,669	126,669	43,216	43,216	43,216	43,216
Volume required per hectare (L/ha)	214	428	62	200	196	392	61	200
Volume required per day (m^3)	27,133	54,265	7,790	25,334	8,470	16,940	2,638	8,643
Core allocation limit (m^3/day)	83,808	83,808	83,808	83,808	26,352	26,352	26,352	26,352
Percentage of recommended core allocation limit required for permitted activity	32	65	9	30	32	64	10	33
Average per property (m^3/day)	6	13	2	6	4	7	1	4

2.4 Property analysis with an allocation based on property size

The Property polygons created from the property analysis had the area in hectares calculated and were then split into 7 categories.

- 0 – 0.5ha
- 0.5 – 1 ha
- 1 – 4 ha
- 4 – 10 ha
- 10 – 30 ha
- 30 – 50 ha
- >50 ha.

The properties in the Upper Manawatu and Mangatainoka catchments, in each of the size categories, were counted (Table 8). Three scenarios were then run, based on the largest land area in each category. For example, where a range of property sizes was 4-10 ha, water use requirements were calculated for all properties using the amount sufficient for 10 ha.

[5] Clark and Roygard, 2008

Scenario 11: A permitted activity allocation of 200 L/ha/day except properties greater than 50 ha which were allocated 15 m^3/day (Table 9 and Table 10);

Scenario 12: A permitted activity allocation of 400 L/ha/day except properties greater than 50 ha which were allocated 30 m^3/day (Table 11 and Table 12); and

Scenario 13: A permitted activity allocation of 200 L/ha/day except properties greater than 50 ha which were allocated 15 m^3/day plus an additional 1.5 m^3/day per property for domestic purposes (Table 13 and Table 14).

Scenario 14: A permitted activity allocation of 200 L/ha/day except properties greater than 50 ha which were allocated 30 m^3/day (Table 15 and Table 16).

Table 8. Number of properties in each size category for the Upper Manawatu and Mangatainoka catchments.

	Property size class						
	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha
Number of properties Upper Manawatu	2,698	221	434	175	165	123	499
Number of properties Mangatainoka	1,492	107	227	80	73	68	231

Table 9. Volume allocated in the Upper Manawatu catchment under maximum permitted activity allocation of 15 m^3/day (Scenario 11).

	Property size class							
	Scenario 11							
	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	Total
Number of properties	2,698	221	434	175	165	123	499	4,315
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	15	
Total allocation per class (m^3/day)	269.8	44.2	347.2	350	990	1,230	7,485	10,716
Core allocation limit (m^3/day)								83,808
Percentage of recommended core allocation limit required for permitted activity								13

Table 10. Volume allocated in the Mangatainoka catchment under maximum permitted activity allocation of 15 m^3/day (Scenario 11).

	Property size class							
	Scenario 11							
	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	Total
Number of properties	1,492	107	227	80	73	68	231	2,278
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	15	
Total allocation per class (m^3/day)	149.2	21.4	181.6	160	438	680	3,465	5,095
Core allocation limit (m^3/day)								26,352
Percentage of recommended core allocation limit required for permitted activity								19

Table 11. Volume allocated in the Upper Manawatu catchment under maximum permitted activity allocation of 30 m^3/day (Scenario 12).

	Property size class							
	Scenario 12							
	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	Total
Number of properties	2,698	221	434	175	165	123	499	4,315
Allocation per property (m^3/day)	0.2	0.4	1.6	4	12	20	30	
Total allocation per class (m^3/day)	539.6	88.4	694.4	700	1,980	2,460	14,970	21,432
Core allocation limit (m^3/day)								83,808
Percentage of recommended core allocation limit required for permitted activity								26

Table 12. Volume allocated in the Mangatainoka catchment under maximum permitted activity allocation of 30 m^3/day (Scenario 12).

