Information on Water Allocation in New Zealand

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SUMMARY

Water allocation is identified as a high priority in the Ministry for the Environment's Draft National Agenda for Sustainable Water Management. The purpose of this project was to develop an information base concerning the status of water allocation in each region, and the systems that are being used to allocate water. The information base will contribute essential information to ongoing work in water allocation.

There are two parts to the report. First, a quantitative analysis based on consent database information to assess where water is allocated from and the uses it is allocated to. Secondly, an overview of current water allocation practice within New Zealand based on interviews with regional council staff and review of documents including draft, proposed or operative regional water plans.

The quantitative analysis has shown that:

- 70.5% of all water allocated in New Zealand is allocated from surface water, 29.5% is allocated from groundwater.
- 77% of water allocated is for irrigation, 16% is for community, municipal and domestic uses, and 7% is for industrial takes.
- 58% of water allocated in New Zealand is allocated from the Canterbury region. The North Island accounts for 17% of water allocated.
- 19% of the current weekly allocation has been allocated since 1990. The majority of water in New Zealand was therefore initially allocated under legislation predating the RMA.
- There is approximately 500,000 hectares of irrigated land in New Zealand, 350,000 hectares of which is in Canterbury.
- 41% of the irrigated land area is irrigated from groundwater.
- The area of irrigated land is increasing at around 55% each decade.
- The "at farm gate" value of irrigation water is estimated to be around $800 million.

The figures above are all based on weekly allocations and will typically relate to the maximum volumes required during a dry summer week. Water taken for hydro-electricity generation or any other non-consumptive use has been excluded from the analysis. The figures are for allocated volumes rather than use. Because irrigation is the dominant use of water, actual use is greatest in dry summers. When measurements of actual water use have been compared to allocated amounts on a weekly basis, the total take from a water resource is seldom more than 40% of the allocated volume. Annual use varies between 20% and 65% of the allocated volume depending on climatic conditions.

The second part of the report summarises the management of water quantity and water allocation by region. Issues addressed are, setting minimum river flows or groundwater levels, determining limits to the total amount of water that can be allocated from a resource, dealing with over-allocated resources, managing abstractions during water-short periods, promoting efficient use, consent administration, and enforcement/compliance issues. The approach chosen by each council depends on a wide variety of factors including: the dynamics of a water resource and the ecosystem it supports, the associated values, the history of water allocation, the level of information available, and the political environment. While it is not appropriate, given differences in these factors, to identify a "right" way to allocate water, the report describes a range of issues, obstacles and research needs for the implementation of successful water allocation systems.

ACKNOWLEGDEMENTS

The preparation of this report has involved input from a large number of people. We would particularly like to acknowledge Maurice Duncan from NIWA who provided the flow statistics from the National Hydrometric Database and Murray Doak from MAF Policy, Christchurch, who co-ordinated the MAF input.

We would like to thank all the regional and district council staff who have provided information, participated in interviews and reviewed the document. The majority of this report is a summary of the work by regional councils in the water allocation area.

We also thank the MAF regional offices for their input into assessing the "at-farm gate value" of irrigation water.

1 INTRODUCTION

Water allocation is identified as a high priority in the Ministry for the Environment's National Agenda for Sustainable Water Management. MfE in partnership with the Ministry of Agriculture and Forestry (MAF) and involving councils, wishes to start a work programme on water allocation. This project is the first step in that process. Its purpose was to develop an information base concerning the status of water allocation in each region, and the systems that are being used to allocate water.

The information base contributes essential information to ongoing work in water allocation. Its uses include:

- Identification of obstacles and information gaps
- Clarification of focus for research
- Identification of needs for and development of water allocation tools
- Assessment of the costs and benefits of different allocation options.

1.1 Project Scope

The scope of this project was to obtain information at a level of detail that will enable regional and national views to be developed of:

- Water use
- Water sources, and how well they are understood
- Current water allocation methods.

The regions studied were Northland, Auckland, Waikato, Environment Bay of Plenty, Gisborne, Hawke's Bay, Manawatu-Wanganui, Wellington, Marlborough, Tasman, Canterbury and Otago. Taranaki and Southland have been included in less detail.

The degree of analysis undertaken was limited to that required to obtain answers to the following questions:

- How much water is being used?
- How has this changed over the past 10 years?
- Where is the water taken from?
- How well are these water resources understood?
- How are they being managed?
- Are they under stress?
- What water allocation systems are in use?

1.2 Project Outputs

Outputs from the study are:

- A summary report
- An electronic information base of water uses in New Zealand
- Presentation to a one-day workshop held in conjunction with NZ Hydrological Society Conference in November to present and receive feedback on the draft summary report.

List of abbreviations used for councils:

NRC – Northland Regional Council
ARC – Auckland Regional Council
EW – Environment Waikato
EBOP – Environment Bay of Plenty
GDC – Gisborne District Council
HMW – Horizons.mw (Manawatu-Wanganui Regional Council)
HBRC – Hawke's Bay Regional Council
TRC – Taranaki Regional Council
WRC – Wellington Regional Council
TDC – Tasman District Council
MDC – Marlborough District Council
CRC – Canterbury Regional Council
ORC – Otago Regional Council
SRC – Southland Regional Council

2 METHODOLOGY

The information contained in this report was obtained from:

- Review of existing documents
- Analysis of regional council/unitary authority databases
- Hydrological analysis of streams/rivers
- Interviews with regional council/ unitary authority staff
- Input from MAF regional offices on irrigated area, and the value of irrigation water.

2.1 Review of Existing Documentation

The following documents were reviewed:

- Regional Council documents
  - Water resource reports
  - Regional Policy statements
  - State of Environment reports
  - Draft, proposed and operative regional plans
  - Issues and Options documents

- MAF documents and data
  - MAF Irrigated Area Surveys (1965 and 1985)
  - 1997 postal survey to irrigators (Lincoln Environmental, 1997)
  - Information on community irrigation schemes

- Other research reports on aspects of water allocation

Section 16 contains a bibliography.

2.2 Analysis of Consent Databases

Consent database records for all existing consents to take were requested and provided by all regional councils or unitary authorities except West Coast Regional Council and Nelson City Council. Table 1 lists the standard set of field names used to standardise the consent information. With the exception of irrigated area, these fields were available, or have been calculated, for all consents to take water. The consents analysed were those for consumptive uses, and consents related to take and discharge such as cooling water or hydro-electric power were excluded.

Within the scope of this project detailed checking of the volumes and categories assigned to each consent was not possible. In cases where a figure was not given for (say) irrigated area, the average value for all other consents of the same TypeID and UseID was used. The analysis was carried out without the benefit of local knowledge. However, the resource summaries contained in the Appendices, which summarise the information by council, were sent to councils for comment.

Table 1: Consent database fields

Fieldname	Example	Explanation
ConsentID	HB950010	Unique identifier for each consent
RegionID	HBRC	Council identifier
TypeID	surface	Broad division of water sources: • *surface* for direct abstractions from surface water • *ground* for groundwater abstraction • *storage* for abstraction from lakes, on stream and off stream storage dams and from damming of surface runoff.
CategoryID	irr	Broad use categories: • *irr* for irrigation • *dri* for drinking, stockwater or municipal • *ind* for industrial use (only includes industries with individual takes, and not those supplied by municipal takes)
UseID	arable	More specific use categories: <u>Irrigation uses</u> • *arable* • *pasture* • *horiculture* • *viticulture* <u>Drinking water uses</u> • *stock* for stockwater • *dom* for domestic water supply • *pws* for public water supply • *mun* for municipal supply <u>Industrial water uses</u> • *ind1* for industries related to agriculture or horticulture – e.g. meatworks, coolstores, • *ind2* for quarrying • *ind3* for other primary industries – e.g. aquaculture, sawmills • *ind4* for service industries • *ind5* for plastics, fellmongery • *ind6* for general or miscellaneous • *ind7* for waste related e.g. landfill, composting • *ind 8* for mining
Description		Sentence describing use (direct from council databases)
SourceID	Tukituki River	Source identifier
Inst_rate	10	Instantaneous take rate in litres per second – either from consents database or calculated from other volumetric information
Daily_rate	700	Daily take rate in cubic metres - either from consents database or calculated from other volumetric information
Weekly_rate	3000	Weekly take in cubic metres - either from consents database or calculated from other volumetric information
Yearly_rate	90,000	Seasonal take in cubic metres – either from consents database or calculated as multiple of weekly take (52 for domestic, 50 for industrial and 30 for irrigation)
Irri_Area	8	Irrigated area in hectares – either from consent database or backcalculated from irrigation allocation – Note: not available for all councils

2.3 Hydrological Analysis of Surface Water Resources

A list of surface water resources from which abstraction occurs was sent to the National Institute of Water and Atmospheric Research (NIWA) for statistical analysis of flow data. All analyses were carried out at main catchment scale as defined by the first three numbers in the river numbering system, ie catchments which flow to the sea (Soil Conservation and Rivers Control Council, 1956).

The source of most of the hydrological data was the National Hydrometric Database administered by NIWA. The contributors to the database are mainly Regional and District Councils and NIWA. Contributions are voluntary and because of this recent data may be missing. Each Regional and District Council was emailed to request permission to use their data for this survey. Some Councils responded by supplying updated or more recently processed data.

