

## CSG Theoretical catchment – Allocation Options

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### Nitrogen

**Table 1: Catchment Parameters**

	Proportion of Catchment	Area (ha)
Native forest	22%	2,200
Pine forest	25%	2,500
Dairy	24%	2,400
Sheep and Beef	24%	2,400
Fruit	2%	200
Extensive cropping	0.5%	50
Intensive cropping	2%	200
Market gardening	0.5%	50

Manageable ha = 5,300 (Ag + Hort)

Current load from manageable sources = 195 tonnes (ag + hort + point source)

Reduction required = 40 tonnes (= 20.5% of manageable load)

Assume that the reduction required from each source is directly proportional to their contribution to the loading.

**Table 2: Loadings and Discharges**

	Proportion of Total Load	Load (kg)	Share of load reduction (kg)	Reduced Load (kg)	Average discharge (kg/ha)*	Reduction Required (kg/ha)	New Average discharge (kg/ha)
Point source	7%	15,000	3,043	11,957			
Dairy	60%	130,000	26,087	103,913	54.2	10.9	43.3
Sheep & Beef	18%	36,000	7,826	28,174	15.0	3.3	11.7
Fruit	0.7%	1,600	304	1,296	8.0	1.5	6.5
Extensive crop	0.3%	750	130	620	15.0	2.6	12.4
Intensive crop	4%	8,000	1,739	6,261	40.0	8.7	31.3
Market Garden	2%	4,000	870	3,130	80.0	17.4	62.6
Total	92.0%	195,350	40,000	155,350			

\*Total load divided by hectares in that activity

## Allocation Approaches

### Averaging

This is where the post reduction discharge is averaged across the land uses within the catchment. The effect of this is shown below.

Table 3: Averaging

	Average original discharge (kg/ha)	Averaged discharge post reduction (kg/ha)*	Difference (kg/ha)	Percentage difference
Native forest	3.6	14.3	+10.7	+294%
Pine forest	4.8	14.3	+9.5	+199%
Dairy	54.2	14.3	-39.8	-74%
Drystock	15.0	14.3	-0.7	-4%
Fruit	8.0	14.3	+6.3	+79%
Extensive crop	15.0	14.3	-0.7	-4%
Intensive crop	40.0	14.3	-25.7	-64%
Market garden	80.0	14.3	-65.7	-82%

\*Excludes point source discharge, which would still face a 20% reduction

Under this scenario:

- Native/pine forest, and to a lesser extent Fruit, have windfall gains
- Drystock and Extensive cropping would probably handle their reductions
- Dairy, Intensive cropping, and Market gardening would cease

### Grandparenting

Under this scenario each land use excluding native/pine forestry would be allocated their current level of discharge (albeit possibly modified via a benchmarking process to give (say) an average of the last 5 years). They would then have to reduce discharges by ~20%. The effect of this on an average farm is illustrated in the tables above.

For example, the average dairy farm discharging 54kgN/ha would have to move down to 43kg N/ha over the prescribed time period.

Note that for point source discharges the only option is to grandparent.

### Modified Grandparenting

There are a range of possibilities within this option. Some examples:

1. Grandparent within sector to sector average

The idea here would be to grandparent discharges up to the average within each sector. So for example dairy farms would be grandparented up to the mid-point of 54kgN/ha – those above this level would have to come down to this.

The effect of this is shown below. Note that a key assumption (given that the actual data isn't available) is that half the farms are above the mid-point (which is by definition) and that half the farms = half the area. Plus that there is an even distribution of discharges above the mid-point.

Table 4: Load Reduction under Grandparenting to Sector Average

	Difference between 75 <sup>th</sup> percentile and mid point (kg/ha)	Total kg Reduced
Dairy	23.0	27,600
Drystock	2.5	3,000
Fruit	3.5	350
Extensive crop	3.5	88
Intensive crop	15.0	1,500
Market garden	10.0	<u>250</u>
		32,788

This shows;

- (i) The load reduction is approximately 4.2 Tonnes (assuming that point source meets its obligation) below the required 40T reduction, so a further “tweaking” of the reduction required by the farms would be required, and
- (ii) The only sector meeting its ~20% reduction is dairying (ref Table 2)

## 2. Grandparent to the 75<sup>th</sup> percentile point.

This is the dairy industry approach, whereby the farms above the 75<sup>th</sup> percentile point are reduced to this level, with all farms then needing to make the required reduction to met the loading requirement– in essence this means farms are grandparented to the 75<sup>th</sup> percentile point.

To illustrate (for dairying):

This becomes a bit tricky given the lack of data within the information provided. For dairying, the distribution was 30 – 100kg N/ha, with a mid-point (from the loading) of 54kg N/ha. Which means the distribution is skewed.

Key assumptions therefore are:

- (i) The distribution is even, and
- (ii) The proportion of farms involved = the proportion of land; i.e. 25% of farms = 25% of the land.

So: Farms are grandparented up to the 75<sup>th</sup> percentile point, which = 76kgN/ha. Which means the top quartile of farms are reduced down to this level immediately. This gives a load reduction of 7.2 tonnes.

Given that dairying’s “share” of the load reduction was 26.1 Tonnes (ref Table 2), it means it still has to find a reduction of 18.9 Tonnes – across all farms.

Which means, for the average farm discharging 54kg N/ha, it would have to reduce by 7.9kg N/ha, or 14.5%, compared to the 20% reduction required under full grandparenting.

Under this approach, the highest discharging farms take the hardest hit, thereby reducing the impact on the rest.

### Land Use Capability

This approach has been used by Horizons’ and Hawke’s Bay RC. There is not enough information provided to apply this to the theoretical catchment (as to areas by land use by LUC), but an illustration, using the Horizons’ allocation is as follows.

Table 5: Horizon’s N Allocation

Period (from the year that the rule has legal effect <sup>2</sup> )	LUC <sup>*</sup> I	LUC <sup>*</sup> II	LUC <sup>*</sup> III	LUC <sup>*</sup> IV	LUC <sup>*</sup> V	LUC <sup>*</sup> VI	LUC <sup>*</sup> VII	LUC <sup>*</sup> VIII
Year 1	30	27	24	18	16	15	8	2
Year 5	27	25	21	16	13	10	6	2
Year 10	26	22	19	14	13	10	6	2
Year 20	25	21	18	13	12	10	6	2

Table 6: Impact of LUC on Theoretical Catchment

	Average discharge (kg/ha)	LUC 1 Allocation (kg/ha)	Difference (kg/ha)	Percentage Difference	LUC 4 Allocation (kg/ha)	Difference (kg/ha)	Percentage Difference
Pine Forestry	4.8	30	25	525%	18	13.2	275%
Dairy	54	30	-24	-45%	18	-36	-67%
Drystock	15	30	15	100%	18	3	20%
Fruit	8	30	22	275%	18	n/a	
Extensive crop	15	30	15	100%	18	3	20%
Intensive crop	40	30	-10	-25%	18	n/a	
Market garden	80	30	-50	-63%	18	n/a	

The implication of this approach is that some sectors have windfall gains, offset by some sectors having windfall losses. The land uses largely restricted to LUC 1 (& 2) land, Intensive cropping and market gardening, would largely cease.