	Property size class							
	Scenario 12							
	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	Total
Number of properties	1,492	107	227	80	73	68	231	2,278
Allocation per property (m^3/day)	0.2	0.4	1.6	4	12	20	30	
Total allocation per class (m^3/day)	298.4	42.8	363.2	320	876	1,360	6,930	10,190
Core allocation limit (m^3/day)								26,352
Percentage of recommended core allocation limit required for permitted activity								39

Table 13. Volume allocated in the Upper Manawatu catchment under maximum permitted activity allocation of 16.5 m^3/day (Scenario 13)

	Property size class							
	Scenario 13							
	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	Total
Number of properties	2,698	221	434	175	165	123	499	4,315
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	15	
Total allocation per class (m^3/day)	269.8	44.2	347.2	350	990	1,230	7,485	10,729
Total additional domestic allowance (m^3/day)	4,047	331.5	651	262.5	247.5	184.5	748.5	6,476
Total allocation per class inc. domestic (m^3/day)	4,316.8	375.7	998.2	612.5	1,237.5	1,414.5	8,233.5	17,189
Core allocation limit (m^3/day)								83,808
Percentage of recommended core allocation limit required for Permitted Activity								21

Table 14. Volume allocated in the Mangatainoka catchment under maximum permitted activity allocation of 16.5 m^3/day (Scenario 13)

	Property size class							
	Scenario 13							
	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	Total
Number of properties	1,492	107	227	80	73	68	231	2,278
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	15	
Total allocation per class (m^3/day)	149.2	21.4	181.6	160	438	680	3,465	
Total additional domestic allowance (m^3/day)	2,238	160.5	340.5	120	109.5	102	346.5	
Total allocation per class inc. domestic (m^3/day)	2,387.2	181.9	522.1	280	547.5	782	3,811.5	8,512
Core allocation limit (m^3/day)								26,352
Percentage of recommended core allocation limit required for permitted activity								32

2.5 Fonterra Submission

Note: Fonterra's submission holds that stock drinking water is excluded from and should be additional to the volume provided for under the permitted activity rule in the POP. The volumes set out in Fonterra's submission **exclude** any allocation for **stock drinking water**. We have added the relevant stock drinking water requirements to the scenario to allow for comparison to the other methods set out here.

In order to address the proposed rules in the evidence of Mr Gerard Willis for Fonterra, the properties were each given a unique identifier and then intersected with the land use layer (Clark & Roygard, 2008). Further analysis was required because the land use layer was not created on a property basis. The data was dissolved based on the unique identifier and the regionally significant land use. If a property had more than one land use identified, the land use that made up the majority of the property was selected. The simplified land use does not separate out pig and poultry farming, so these properties have not been included in the analysis.

(i) and (ii) The Fonterra submission proposed a maximum allocable volume of 30 m^3/day for dairying on properties of 150 ha or more. To calculate the required daily volume for this, the number of dairying properties of >150 ha was multiplied by 30 m^3/day. The total land area of the remaining properties (<150 ha) in the catchment was added up and divided by 5 to give the total volume required by these properties (at 1 m^3/day for every 5 ha of land).

(iii) and (iv) To determine the number of properties not included in parts (i) and (ii), the number of properties identified as dairying or cropping that were >4 ha was subtracted from the total number of properties in each of the catchments ((iii)); and the number of properties identified as dairying or cropping that were <4 ha was subtracted from the total number of properties in each catchment ((iv)).

As stated in the introduction and Section 1.1 of this report, some the DoC land in both the Upper Manawatu and Mangatainoka catchments was removed

from the calculation, as was one other property that was an error in the CRS polygon layer. The maps in Figures 1 and 2 show the land area in both catchments before and after the removal of these properties.

The resultant daily water requirements are set out in Tables 17 and 18 below. As noted above, the Fonterra proposal does not include stock drinking water, so the relevant volumes have been added to allow comparison with all of the others scenarios tested.

Table 15. Volume allocated in the Upper Manawatu catchment under Fonterra submission (with the DoC land removed) (Scenario 14 and Scenario 15 – including stock drinking water requirements)

Scenario 14						
	Cropping	Dairy <150 ha	Dairy >150 ha	Properties not included in (i) or (ii) <4 ha	Properties not included in (i) or (ii) >4 ha	Total
Number of properties	9	236	44	3,304	722	4,315
Allocation per property (m^3/day)	15	1m^3/5ha	30	1.5	5	
Total allocation per class (m^3/day)	135	2,443	1,320	4,956	3,610	12,464
Core allocation limit (m^3/day)						83,808
Percentage of recommended core allocation limit required for permitted activity						15
STOCK DRINKING WATER			Scenario 15			
Area (ha)	437	12,216	9,960	1,326	106,069	130,009
Stock drinking water requirement (m^3/day)	n/a	2,617	2,133	82	6,523	11,355
Total water requirement (m^3/day)	135	5,060	3,453	5,038	10,133	23,819
Core allocation limit (m^3/day)						83808
Percentage of recommended core allocation limit required for permitted activity						28