The data is archived and was accessed and analysed using software called TIDEDA. The TIDEDA process PDIST was used to calculate mean, median and percentile flows and the process EVAN (EVent ANalyisis) was used to determine 7-day mean annual, and 7-day average 0.2 annual exceedence probability (5-year return period) values. Alternative distributions to the Gumbel distribution were used if the fit was poor or the L-moments indicated a different distribution be used. In a few cases where the fit was poor, values were chosen by eye from plots of the data. As most of the data on the archive has been subject to quality assurance procedures no further quality checks were made. The data was used as filed and no allowances were made for abstractions. The repercussions of this is that for some streams, especially small ones in water short areas, that values calculated may under estimate the natural low flow of the stream. It was well beyond the scope of this project to calculate natural flows for the streams and rivers.

2.4 Interviews with Council Staff

Interviews with staff from Northland, Auckland, Waikato, Environment Bay of Plenty, Gisborne, Hawke's Bay, Manawatu-Wanganui, Wellington, Marlborough, Tasman, Canterbury and Otago were carried out between August and October. The interview schedule is contained in the Appendices. The interview schedule was sent to councils at least a week before the interviews.

Following the interviews, an overview of water allocation in each region was written and sent to councils for review. Appendices to this report contain the overviews as edited and approved by council staff.

Sections 5 to 15 contain a summary of existing water allocation management based on the interviews and review of planning documents. Readers requiring more detailed explanation are referred to the water allocation overviews contained in the appendices.

2.5 MAF Input

MAF input was co-ordinated through the Canterbury MAF regional office. MAF regional offices were sent the irrigated area and irrigation land-use figures obtained from the analysis of consent databases. They were also provided with current Agribase information on land use by area and farm type for all districts within each region. They were asked to review the irrigated areas in each land use type.

A method for estimating the "at-farm-fate" value of irrigation water was developed in consultation with MAF. MAF regional offices provided all the assumptions used to determine the value of irrigation water (Section 3.6).

3 ANALYSIS OF CONSENT DATABASES

3.1 Where is the Water Allocated from?

Table 2 shows the amount of water allocated from each region and the percentage from surface and groundwater. Where consent databases differentiate takes from storage, a separate value for storage takes is given. However, a clear delineation between direct surface water takes and takes from storage is not always possible. For example, direct takes from the Waikato River or the Waitaki canal systems could also be considered takes from storage given the influence of storage dams on these rivers. The volumes are all calculated from weekly allocations as given in the consent databases or calculated from other rates/volumes (refer Table 1), converted into an instantaneous flow.

Table 2: Water allocated by region in groundwater, direct surface water and takes from storage

Council	Weekly allocation (*coldwater)*				Weekly Allocation Geothermal water (m^3/s)
	Total weekly allocation (m^3/s)	% allocated from groundwater	% allocated in direct takes from surface water	% allocated from storage[1]	
Northland	7.9	4%	66%	30%	
Auckland	8.1	34%	12%	54%	0.03
Waikato	10.3	39%	61%		1.2
Bay of Plenty	8.9	29%	71%		0.2
Gisborne	1.4	31%	69%		
Hawke's Bay	16.8	67%	33%		
Taranaki	3.4	4%	96%		
Manawatu-Wanganui	5.2	56%	44%		
Wellington	9.8	47%	53%		
Tasman	6.7	62%	30%	8%	
Marlborough	8.2	71%	29%		
Canterbury	249.8	33%	67%		
Otago	90.1	6%	85%	9%	
Southland	2.4	24%	76%		
TOTAL NZ	**428.9**	**29.5%**	**67%**	**3.5%**	**1.4**

Note:

1. Takes from storage include takes from lakes, and takes from dams which trap surface runoff, are across small unnamed streams or fill from rivers during high flows.

The most common way of recording the amount allocated to each consent is daily volumes. Weekly and monthly allocations are also common, as is maximum rate of take (instantaneous). Maximum instantaneous takes by region range from five times to

equal to the weekly allocation converted to an instantaneous flow. Weekly allocations have been used in Table 2 as a reasonable compromise, and will typically relate to the maximum volumes used during a dry summer week.

ARC is the only council routinely setting annual allocations. Based on the ARC consent database information, the annual allocation for irrigation is 11 times the weekly allocation, for industrial takes it is 37 times the weekly allocation, and for public water is 49 times the weekly amount.

3.2 What Uses is the Water Allocated to?

Table 3 gives the percentage of direct takes by region allocated to irrigation, industrial use and public water supply. Public water supply covers municipal, stockwater, domestic, community and rural water supplies. Industrial takes only include those industries that take directly from a source: industries supplied by municipal or community takes are included in public water supply. All analysis is based on the weekly allocations.

Table 3: Uses of allocated water by region

Council	Water allocated (m^3/s)	% of allocation for irrigation	% of allocation for industrial use	% of allocation for public water supply
Northland	7.9	46%	13%	41%
Auckland	8.1	26%	9%	65%
Waikato	10.3	32%	42%	26%
Bay of Plenty	8.9	40%	19%	41%
Gisborne	1.4	86%	<1%	14%
Hawke's Bay	16.8	68%	11%	21%
Taranaki	3.4	13%	41%	46%
Manawatu-Wanganui	5.2	39%	20%	41%
Wellington	9.8	40%	4%	56%
Tasman	6.7	87%	6%	7%
Marlborough	8.2	79%	12%	9%
Canterbury	249.8	84%	3%	13%
Otago	90.0	85%	10%	5%
Southland	2.4	21%	34%	45%
TOTAL NZ	**428.9**	**77%**	**7%**	**16%**

Of the surface water allocated in direct takes,

14% is for public water supply, 6% for industrial use and 80% for irrigation

Of the groundwater allocated,

17% is for public water supply, 9% for industrial user and 74% for irrigation

Of the water allocated from storage,

39% is for public water supply, 8% for industrial use and 53% for irrigation

3.3 Measured Water Use

Information on water use, as opposed to allocation, has been reported in the individual council resource summaries. Figure 1 illustrates how actual use can vary considerably from year to year. MDC calculate groundwater allocations in m^3/week so the values in Figure 1 cannot be compared directly to allocated volumes. However, MDC consider that the amount taken in 1997/98 (a very dry summer) was close to a sustainable limit given that some users were experiencing reduced well yields, and a voluntary reduction in takes was in place. Figure 2 is an example of how abstraction can vary throughout the year, and shows the weekly use for four management zones within the Tasman region (the 1997/98 summer was extremely dry). TDC require meters in zones considered close to or at full allocation.

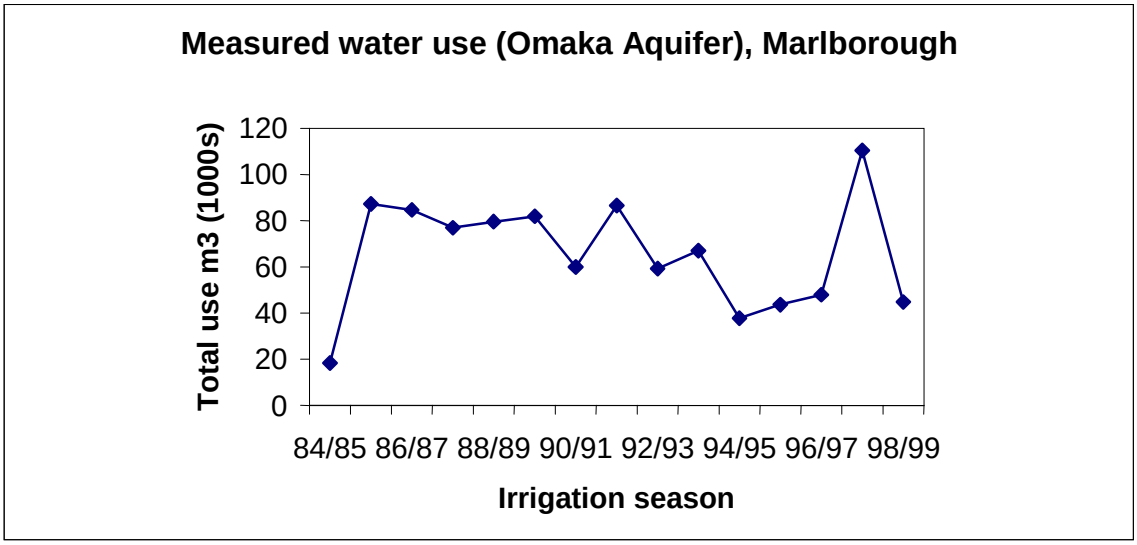

Figure 1: Example of variation in water use from year to year (Source: MDC)

