Permitted Activity Water Takes – Comparison of Options

Technical Report to Support Policy Development

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1. Introduction

Rule 15-1 of the Proposed One Plan (POP) sets out a recommendation for volumes of water to be abstracted as a Permitted Activity (ie. 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 the Permitted Activity 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;
(b) on a per hectare basis using known land use and average stocking rates (including an 'expansion' scenario for dairy land use (from 17% to 25% in the Upper Manawatu);
(c) for the whole catchment at:
    (i) at the daily volume required for drinking by dairy stock;
    (ii) at the daily volume required for drinking by dairy stock and shed washdown;
    (iii) at the daily volume required for sheep and beef; and
    (iv) 200 L/ha.
(d) as a scaled allocation per property according to property size;
(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 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.

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 'permitted 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 manipulated 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 five 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 Number, 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.

The final number of properties in the Upper Manawatu catchment was 4,316, and in the Mangatainoka catchment, 2,280.

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 4, page 64).

For the Mangatainoka catchment, the average stocking rate used was **2.8 cows/ha** (Alec McKay, *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 (Alec McKay, *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 required 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 2 and 3 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.

[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 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

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 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	Table 15 and 16
Scenario 15	as per Fonterra's submission to the POP – including stock drinking water	Table 15 and 16

2.1 Current 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 4 sets out the results of the analysis. The total water requirement in the Upper Manawatu catchment, under the proposed scenario, is 129,480 m^3/day at an allocation of 30 m^3/day per property. This is 155% of the proposed core allocation limit for the Upper Manawatu catchment.

The permitted activity allocation in the Mangatainoka catchment would be 68,400 m^3/day, or 260% 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	4,316	4,316	2,280	2,280
Permitted activity allocation (m^3/day)	64,740	129,480	34,200	68,400
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	155	130	260

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

Estimated land use was taken from Clark and 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 5 for the Upper Manawatu catchment and Table 6 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

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	10	20	5	15	24

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

limit required for permitted activity					

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	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

2.3 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;
b) at the daily volume required for dairy stock drinking and washdown;
c) at the daily volume required for sheep and beef;
d) 200 L/ha.

[4] Clark and Roygard, 2008

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 wash-down 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 7). Three scenarios were then run, based on the largest land area in each category. For example, where a range of property size was 4-10 ha, water use requirements were calculated for all properties using the amount sufficient for 10 ha.

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;

[5] Clark and Roygard, 2008

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).

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	500
Number of properties Mangatainoka	1,492	107	227	80	73	68	233

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	500	4,316
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	15	
Total allocation per class (m^3/day)	270	44	347	350	990	1,230	7,500	10,731
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	233	2,280
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	15	
Total allocation per class (m^3/day)	149	21	182	160	438	680	3,495	5,125
Core allocation limit (m^3/day)								26,352
Percentage of recommended core allocation limit required for Permitted Activity								20

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	500	4,316
Allocation per property (m^3/day)	0.2	0.4	1.6	4	12	20	30	
Total allocation per class (m^3/day)	540	88	694	700	1,980	2,460	15,000	21,462

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	233	2,280
Allocation per property (m^3/day)	0.2	0.4	1.6	4	12	20	30	
Total allocation per class (m^3/day)	298	43	363	320	876	1,360	6,990	10,250
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							
								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	2698	221	434	175	165	123	500	4,316
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	15	
Total allocation per class (m^3/day)	270	44	347	350	990	1,230	7,500	10,729
Total additional domestic allowance (m^3/day)	4,047	332	651	263	248	185	750	6,476
Total allocation per class inc. domestic (m^3/day)	4,317	376	998	613	1,238	1,415	8,250	17,205
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							
								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	233	2,280
Allocation per property (m^3/day)	0.1	0.2	0.8	2	6	10	15	
Total allocation per class (m^3/day)	149	21	182	160	438	680	3,495	5,123
Total additional domestic allowance (m^3/day)	2,238	161	341	120	110	102	350	3,422
Total allocation per class inc. domestic (m^3/day)	2,387	182	522	280	548	782	3,845	8,545
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 and 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)).

The resultant daily water requirements are set out in Tables 15 and 16 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 (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	794	4,387
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	909	3,970	8,777
Core allocation limit (m^3/day)						83808

Percentage of recommended core allocation limit required for Permitted Activity						11
STOCK DRINKING WATER						Scenario 15
Area (ha)		12,812	9,802	1,326	142,078	166,018
Stock drinking water requirement (m^3/day)	n/a	2,744	4,199	82	8,738	15,763
Total water requirement (m^3/day)	135	5,188	5,519	991	12,708	24,540
Core allocation limit (m^3/day)						83808
Percentage of recommended core allocation limit required for Permitted Activity						29

Table 16. Volume allocated in the Mangatainoka catchment under Fonterra submission (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	140	40	1,803	336	2,320
Allocation per property (m^3/day)	15	1m^3/5 ha	30	1.5	5	
Total allocation per class (m^3/day	15	1,465	1,200	2,705	1,680	7,064
Core allocation limit (m^3/day)						26,352
Percentage of recommended core allocation limit required for Permitted Activity						27
STOCK DRINKING WATER						Scenario 15
Area (ha)		7,327	9,597	704	89,567	10,7195
Stock drinking water requirement (m^3/day)	n/a	1,570	4,111	43	5,467	11,191
Total water requirement (m^3/day)	15	3,034	5,311	2,747	7,147	18,255
Core allocation limit (m^3/day)						26,352
Percentage of recommended core allocation limit required for Permitted Activity						69

2.6 Summary of results

A summary of the results from the analysis is presented in Table 17. 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 17. 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	64,740	77	34,200	130
Scenario 2	at 30 m^3/day per property	129,480	155	68,400	260
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 the daily volume required for sheep and beef	7,790	9	2,638	10
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	10,731	13	5,125	20
Scenario 12	400 L/ha/day except properties greater than 50 ha which were allocated 30 m^3/day	21,462	26	10,250	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	17,205	21	8,545	32
Scenario 14	as per Fonterra's submission to the POP – excluding stock drinking water	8,777	11	7,064	27
Scenario 15	as per Fonterra's submission to the POP – including stock drinking water	24,540	29	18,255	69

3. 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.

4. 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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5. 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.

6. 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