Table 16. Volume allocated in the Mangatainoka catchment under Fonterra submission with the conservation land removed (Scenario 14 and Scenario 15 – including stock drinking water requirements)

Scenario 14						
	Cropping	Dairy <150 ha	Dairy >150 ha	Properties not included in (i) or (ii) <4 ha	Properties not included in (i) or (ii) >4 ha	Total
Number of properties	1	139	40	1,803	295	2,278
Allocation per property (m^3/day)	15	1m^3/5 ha	30	1.5	5	
Total allocation per class (m^3/day	15	1,446	1,200	2,705	1,475	6,841
Core allocation limit (m^3/day)						26,352
Percentage of recommended core allocation limit required for permitted activity						26
STOCK DRINKING WATER			Scenario 15			
Area (ha)	5	7,231	9,597	704	26,808	44,344
Stock drinking water requirement (m^3/day)	n/a	1,417	1,881	43	1,636	4,978
Total water requirement (m^3/day)	15	2,863	3,081	2,748	3,111	11,818
Core allocation limit (m^3/day)						26,352
Percentage of recommended core allocation limit required for permitted activity						45

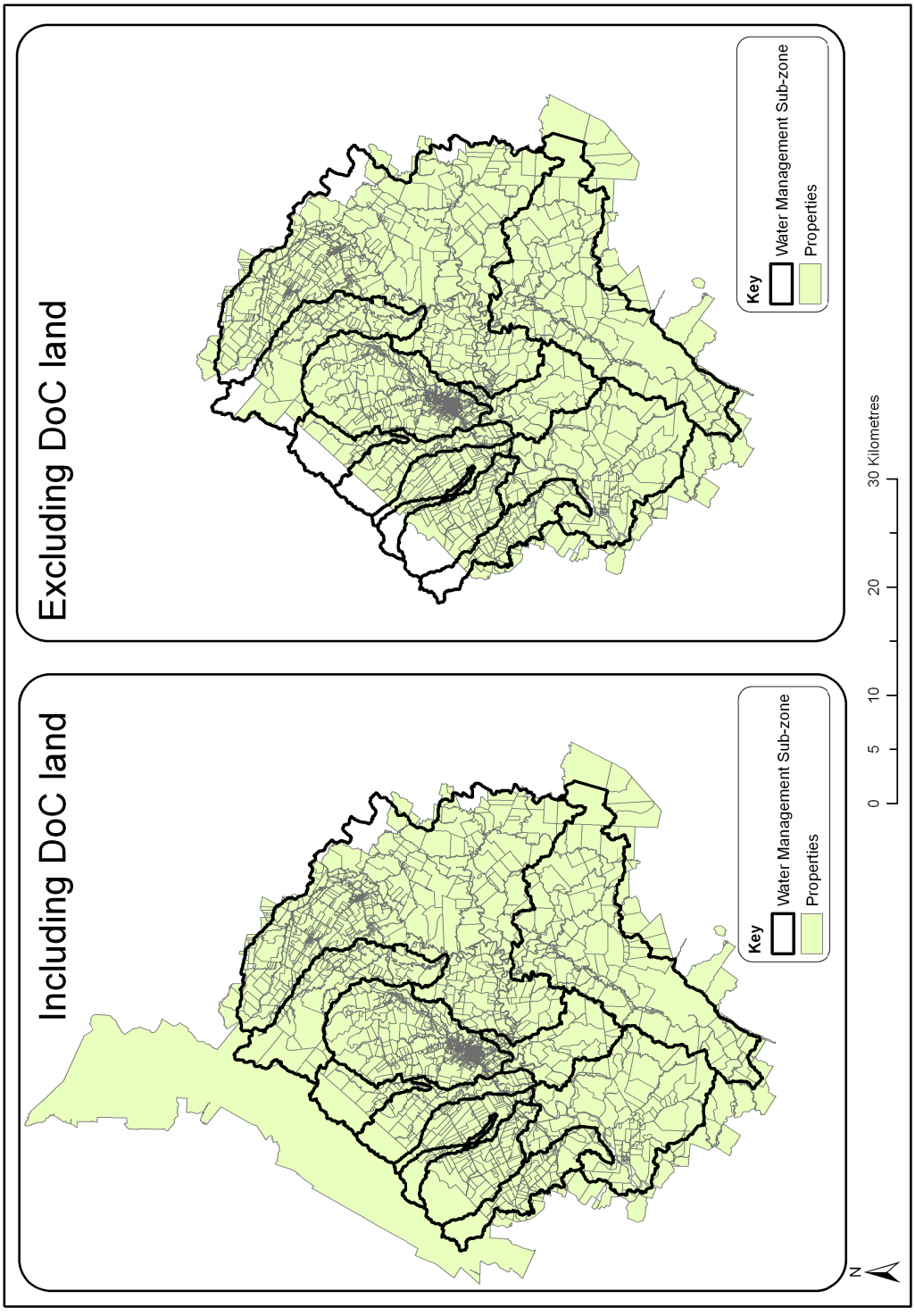

Figure 1. Maps showing the land area of the Upper Manawatu catchment, before and after removal of DoC land

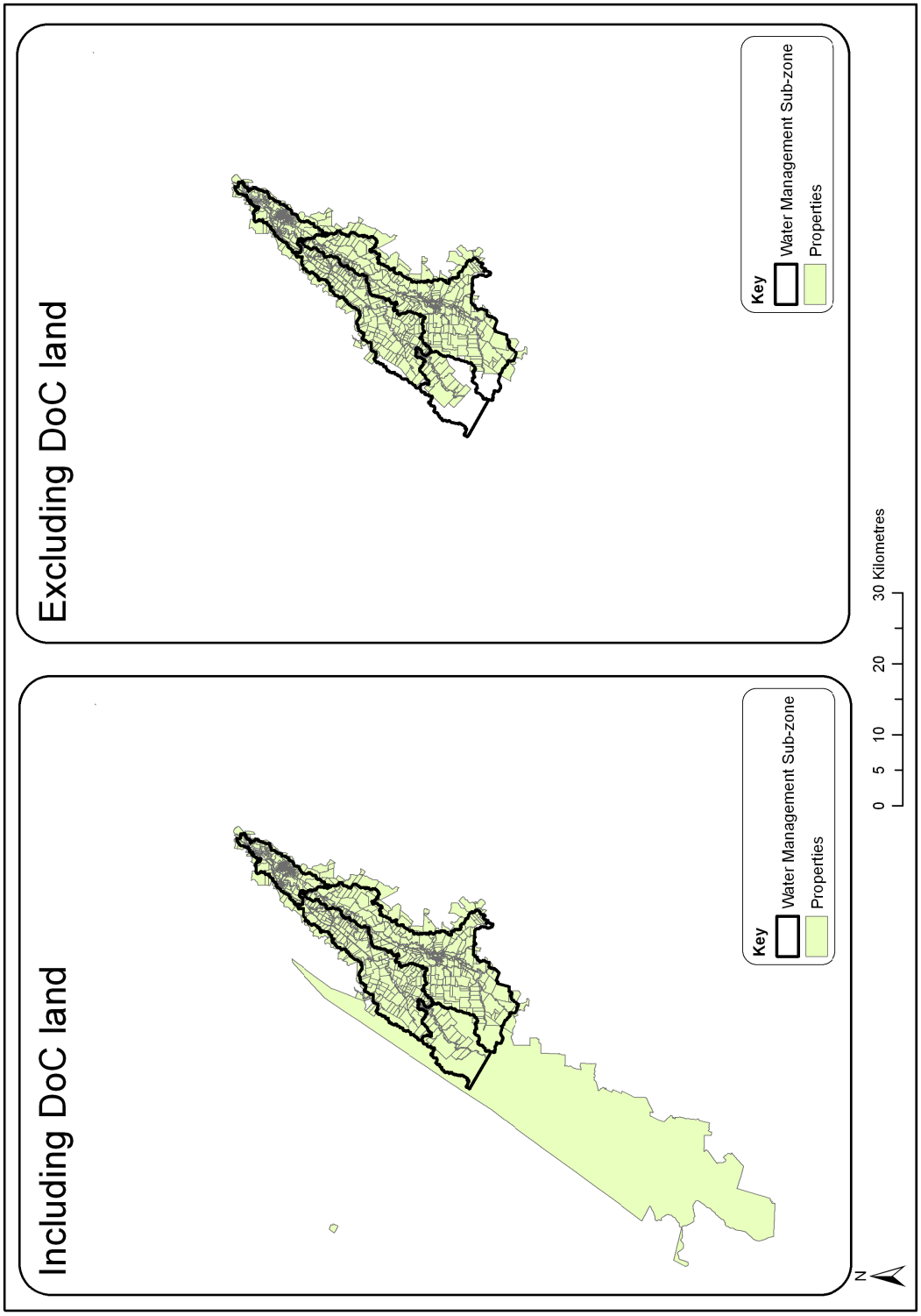

Figure 2. Maps showing the land area of the Upper Manawatu catchment, before and after removal of DoC land