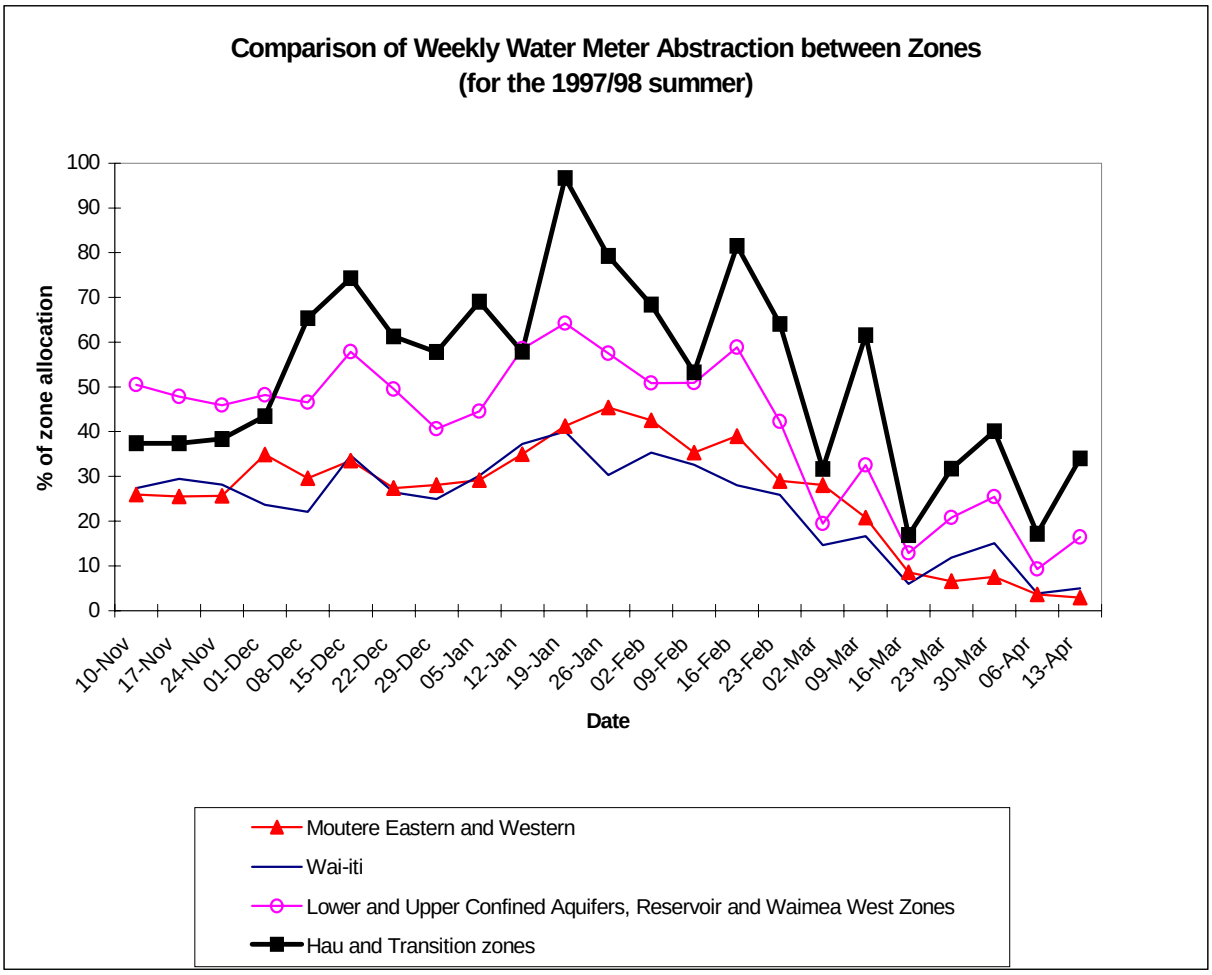

Figure 2: Example of weekly use as a percentage of allocation (Source: TDC)

The difference between water use and water allocated is attributable to a range of factors including:

- Allocations are generally for peak or near-peak demand (e.g. irrigation allocation based on a dry year, entire area irrigated/planted and crops which use most water).
- Different uses require peak volumes at different times
- Allocated volume will not be required every year (e.g. some land not irrigated, industrial plant shut-down for a period)
- Reservation of water for future development or urban use
- Variation in climate
- Variation in markets
- Allocated amounts are in excess of what can be abstracted and/or used.

3.4 Trends in Allocated Volumes

An assessment of the volume of water allocated since 1990 was made using commencement dates given in council databases. Other information was taken into account such as the start dates for irrigation schemes in Canterbury. Councils in which all consents were dated after 31 December 1989, and "replacement consent" flags were unavailable, were not included in the analysis. These councils are NRC, TRC, HMW, MDC and SRC.

Results indicate that 19% of the current weekly allocation has been allocated since 1990. The majority of water in New Zealand was therefore allocated under legislation predating the RMA. Although groundwater represents 29.5% of water currently allocated in New Zealand, half of the water allocated since 1990 has been allocated from groundwater. The percentage of water allocated to irrigation since 1990 is similar to the percentage allocated prior to 1990. Since 1990, more water has been allocated to industrial uses than to public/community uses. Eight percent of the allocation since 1990 is to public/community water, and 14% is to industrial users.

Section 5.3 briefly outlines how rights and authorities to take water granted prior to the RMA are managed under Transitional Provisions of the RMA.

3.5 Trends in Irrigated Area

Figures 3 to 6 and Table 4 illustrate trends in irrigated area nationally, by region and by land-use type. Table 4 also contains a calculation of the irrigation allocation expressed as millimetres per hectare per week. The following sources were used:

- ***MAF Agricultural Statistics.*** Up to 1985, annual agricultural surveys included a question on irrigated area every four years. The results for 1965 and 1985 have been used in the following figures.

- ***1997 survey of New Zealand's irrigators undertaken by MAF*** (Lincoln Environmental, 1997). A postal survey on irrigation management was sent to farmers who held water take consents or who were supplied by an irrigation company. The regions covered were Auckland, Gisborne, Marlborough, Tasman, Canterbury and Otago. 19% of surveys were returned and the results extrapolated to provide irrigated areas by region. Irrigated area in regions not included in the survey was based on agricultural statistics. For farms supplied by irrigation companies, the estimates of irrigated area were compared to MAF data on irrigation schemes. It was noted that the actual average irrigated area in the schemes was 45% to 65% of that determined from the survey, indicating that survey responses were biased towards larger properties, and therefore results probably over-estimate irrigated area.

- ***Consented Irrigated area from consent databases*** (1999). Where irrigated area was not available, an irrigated area was calculated based on standard allocations per hectare used by the council. The result was compared to the 1997 survey results and a reasonable assessment of irrigated area made. The area of unspecified land use has been apportioned over the known values. This approach appears to over-estimate irrigated area. A survey by HBRC in 1994/95 indicated that on average 64% of the consented area was irrigated.

- ***Estimates by MAF Regional Offices (***1999***).*** MAF regional offices were sent the consented irrigated area and the breakdown by land-use which appear in the resource summaries in the Appendix. This information was supplemented with Agribase data on agricultural land use which does not differentiate between irrigated and non-irrigated land. Staff were asked to provide their "best estimate" of irrigated land area and land-uses.

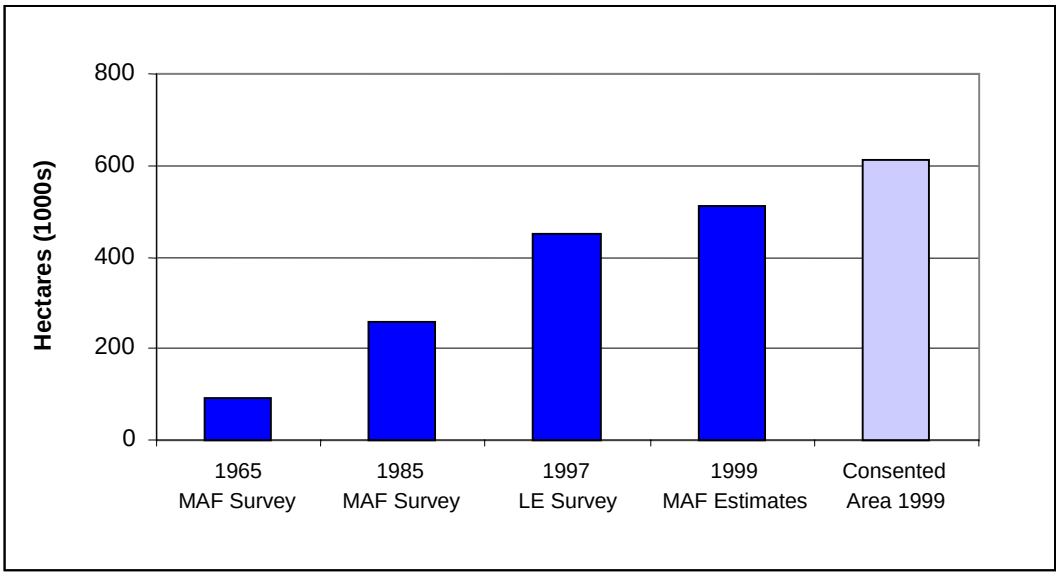

Figure 3: Irrigated area in New Zealand

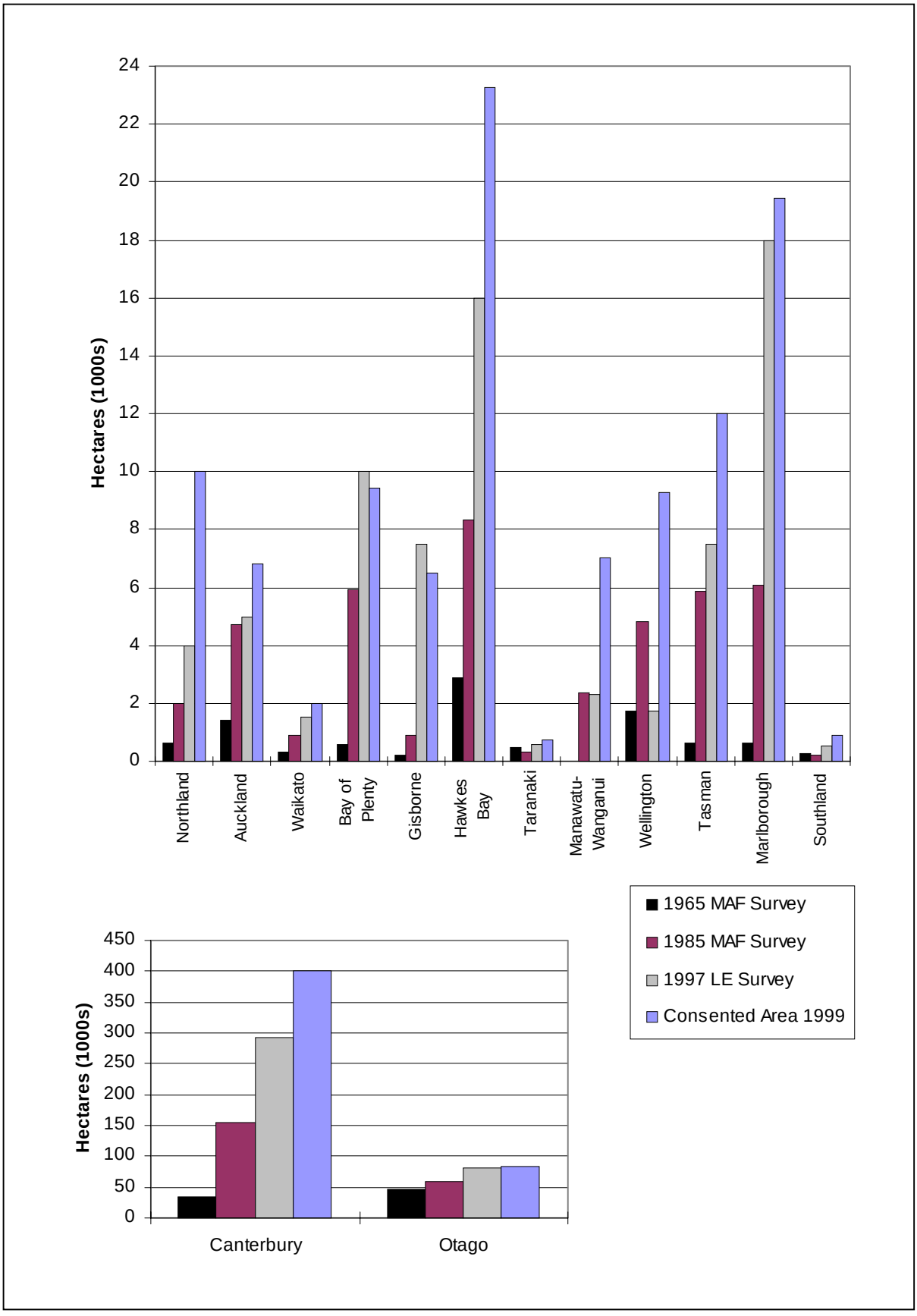

Figure 4: Trends in irrigated area by region

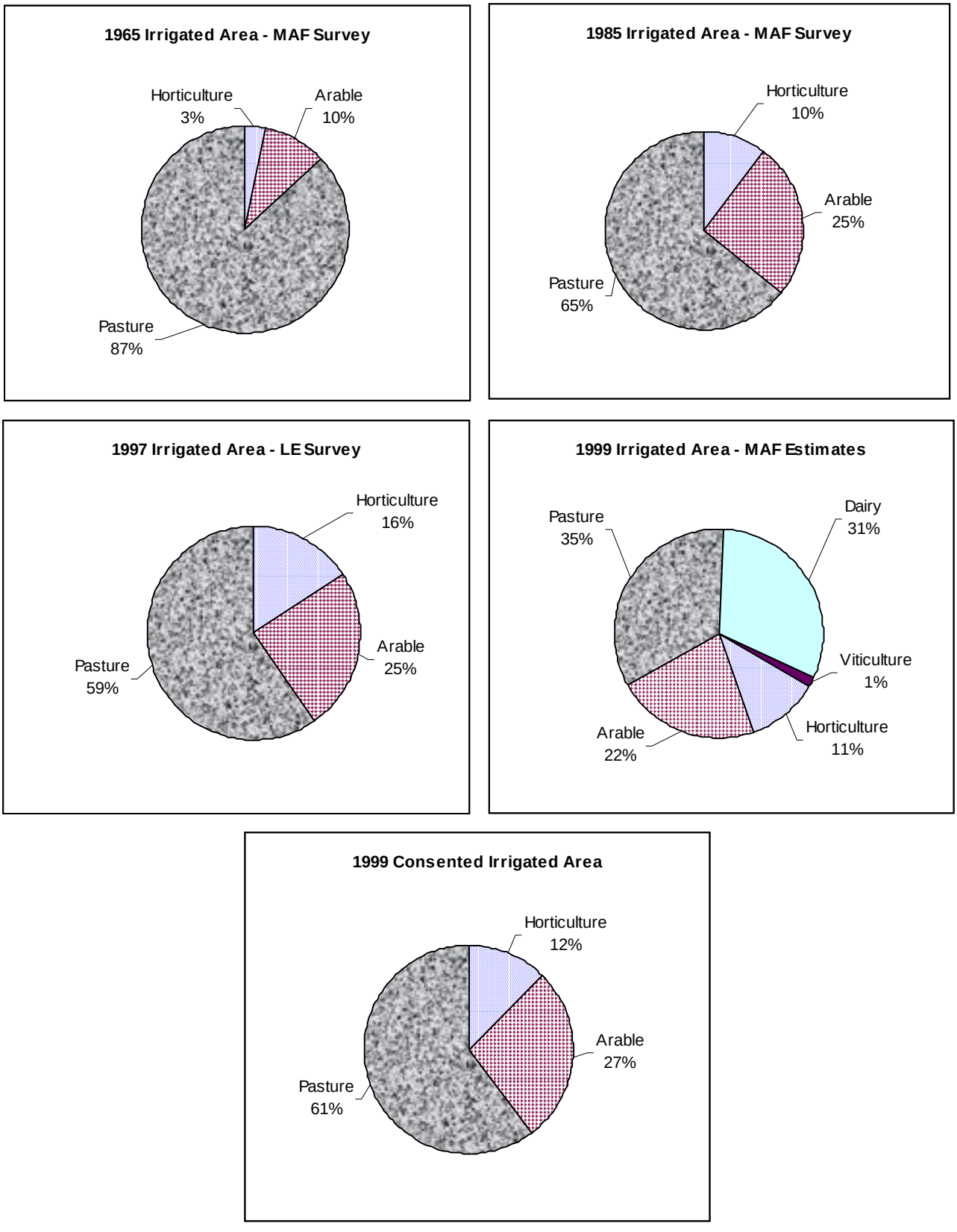

Figure 5: Trends in irrigated area by land use type

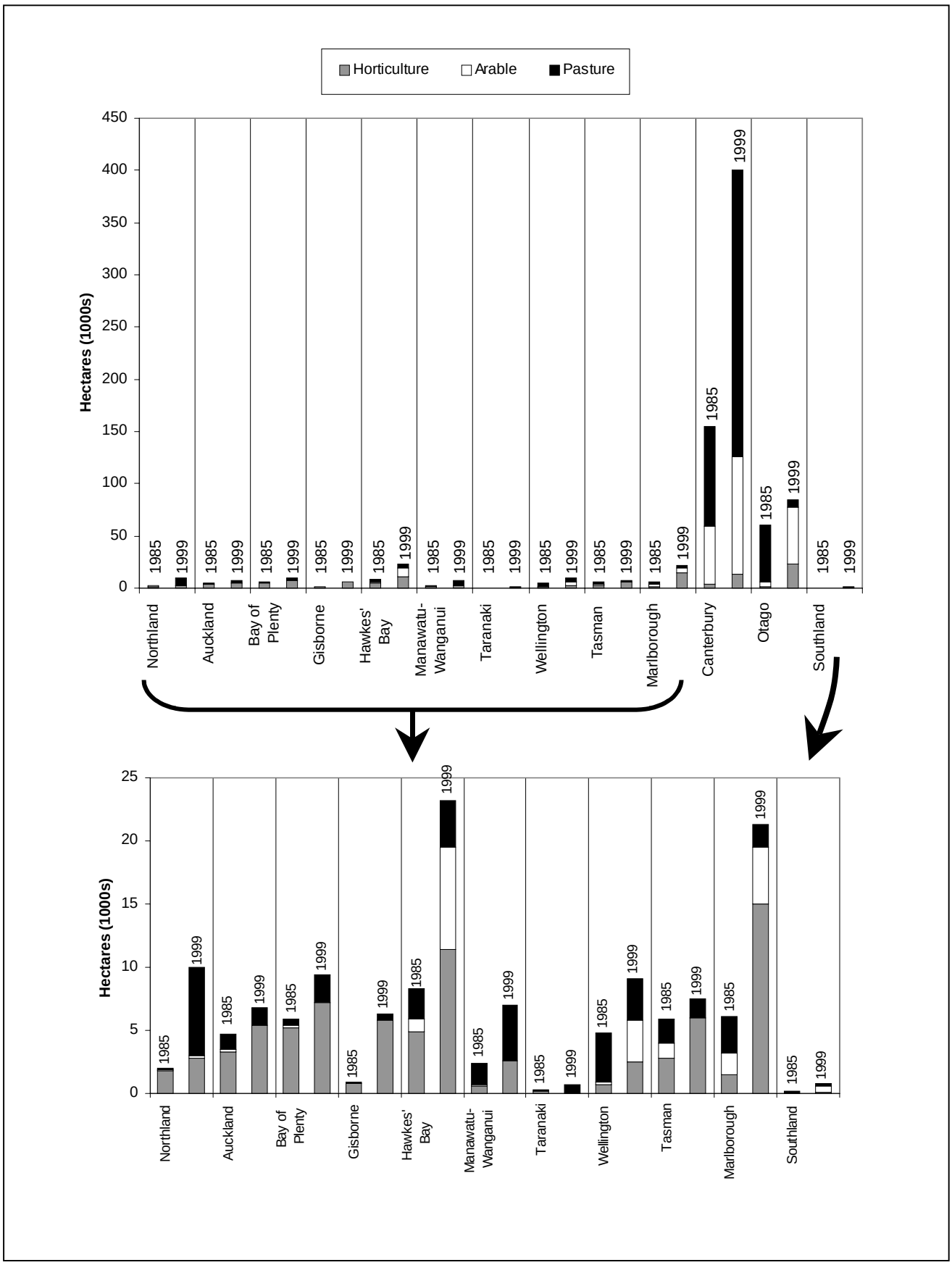

Figure 6: Increase in irrigated area (1985-1999) by region and type

Table 4: Water allocated for irrigation and irrigated area by region and land-use type

Council	Water allocated for irrigation (m^3/s)[1]	Consented irrigated area (ha)	Irrigated area (MAF estimates) (ha)	Allocation[2] (mm/ha/wk)	% of irrigated area in land-use type (MAF estimates)				
					Dairy Pasture	Other pasture	Arable	Horticulture[3]	Viticulture
Northland	3.9	not avail	4,000	55	62%		2%	37%	
Auckland	2.1	6,833	6,500	19	13%			87%	
Waikato	3.3	not avail	4,500	44	14%			84%	2%
Bay of Plenty	3.6	9,435	9,435	23	23%			76%	
Gisborne	1.2	not avail	5,000	15	8%		2%	90%	<1%
Hawke's Bay	11.4	23,242	23,242	30	8%	8%	35%	41%	8%
Taranaki	0.4	not avail	2,000	13	88%		12%		
Manawatu-Wanganui	2.0	not avail	8,000	15	70%	8%	20%	2%	
Wellington	3.9	9,273	9,273	26	60%	10%	10%	14%	6%
Tasman	5.8	11,737	8,000	30	5%	3%	5%	84%	3%
Marlborough	6.5	19,415	12,087	20	7%	2%	29%	33%	29%
Canterbury	209.8	400,091	350,000	32[4]	34%	36%	27%	2%	<1%
Otago	75.8	84,593	66,260	55[4]	24%	67%	2%	6%	1%
Southland	0.5	not avail	1,500	20	70%		20%	10%	
TOTAL in NZ	**331.8**		**509,797**	**34**	**31% (158,229 ha)**	**34% (173,186 ha)**	**22% (112,613 ha)**	**11% (58,389 ha)**	**1% (7379 ha)**

Notes:

1. All based on weekly allocated volumes.
2. Allocation per hectare is worked out using the consented irrigated area where available. Otherwise the MAF estimates are used.
3. Horticulture includes fruit, vegetables, market gardens, glasshouses, and plastichouses.
4. Canterbury and Otago have substantial difference in allocation between surface water and groundwater - surface water allocation is 40 mm/ha/wk (Canterbury), 55 mm/ha/wk (Otago), groundwater is 24 mm/ha/wk (Canterbury), 25 mm/ha/wk (Otago).

3.6 "At-farm gate" Value of Irrigation Water

An accurate assessment of the value of irrigation water would require specific economic modelling and detailed surveys of irrigated farming and horticultural enterprises. However, general information on the economic implications of irrigation at the farm scale is available. Within the scope of this report, a rough estimate of the "at-farm-gate" value of irrigation has been made, based on "with irrigation" and "without irrigation" gross margin figures. The gross margin approach gives an indication of net value added at the farm gate from having irrigation available. As such it takes into account the increased costs associated with irrigation as well as increasing farm output.

One of the key inputs to the analysis is the assumption as to what the land would have been used for in the absence of irrigation. For example, in Canterbury most irrigated dairy land would probably be dryland sheep, although a proportion of heavier land would still be dairying. The production from this dryland dairying would be less than that achieved with irrigation.

MAF regional offices were sent the irrigated area and irrigation land-use figures obtained from the analysis of consent databases. They were also provided with current Agribase information on land use by area and farm type for all districts within each region.

They were asked to:

- Review the irrigated areas in each land use type
- Provide estimates of the average gross margin for each irrigated land use
- Estimate the most likely land use if irrigation water was not available