2.6 Federated Farmers' Submission (received after the Water Hearing)

Federated Farmers has suggested a further scenario as part of its submissions to the Hearing Panel following the Hearing. This is outlined as:

"*The taking and use of surface water pursuant to s14(2) and s14(3)(a): That water be allocated on a per hectare basis up to a maximum of 40 m^3 per day for properties 50 ha or greater as outlined below*"

Property size (ha)								
	0-0.5	0.5-1	1-4	4-10	10-30	30-50	50-100	>100
Water Allocated m^3	0.2	0.4	2	4	12	20	30	40

This suggested scenario is listed here as Scenario 16. An additional scenario (Scenario 17) has been added to include stock drinking water for comparison. Because of the late receipt of this submission, there has not been sufficient time to complete a detailed analysis for the stock drinking water requirements on the property classes suggested here. It has been assumed that the total stock water drinking requirement would be as for the analysis under Scenario 15, as the total land area and stocking rate used in the calculations is the same. The results of the analysis under Scenarios 16 and 17 are set out in Tables 17 and 18.

Table 17. Volume allocated in the Upper Manawatu catchment under Federated Farmers' submission (Scenario 16 and Scenario 17).

Scenario 16									
Property size class	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	>100 ha	Total
Number of properties	2,698	221	434	175	165	123	159	340	4,315
Allocation per property class (m^3/day)	0.2	0.4	2	4	12	20	30	40	
Total allocation per class (m^3/day)	539.6	88.4	868	700	1,980	2,460	4,770	13,600	25,006
Core allocation limit (m^3/day)									83,808
Percentage of recommended core allocation limit required for permitted activity									30
STOCK DRINKING WATER Scenario 17									
Stock water requirement (m^3/day)									11,355
Total water requirement (m^3/day)									36,361
Core allocation limit (m^3/day)									83,808
Percentage of recommended core allocation limit required for permitted activity									43

Table 18. Volume allocated in the Mangatainoka catchment under Federated Farmers' submission (Scenario 16 and Scenario 17).

Scenario 16									
Property size class	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	>100 ha	Total
Number of properties	1,492	107	227	80	73	68	92	139	2,278
Allocation per property class (m^3/day)	0.2	0.4	1.6	4	12	20	30	40	
Total allocation per class (m^3/day)	298.4	42.8	363.2	320	876	1,360	2,760	5,560	11,580
Core allocation limit (m^3/day)									26,352
Percentage of recommended core allocation limit required for permitted activity									44
STOCK DRINKING WATER Scenario 17									
Stock water requirement (m^3/day)									4,978
Total water requirement (m^3/day)									16,558
Core allocation limit (m^3/day)									26,352
Percentage of recommended core allocation limit required for Permitted Activity									63

2.7 Additional scenario suggested by Horizons Planning Team

Tables 19 and 20 set out the results of an additional Scenario (Scenario 18) related to Scenario 11, but allowing a maximum allocation of 30 m3/day for properties >50 ha.

Table 19. Volume allocated in the Upper Manawatu catchment under maximum permitted activity allocation of 30 m^3/day (Scenario 18).

	Property size class							
	Scenario 18							
	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	Total
Number of properties	2,698	221	434	175	165	123	499	4,315
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	30	
Total allocation per class (m^3/day)	269.8	44.2	347.2	350	990	1,230	14,970	18,201
Core allocation limit (m^3/day)								83,808
Percentage of recommended core allocation limit required for permitted activity								22

Table 20. Volume allocated in the Mangatainoka catchment under maximum Permitted Activity allocation of 30 m^3/day (Scenario 18)

	Property size class							
	Scenario 18							
	0-0.5 ha	0.5-1 ha	1-4 ha	4-10 ha	10-30 ha	30-50 ha	>50 ha	Total
Number of properties	1,492	107	227	80	73	68	231	2,278
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	30	
Total allocation per class (m^3/day)	149.2	21.4	181.6	160	438	680	6,930	8,560
Core allocation limit (m^3/day)								26,352
Percentage of recommended core allocation limit required for permitted activity								33

3. Summary of results

A summary of the results from the analysis is presented in Table 21. These results indicate the potential size of permitted activity take volumes in relation to the core allocation limits proposed in the POP for consented takes.