- Provide gross margin figures for each alternative dryland land-use

Current landuse, gross margins and alternative landuse were all best guess MAF estimates, using existing information and judgement. A summary of results is given in Table 5, Details of assumptions used in the analysis for each region can be found in the Appendix. The results are very sensitive to the assumed alternative land use for horticulture; 55% of the total 'farm-gate" value comes from horticulture. Gross margins for horticulture are very high, and in most cases it has been assumed that the land would not be in horticulture unless there was irrigation water available.

Table 5: Water allocated for irrigation and irrigated area by region and land-use type

Council	Dairy benefit	Pasture benefit	Arable benefit	Hort benefit	Viticulture benefit	Region total ($ millions)
Northland	0.33	0.00	0.06	30.30	0.00	30.69
Auckland	0.21	0.00	0.00	31.26	0.06	31.53
Waikato	0.09	0.00	0.00	26.31	0.61	27.02
Bay of Plenty	0.33	0.00	0.00	12.39	0.00	12.72
Gisborne	0.60	0.00	0.04	10.50	0.01	11.15
Hawkes Bay	2.70	0.46	8.13	73.94	7.44	92.68
Taranaki	0.26	0.00	0.00	0.41	0.00	0.67
Manawatu-Wanganui	1.68	0.16	5.28	0.00	0.00	7.12
Wellington	1.67	0.23	0.60	9.93	2.23	14.66
Tasman	0.08	0.02	0.10	47.73	0.91	48.84
Marlborough	0.32	0.04	1.26	31.78	13.79	47.19
Canterbury	175.62	32.43	54.40	87.13	1.60	351.18
Otago	28.26	14.27	0.38	81.16	5.69	129.75
Southland	0.53	0.00	0.08	1.46	0.00	2.06
TOTAL	**212.67**	**47.62**	**70.33**	**444.31**	**32.33**	**807.26**

As well as increase "at-farm-gate" value, the increased expenditure and output associated with irrigation will increase off-farm economic activity. The multiplier effect of irrigation through the economy may or may not be higher than the muliplier for all agriculture and horticulture production. To calculate specific multipliers for irrigation, models of irrigated versus non-irrigated systems would need to be created for each sector. Standard multipliers apply to gross production rather than gross margin figures. In addition, the standard gross margins used in the analysis differ in their treatment of intermediate inputs such as labour, fertiliser, repairs and maintenance, so it is not straightforward to convert the gross margins to gross production. To provide adequate mulitiplers for irrigation is a major undertaking that would require survey work.

To put the $807 million "at-farm-gate" in context, New Zealand's agriculture/ horticulture production (less intermediate inputs) contributes $5.2 billion (1998) to Gross Domestic Product (GDP). The total contribution of agriculture and horticulture to total GDP is $14.8 billion, 15% of total GDP ($98 billion). While it is not correct to approximate a multiplier for agriculture/horticulture by using the ratio of farmgate ($5.2 billion) to total ($14.8 billion), nor to apply that multiplier to the 'at-farm-gate" value of irrigation, the two figures provide some relativity for the $807 million figure.

4 WATER RESOURCES AND LEVEL OF ALLOCATION

Surface and groundwater resources that represent a significant proportion (>1%) of a region's abstraction are listed in resource summaries in the Appendix. The information gives a picture of the aquifers and catchments where water is allocated from within a region, and their relative importance as a water source. It allows groundwater allocation to be compared to surface water allocation and indicates whether a council has a large number of resources contributing water or a single major source. For example, HBRC and MDC both have a single large aquifer system that supplies over half of the total regional allocation.

Reporting of these water allocations gives a measure of water demand, but it is not correct to use the allocated volume as a measure of "pressure" on a resource. Account must also be taken of water availability. A more standardised measure of the level of allocation can be provided by expressing the amount allocated as a percentage of the water available in a resource. While this percentage provides some relative measure of allocation, it still does not by itself measure "pressure" on a resource. Whether a resource is under pressure depends on the values associated with the resource and the potential effects abstraction could have on those values. This aspect will differ from resource to resource and cannot be answered by a comparison of flow statistics and allocated volumes.

For the purposes of this report, the assessment of allocation relative to availability has been calculated for significant resources where there is sufficient data. Mean annual flow and average annual recharge are reported in the resource summaries. The measures of allocation relative to water availability are referred to as "level of allocation" and, as noted above, it is incorrect to assume that resources with a high level of allocation are "under pressure" or have "unsustainable" allocations.

4.1 Surface Water

The availability of surface water is calculated using flow statistics from the NIWA archives (refer Section 2.3). Using only main catchments, 95% of surface water allocated (based on weekly allocated volume) is allocated from catchments with flow records. The remaining 5% has not been included in the following analysis.

This section aims to provide a relative measure of the level of allocation from surface water resources, based on data from gauged catchments and weekly allocated volumes. The analysis was carried out at the main catchment level (refer Section 2.3), and covers two issues:

Do a region's surface water resources have the capacity on average to supply the total allocated volume? – a resource size issue

How reliably do a region's surface water resources meet the allocated flow? – an estimate of shorter term availability

To address issue 1, the sum of the mean annual flows of those catchments which have abstraction was used as a measure of annual surface water capacity. It is of limited value as an indicator of shorter term ability to meet demand.

The second issue is addressed by comparing flow exceedance statistics with the sum of the minimum flow and the allocated volume expressed as a flow rate. This provides a measure of the proportion of time the currently allocated volume is available. Where minimum flows were not set, the five-year 7-day low flow was used in its place.

Table 6 gives the results by region. The values in Table 6 are not catchment- specific and are intended to provide a relative measure of the pressure on resources by region. The first column of Table 6 relates to the capacity of water resources to meet allocated volume on an annual basis. The next three columns provide a measure of how frequently the allocated volume is available. The percentages in the last three columns are calculated using only those resources with sufficient information on the NIWA archives to assign flow exceedance values. For example, of the surface water allocated from Northland rivers with sufficient flow data, 72% of the allocated amount is available more than 95% of the time.

Auckland, followed by Canterbury, has the highest level of allocation per unit of water available. Northland, Tasman, Canterbury and Otago have some surface water resources where the allocated volume is available less than 75% of the time. As with most of the information in Section 3, figures are based on allocated amounts not on actual use. The analysis does compare the seasonal variation in demand and river flows. For example, some of Canterbury's snow fed rivers are at their lowest flows in the winter whereas the greater demand is in spring/summer. In addition, using only main catchments in the analysis masks what happens at a more local scale (e.g. tributary).

Table 6: Level of allocation of surface water by region

Council	% of mean flow allocated	% of time allocated volume available			
		>95% of the time	85-95% of the time	85-75% of the time	<75% of the time
Northland	4%	72%	9%	12%	7%
Auckland	22%	24%	3%	73%	
Waikato	2%	Not calculated			
Bay of Plenty	2%	80%		20%	
Gisborne	2%	92%	8%		
Hawke's Bay	2%	67%	33%		
Taranaki	9%	18%	63%	19%	
Manawatu-Wanganui	1%	100%			
Wellington	4%	94%	6%		
Tasman	3%	74%			26%
Marlborough	3%	100%			
Canterbury	16%	33%	14%	27%	26%
Otago	8%	63%	3%		34%
Southland	1%	100%			

It is not appropriate to conclude that catchments where the allocated volume is available <75% of the time have little protection of instream values or that all abstracters have very low reliability of supply. For example, a catchment may fall into this category because the minimum flow has been set at a high level and therefore the potential of adverse effects on the river ecosystem may be lower than for a similar resource which has a lower minimum flow and an allocated volume that is available more often. Similarly, options for prioritising and managing abstractive users can provide higher reliability of supply. The figures in Table 6 do provide a measure of the level of management required of abstractive users.

4.2 Groundwater

Groundwater level or pressure is monitored in all aquifers where there is significant abstraction pressure, and assessed for any long-term downward trends. Bore logs and pump tests are usually requested with new consent applications. However, unlike surface water, this monitoring information does not directly indicate the amount of water in the resource. Most groundwater resources (*estimated as representing 76% of groundwater allocated*) are being assessed and managed using a "safe yield" concept based on estimated recharge, annual water budgets or throughflow analysis. Others (*estimated as representing* 20% *of groundwater allocated*) are managed with computer simulation models which tie abstraction to environmental effects such as stream/spring flows and salt water intrusion.

Inputs to "safe yield" calculation and model development include:

- Groundwater level/pressure records
- Aquifer hydraulic characteristics
- Aquifer boundaries
- Estimation of river recharge or loss to rivers/springs from gauging
- Estimation of rainfall recharge based on simulated daily soil moisture balance.
- Estimation of rainfall recharge based on a percentage of average annual rainfall
- Simulation of irrigation recharge based on simulated daily soil moisture balance and irrigation management
- Actual water use records
- Allocated volumes from consent information
- Estimates of permitted takes
- Isotope analysis of the relative contribution of river recharge and rainfall recharge

Initially it was considered impossible to provide sufficiently consistent data to calculate groundwater availability and compare it to allocated volumes. The methods and information used to quantify groundwater resources vary considerably. However, a majority of councils calculate average annual recharge (or annual recharge in a dry year) for all or some of their aquifers. Average annual recharge measures the average volume of water entering a groundwater system in a year.

Table 7 relates the average annual recharge by region to groundwater allocation. References for recharge figures are given in the resource summaries in the Appendix.

The weekly allocations have to be factored to give seasonal allocations for comparison with the average annual recharge. ARC are the only council routinely using seasonal allocations. For other councils, the annual allocation has been based on 30 weeks of irrigation, and 52 weeks of industrial and community takes. This approach is likely to overestimate the annual allocation given that the total ARC seasonal irrigation allocation is 11 times the weekly allocation for irrigation, 37 times the weekly allocation for industrial takes, and for public water is 49 times the weekly amount. To address this issue, Table 7 includes a column giving the number of weeks for which the weekly allocation could be taken given the average annual recharge.

Table 7: Level of allocation of groundwater by region

Council	% of groundwater allocation for which ARR is available	Average estimated annual recharge (millions m^3)	Allocated annually from resource with calculated ARR (millions m^3)	% of average annual recharge allocated	Number of weeks for which weekly allocation could be taken
Northland	Uncalculated	>90	6.9	<8%	>482
Auckland	87%	46	30.8	67%	32
EBOP	18%	54	11.7	22%	190
Hawke's Bay	86%	188[1]	220	117%	32
Wellington	94%	390	107	27%	150
Tasman	82%	196	67.8	35%	97
Canterbury	75%	2643	1236.1	47%	71

Note:

1. Based on 1994/95 year rather than an average year.

The methods used to calculate the average annual recharges given in Table 6 vary. River recharge is generally assumed to be a fixed flow, and is estimated from gain/loss gaugings along the river. Rainfall recharge is calculated as a set percentage of annual rainfall or from daily soil moisture models. Other factors included in some recharge calculations are losses from drainage or stockwater races, and irrigation-induced recharge.

Similar to the analysis for surface water, comparing groundwater allocation to average annual recharge estimates is only a first step to assessing the "sustainability" of allocations from groundwater resources. The figures in Table 6 give a broad assessment of the level of water allocation relative to water availability, but do not relate abstraction to potential environmental effects such as salt water intrusion, surface water flows, ground subsidence or to the reliability of supply for abstractive users.

5 PLANS

5.1 Region Wide Plans

All councils have or are in the process of developing a region-wide plan that includes management of water quantity and allocation.

The following plans are operative:

- Wellington – Regional Freshwater Plan 1999
- Hawke's Bay Regional Water Resources Plan 1998. This plan is currently being reviewed and will be superseded by a Regional Resource Management Plan (see below).

The following plans have been released with Council decisions on submissions:

- Proposed Regional Freshwater Plan for Taranaki (no appeals relating to water quantity provisions)
- Marlborough – Proposed Wairau/Awatere Resource Management Plan and Proposed Marlborough Sounds Resource Management Plan, which include district plan provisions (one request for review of water quantity provisions)
- Proposed Regional Water and Soil Plan for Northland (18 appeals on water quantity provisions)

The following plans have been released and submissions received:

- Proposed Waikato Regional Plan
- Otago – Proposed Regional Plan: Water

The following draft plan has been released:

- Draft Hawke's Bay Regional Resource Management Plan (will supersede the Regional Water Resources Plan, 1998)

The following plans are in preparation:

- Auckland – Land, Air and Water Plan
- Environment Bay of Plenty – Land and Water Plan
- A water chapter to add as a variation to the Tasman Resource Management Plan, which includes district plan provisions
- Canterbury – Natural Resources Regional Plan: Part C Water
- Southland – Water Plan

Gisborne District Council is preparing a water strategy as a first phase in preparing a formal plan.