In assessing core allocation limits, the level of current stock drinking water/washdown/permitted use was considered to be provided for in the hydrological flow statistics used to calculate minimum flows. A potential limitation of this approach is that if stocking rates increase, these may have a greater impact on surety of supply.

Table 21. Summary of results from all scenarios.

	Methodology	Upper Manawatu		Mangatainoka	
		Total permitted activity allocation (m^3/day)	% of core allocation limit	Total permitted activity allocation (m^3/day)	% of core allocation limit
Scenario 1	at 15 m^3/day per property	64,725	77	34,170	130
Scenario 2	at 30 m^3/day per property	129,450	154	68,340	259
Scenario 3	on a per hectare, by sector, basis using estimated land and average stocking rates (stock drinking water only for dairy and mixed sheep and beef)	9,583	11	3,833	15
Scenario 4	on a per hectare, by sector, basis using estimated land and average stocking rates (stock drinking water plus dairy shed washdown water for dairy; and mixed sheep and beef)	13,897	17	6,412	24
Scenario 5	on a per hectare, by sector, basis using estimated land and average stocking rates (stock drinking water only for dairy and mixed sheep and beef) under a 'dairy expansion' scenario for the Upper Manawatu	11,343	14	n/a	n/a
Scenario 6	on a per hectare, by sector, basis using estimated land and average stocking rates (stock drinking water plus dairy shed washdown water for dairy; and mixed sheep and beef) under a 'dairy expansion' scenario for the Upper Manawatu	18,126	22	n/a	n/a
Scenario 7	total water requirements for the whole of the Upper Manawatu and Mangatainoka catchments at the daily volume required for dairy stock drinking water	27,133	32	8,470	32
Scenario 8	total water requirements for the whole of the Upper Manawatu and Mangatainoka catchments at the daily volume required for dairy stock drinking and washdown	54,265	65	16,940	64
Scenario 9	total water requirements for the whole of the Upper Manawatu and Mangatainoka catchments at	7,790	9	2,638	10

	Methodology	Upper Manawatu		Mangatainoka	
		Total permitted activity allocation (m^3/day)	% of core allocation limit	Total permitted activity allocation (m^3/day)	% of core allocation limit
	the daily volume required for sheep and beef				
Scenario 10	total water requirements for the whole of the Upper Manawatu and Mangatainoka catchments at 200 L/ha	25,334	30	8,643	33
Scenario 11	200 L/ha/day except properties greater than 50 ha which were allocated 15 m^3/day	10,716	13	5,095	19
Scenario 12	400 L/ha/day except properties greater than 50 ha which were allocated 30 m^3/day	21,432	26	10,190	39
Scenario 13	200 L/ha/day except properties greater than 50 ha which were allocated 15 m^3/day plus an additional 1.5 m^3/day per property for domestic purposes	17,189	21	8,512	32
Scenario 14	as per Fonterra's submission to the POP – excluding stock drinking water	12,464	15	6,841	26
Scenario 15	as per Fonterra's submission to the POP – including stock drinking water	23,819	28	11,818	45
Scenario 16	as per Federated Farmers' submission to the POP – excluding stock drinking water	25,006	30	11,580	44
Scenario 17	as per Federated Farmers' submission to the POP – including stock drinking water	36,361	43	16,558	63
Scenario 18	200 L/ha/day except properties greater than 50 ha which were allocated 30 m^3/day	18,201	22	8,560	32

4. References

Clark M. and Roygard J. Land Use and Land Use Capability in the Manawatu-Wanganui Region. Internal report to support policy development. Horizons Regional Council, ISBN: 978-1-877468-51-3, Report No. 2008/INT/616.

Clothier B., Mackay A., Carran A., Gray R, Parfitt R., Francis G., Manning M., Duerer M., and Green S. 2007. Farm Strategies for Contaminant Management. A report by SLURI, the Sustainable Land Use Research Initiative, for Horizons Regional Council.

Mackay, A. 2009. Personal communication by email 9 November 2009.