HMW has notified a Proposed Land and Water Regional Plan which specified permitted takes, National Water Conservation Orders and Whanganui River flows. For other water quantity, provision HMW will instead puts its efforts into developing non-

regulatory methods. The preparation of a water allocation policy has been identified as a necessary tool to help guide consents and non-regulatory methods in the future.

5.2 Resource-Specific Plans

Many of the region-wide plans incorporate measures that were originally part of non-statutory catchment plans, draft plans or strategies. It is seen as very important to maintain continuity with these plans given the investigations and consultation that has gone into them. Continuity recognises the communities of interest and caters for specific local issues.

The following resource-specific plans are formal RMA regional plans:

- Oroua Catchment Water Allocation and River Flows Regional Plan (1995), HMW
- Proposed Opihi River Regional Plan (at consent order stage), CRC
- Proposed Waimakariri River Regional Plan (hearings on submissions completed), CRC
- Moutere Water Management Plan (1992), TDC (will be superseded by water chapter of Tasman Resource Management Plan)
- Motueka/Riwaka Plains Water Management Plan (1995), TDC (will be superseded by water chapter of Tasman Resource Management Plan)

NRC and EW intend resource-specific plans to sit under the umbrella of the region-wide plan. Whether these plans become statutory or are incorporated into the region-wide plan is not yet decided. ARC use a similar approach under their Regional Policy Statement, under which ARC will identify catchments and aquifers for priority investigations and prepare non-statutory Water Resource Assessment Reports (WRAR) or catchment management plans. The scope of these reports, the consultation required and a process for dealing with unresolved issues are all set out in the Auckland Regional Policy Statement. Consultation with local communities is a key component of preparing these plans.

GDC intend to develop a strategy prior to preparing a formal plan for water issues. "Strategies" are developed consultatively, provide an opportunity to test the approach on an informal basis, and educates users prior to wording of a formal plan.

5.3 Water Takes that Pre-date the RMA

The transitional provisions under s. 386 of the RMA provide that rights and authorities to take water granted under the Water and Soil Conservation Act 1967 become "water permits" deemed to have been granted under the RMA with the same conditions. These deemed permits are grouped into two categories: "existing rights" and "existing authorities". Permits resulting from existing rights which would have finally expired after 31 October 2026 now expire on that date. Permits resulting from existing authorities, many of which were granted in perpetuity, finally expire on 10 October 2001. Existing authorities are not transferable and s. 319 enforcement orders can only be made on application by the relevant regional council. In the application of regional

plans and rules, consents relating to existing rights and authorities are treated the same way as consents issued under the RMA.

Mining privileges to take water that were issued under the Mining Act 1926 and earlier mining legislation are referred to as "deemed permits" under s. 417 of the RMA. Unlike existing rights and authorities, compensation must be paid for any restriction (change in conditions) of a mining privilege that limits is ability to be exercised. Therefore deemed permits are not subject to regional plan provisions in the same way as other water permits, unless compensation is paid or the holder of the permit requests a change to their consent conditions. Deemed permits finally expire on 1 October 2021. (See Otago Regional Council – Overview of Water Allocation in Appendix for further discussion of mining privileges).

6 ENVIRONMENTAL BOTTOM LINES

6.1 Surface Water

Minimum flows and occasionally water quality triggers, are used to protect environmental bottom lines for surface water. Of the surface water allocated, 94% is from catchments with minimum flows in place.

Minimum flows are set to protect fish habitat, benthic invertebrates, recreation opportunities, natural character, groundwater recharge, and stock/domestic water supplies. Water quality classifications are often used to indicate important values associated with a river/stream. Most councils set minimum flows to protect a range of values. TRC have a policy in the plan that minimum flows will be set to achieve two thirds of trout habitat available at the mean annual low flow. While one instream value may dominate in setting a flow, it will often be used because it is the most limiting rather than the only important value. Other values are protected by providing for the most limiting one.

Minimum flows are set in regional plans, informal plans or strategies, national water conservation orders, or via the resource consent process. Methods include statistical flows, expert panels, and detailed assessment. Nearly all councils recognise that specific assessment using habitat methods, WaiOra, or environmental indicators, in conjunction with a community consultation process, is the best method for setting minimum flows. They also all state that the time and resources required to do this for all surface water bodies is too high and it is infeasible to use in all cases. HMW and HBRC have ongoing programmes to complete IFIM studies on all larger streams/rivers. EBOP and HBRC are looking at regional approaches to applying habitat methods, and many councils highlighted this area as one requiring further work. Most councils coincide renewal or review dates within a catchment, and intend to review minimum flows when catchments come up for renewal or review. Most recently issued consents contain a condition that abstraction will comply with any minimum flows set in regional plans.

NRC and ORC have set a default minimum flow (statistical flow), which has been tested for its ability to protect instream values and is considered precautionary. This "default" approach gets minimum flows in place across a region, then allows rivers to be assessed on a case-by-case basis, with priority set for more detailed investigations and consultation according to consent applications, the demand/supply ratio and/or the significance of environmental values. Minimum flows set on a case-by-case basis can be higher or lower than the default value.

For streams/rivers where there is insufficient information to set minimum flows, the WRC Plan contains a policy that they shall be managed by having regard to the significance, scale/magnitude and reversibility of effects on natural, amenity and tangata whenua values. Historical flow methods are recommended as a general guide for minimum flows with habitat methods to be considered if the mean annual low flow is greater than 1 m^3/s. The Council has already begun addressing river flows and water allocation for some of these rivers in ways that are consistent with the approach already used in the Plan. In due course they will also be included in the Plan.

In Otago, water bodies without flow recorders are grouped into minimum flow water management areas. Takes from these areas will be suspended when the flow at a specified surrogate indicator site for the areas concerned fall below their respective minimum flows. HBRC used a similar approach. In an appendix to their plan, NRC provide a method for estimating design minimum flows using flow correlations.

6.2 Groundwater

Environmental bottom lines, (e.g. groundwater levels or pressures at which abstraction must be restricted or cease) are not as widely used in groundwater compared to surface water. The most commonly used are groundwater level, pressure or water quality triggers set in coastal aquifers to prevent salt water intrusion. Groundwater triggers are set for an estimated 14% of groundwater allocated. Adverse effects of groundwater abstraction are more frequently managed on the basis of total take. Groundwater takes can also be self-limiting, with pump yields declining as groundwater level or pressure drops.

In Otago, groundwater abstraction must be reduced by 25%, 50% and cease when groundwater levels or pressures at monitoring wells reach specified values. These triggers were set by examining aquifer extent and properties, groundwater level records, bore logs, existing and potential use and recharge estimates. As for surface water, these limits can be exceeded on a case-by-case basis if detailed investigation indicate no adverse environmental effects.

WRC have trigger levels in the Lower Hutt and Moroa aquifers. In Lower Hutt the level is set to maintain flows in undersea springs and prevent salt water intrusion. In the Moroa aquifer, users are restricted at a set trigger level to ensure water supply to all areas of the aquifer. CRC have set trigger levels in the Christchurch-West Melton aquifer which supplies Christchurch's drinking water and spring-fed streams that flow through the city.

TDC manages the Motueka/Riwaka and Waimea plains in zones. Groundwater and surface takes are considered together and both are subject to minimum flow triggers, groundwater quality or groundwater level/pressure triggers. CRC and ORC use the same approach for managing takes from shallow groundwater. In both the Opihi and Waimakariri plans, groundwater takes with stream depletion rates in excess of 5 ℓ/s are subject to minimum flows. The issue of delineating whether groundwater is hydraulically connected to a surface resource was raised as an issue by CRC, MDC, WRC and HBRC, all of whom have alluvial gravel aquifers.

6.3 Restricting Takes in Water-Short Periods

The simplest approach to implementing minimum flows is to have an upstream recorder and require all abstraction to cease once flows reach the minimum flow. Most councils have a more sophisticated system that attempts to allow successive reductions in take as the minimum flow or aquifer trigger level/pressure is approached. Councils notified users of possible restrictions by phone, mail, website and newspaper advertisements. Websites and 0800 numbers are used to make river flow information available. If possible, users are given warning of impending restrictions.

Takes are restricted by one or a combination of the following:

- Use of a band or permit class system with successively higher river flows at which abstraction must cease
- Stepped cutbacks. For example, a 25% reduction once a specified flow is reached.
- Pro-rata cutbacks. All takes must be reduced by the ratio of water available to allocated volume.
- Informal arrangements with irrigators such as alternative days or sides of rivers
- User groups required to work out amongst themselves the best option for reducing overall take
- Allowing transfers of permits among users

Restrictions that quantify the cutbacks are based on allocated amount rather than actual take. Using the allocated amount is practical from an administrative viewpoint, but means that restrictions often do not apply equally across all users.

EW, EBOP, HBRC and GDC have set flows which trigger more detailed monitoring of river/stream flows. EW specifies a flow at which "no take days" are introduced. Gaugings of the natural river flow are then made while all takes are off.

Implementing pro-rata or stepped cutbacks on a take-by-take basis is difficult and often is impractical for users to achieve. It is also difficult to enforce without frequent measures of actual use, or an upstream and downstream recorder for surface water takes.