Stewart G. and Rout R., 2007. Reasonable Stock Water Requirements Guidelines for Resource Consent Applications. Technical Report prepared for Horizons Regional Council by Aquas Consultants Ltd and Aqualinc Research Ltd.

5. Appendix One

From: Mackay, Alec [mailto:alec.mackay@agresearch.co.nz]
Sent: Monday, 9 November 2009 9:22 a.m.
To: Maree Clark
Subject: RE: Stocking Rates Mangatainoka

Dear Maree
Not sure, my guess would be a little higher 65:35
Regards Alec

From: Maree Clark [mailto:Maree.Clark@horizons.govt.nz]
Sent: Monday, 9 November 2009 8:26 a.m.
To: Mackay, Alec
Subject: RE: Stocking Rates Mangatainoka

Hi Alec,

Thanks for that. Does the 70:30 ratio of sheep to beef apply in the Mangatainoka also?

Regards
Maree

MAREE CLARK l Environmental Scientist - Water
DDI 06 9522 878 l M 021 2277 234

From: Mackay, Alec [mailto:alec.mackay@agresearch.co.nz]
Sent: Thursday, 5 November 2009 10:23 p.m.
To: Maree Clark
Subject: RE: Stocking Rates Mangatainoka

Dear Maree

Dairy; 2.8 cows/ha
Mixed Sheep and Beef; 9.5 su/ha
Sheep; and (same as sheep and beef)
Cattle farming 12 su/ha

Regards Alec

From: Maree Clark [mailto:Maree.Clark@horizons.govt.nz]
Sent: Monday, 2 November 2009 1:53 p.m.
To: Mackay, Alec
Cc: Jon Roygard
Subject: Stocking Rates Mangatainoka

Hi Alec,

We are undertaking some analysis for the POP in regard to the Permitted Activity rule for surface water abstractions and looking at different ways of allocating this. I am after some average stocking rate numbers for the Mangatainoka catchment for the following activities:

Dairy;
Mixed Sheep and Beef;
Sheep; and
Cattle farming

If you could send me through these figures as soon as possible I would appreciate this.

Cheers
Maree

MAREE CLARK I Environmental Scientist - Water
DDI 06 9522 878 I M 021 2277 234

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6. Appendix Two

Range for Devising a Standard for Stock Drinking-Water Requirements

Farming Enterprise	Type of Animal	ADD (l/h/d)	PDD (l/h/d)
Dairy	Milking cows	45	70
	Dry stock	30	45
Beef	Mature cattle, herd replacement stock and bulls	30	55
Sheep	Ewes, hoggets and rams	3.0	4.5
Deer	Hinds and stags (all ages)	6.0	12.0
Horses	Working horses	55	70
	Grazing horses	35	50
Goats	Milking goats	5.0	10
	Dry goats	3.5	7.0
Pigs	Mature pigs	11	18
	Brood sows	22	35
	Pigs up to 120 kg	7.0	11
Poultry ** all figures are for l/100 birds/d*	Laying and breeder hens	30*	45*
	Non-laying hens and chickens	18	29
	Turkeys	55	100

From: Aquas Consultants (2007). Reasonable Stock Water Requirements – Guidelines for Resource Consent Applications. Technical Report prepared for Horizons Regional Council.

7. Appendix Three

Stock unit factors used at the national level by MAF and the MWI Economic Service since 1992

Sheep	Per Head	Deer	Per Head
		Hinds Breeding	1.9 SU
Ewes	**1.0 SU**	Hinds 1.5 yr	1.8 SU
Hoggets	0.7 SU	Hinds Weaner	1.2 SU
Wethers	0.7 SU	Stags Weaner	1.4 SU
Rams	0.8 SU	Stags 1.5 yr	1.8 SU
		Stags Mature	2.2 SU
Beef Cattle		**Goats**	
Cows	5.5 SU		
Heifers 1.5 yr	4.5 SU		
Heifers Weaners	3.5 SU		
Bulls Weaners	4.5 SU	Bucks & Does 1 yr +	0.8 SU
Steers Weaners	4.5 SU	Bucks & Does to 1 yr	0.5 SU
Steers 1.5 yr	5.0 SU	Buck	0.8 SU
Steers 2.5 yr	**5.5 SU**		
Bulls	5.5 SU		
Dairy Heifers	4.5 SU		

Source: http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/best-management-practices/reassessment-of-the-stock-management-system/re-assessment-of-stock-unit-system03.htm#A%20History%20of%20the%20Stock%20Unit%20System