In ORC and on the Riwaka River (TDC) formal user committees are used to establish rostering of takes when river levels drop close to minimum flows. A condition on ORC consents states that the holder will comply with directives from a water allocation committee set up by the regional council. These are local water users groups who decide how cut-backs will be implemented. Council contacts the group when river levels are getting low. On the Riwaka River, a pre-determined and very detailed rostering schedule has been established by the 32 users taking into account pump size, crop type and irrigation system. Flow recorders are sited upstream and downstream of the reach where abstraction occurs.

CRC have suggested an option of restricting seasonal groundwater take based on groundwater levels at the beginning of the season.

TRC are developing a "Regional Low Flow Strategy" which will specify cut-off flows and a series of actions such as newspaper releases etc.

Water shortage directions under s329 of the RMA are rarely used despite mention in a number of plans. These would only be required if there was a need to cutback permitted takes or to restrict existing consents that have not yet been reviewed to include minimum flow provisions in their conditions.

Domestic and stockwater takes are often not subject to minimum flow or aquifer trigger levels. NRC has a policy in the plan that sets priorities for water during severe water shortages. Water for public health is the top priority, with lowest priority to swimming pools and commercial uses for which water is non-essential. In Otago, permitted takes

from surface water, other than takes for reasonable domestic and stockwater needs, are subject to minimum flow controls. Takes are only permitted activities if abstraction is not suspended under minimum flow rules. CRC have suggested an option in which community water supplies would be restricted to 250l/person/day when rivers are at or below their minimum flows. MDC has a condition for permitted activities in some resources which specifies that domestic use must reduce to 1 m^3/day when rationing restrictions have been imposed.

6.4 Flow Sharing

There are two situations where flow sharing between instream and abstractive uses occurs. These sharing systems are intended to stop rivers being at or near the minimum flow for long periods of time.

In Canterbury, the National Water Conservation Order (Rakaia River) and some non-statutory plans require a 1:1 sharing rule between the amount of water abstracted and the amount left in the river above the minimum flow. Takes from these rivers are implemented with a priority/band system, where users or groups of users have successively higher flows at which abstraction must cease. The flows at which bands must start restrictions takes into account the instream proportion of flow. These sharing systems are difficult to implement and enforce.

In Marlborough, Class B and C permits (refer Section 7.1), operate 2:1 sharing between abstraction and instream uses. Flow restrictions will start when the river reaches the A permit limit plus 1.5 times the flow allocated to B permits. Very few Class B permits have been issued and water restrictions have not yet been required.

7 ALLOCATION LIMITS

For the purposes of this report, an allocation limit is a predetermined limit on the total amount of water that can be abstracted from a resource. The absence of an allocation limit does not imply consents will be issued without limit. Rather, the cumulative effects of all takes on instream values and on existing users can be taken into account through resource consent applications and decisions.

7.1 Surface Water Allocation Limits

Setting surface water allocation limits is not as common as the setting of minimum flows. Setting limits is closely associated with allowing takes to storage during times of high flow or over winter. Blocks or bands of allocations are reasonably common, where successive bands have higher flows at which abstraction is restricted or stopped. National water conservation orders often set total allocation limits from a resource. Those councils who do not set allocation limits often use or intend to use a band system where every subsequent user (or group of users) is restricted at an increasingly higher flow. The implementation of allocation limits through rules is outlined in Section 7.3. A summary of current practice for those councils who set allocation limits for surface water is given below.

Surface water allocation limits are expressed on an instantaneous flow basis.

	Method for setting allocation limits for surface water resources
EW	A percentage of the 5-year low flow. Values range from 5% to 40%, with a default value of 10% used in the absence of adequate information.
EBOP	30% of the 5-year low flow.
HBRC	7-day average flow exceeded 95% of the time from November to April less the minimum flow. Existing allocation is worked out on the basis of weekly flow converted to an instantaneous flow.
WRC	A "Core allocation" was originally set based on a low-flow statistic and adjusted during plan consultation. In some cases the core allocation was set equal to the existing takes. A flow at which "supplementary allocations" can be taken is also given, and is often higher than the upper limit of the core allocation. There is no limit to supplementary allocations.
TDC	Allocation limit for a zone set so that users experience a certain reliability in a specified drought. For example, 35% reduction in water availability during a 10-year drought. Limits are worked out using simulation models and taking environmental bottom lines into account.

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	Method for setting allocation limits for surface water resources
MDC	Band system. The limit for Class A permits is the 1-in-5 year 7-day low flow (less the minimum flow). Class A permits are available 93 to 97% of the time). The limit to Class B permits is based on the 80 percentile flow and provide a moderate degree of certainty. There is no limit on Class C permits which are intended for storage and for power generation.
CRC	A band system on the Opihi sets A permits to the limits of existing irrigation (as at 1994), there is no limit on B permits. On the Waimakariri, A permits are used for stock/drinking water, B permits have an upper limit based on providing reasonable reliability.
ORC	Band system. The limit for Class A permits is the greater of 50% of the 7-day mean annual low flow or the current assessed level of take. The limit for B Permits is the mean annual low flow less the Class A allocation. Where the Class A allocation is greater than the mean annual low flow there is no Class B allocation. As for minimum flows, allocation limits are set as "default" values and can be varied on a case-by-case basis.

Reasons for setting an allocation limit are:

- Minimising the effects of abstraction on low flow regime and natural character
- Specifying a reliability of supply to existing and potential users
- Maintaining groundwater recharge
- Providing certainty to users
- Guidance for consent processing
- Waste assimilation capacity of a river/stream

Information taken into account includes:

- Hydrological characteristics of the river
- Current and potential water uses
- Reasonable risk to users
- Groundwater recharge information
- Availability of water storage
- Level of demand relative to supply
- Potential for adverse environmental effects

7.2 Groundwater Allocation Limits

Although annual water budget approaches are widely used to quantify groundwater resources, formal setting of allocation limits from groundwater is not widespread. Groundwater takes that are considered connected to surface water will be subject to any surface water allocation limits. The following councils have set allocation limits for groundwater resources.

	Methods	Calculated	Expressed
ARC	Groundwater models and annual water budgets	Annually	Annually
WRC	"Safe yield" set based on annual water budgets and throughflow analysis	Annually	Daily
TDC	Groundwater models and annual water budgets	Weekly/Annually	Weekly
MDC	"Safe yield" based on throughflow analysis	Annually/Daily	Daily

NRC do not specify allocation limits in the plan, but require water meters on groundwater takes when the total allocation equals or exceeds 50% of the average annual recharge.

Allocation limits for ground water are intended to:

- Protect aquifers from any physical damage;
- Ensure availability of the resource;
- Avoid saline intrusion; and
- Maintain spring flows.
- Provide a specified reliability of supply to users

7.3 Implementation of Allocation Limits

Allocation limits are not equivalent from council to council. For some councils the allocation limit specifies a volume that can be allocated as a controlled activity, whereas other councils will decline applications to take beyond the allocation limit. The following table lists the status of water takes for those councils with operative or proposed plans.

	Status of water takes for other than permitted takes
NRC	Discretionary, except for takes from "outstanding" rivers and lakes which are non-complying.
EW	Takes within the allocable volume are controlled, otherwise discretionary. Takes from lakes (excluding Taupo) and wetlands is prohibited.
TRC	Most takes discretionary. Takes from some resources are prohibited.
HBRC	Takes within allocation limit are controlled, otherwise discretionary.
WRC	All takes discretionary, except takes from over-allocated resources which are non-complying. For over-allocated resources, the allocation limit is set in the rule. Other allocation limits are set in policies.
TDC	Allocation limits are set as criteria for discretionary activities (Motueka/Riwaka Plains).
MDC	Takes above 500 m^3/day (or 1000 m^3/day from the Wairau aquifer), or any takes from some specified resources are non-complying, otherwise discretionary. Takes from some resources are prohibited.
CRC	Allocation limits are set in a policy (Opihi and Waimakariri).
ORC	Takes which comply with default regime are restricted discretionary, otherwise non-complying.

8 OVER AND FULLY-ALLOCATED RESOURCES

The determination of over and/or fully allocated resources is not straightforward. A comparison of flow statistics and allocated volumes does not by itself indicate the abstractive pressure place on a resource (refer Section 4). The potential effects of a specified allocation depends on the values associated with a resource and how they are influenced by abstraction. Over-allocation can be related solely to reliability of supply for existing users, rather than to environmental effects. McLellan (1998) conducted a survey of regional councils asking them to identify an fully allocated water resources. His definition included resource where "existing take is close to the maximum that you believe can be justified under the RMA".

For the purposes of this report, an over-allocated resource is one where an allocation limit has been set and the existing allocation retrospectively found to be above the allocation limit. In some cases, this situation has been avoided by setting the allocation limit equal to existing takes. A fully-allocated resource is one where the allocated amount equals the allocation limit.

8.1 Dealing with Over-Allocated Resources

Councils' responses to questions about over-allocated resources support previous findings (McLellan 1998). The survey identified 134 fully or over-allocated resources in New Zealand, 112 of which were rivers or streams. McLellan concludes that, despite the number of resources considered fully-allocated, only about 60% of the allocated volume is used and there are few indications of economic scarcity.

Over-allocation has occurred in ARC, EW, EBOP, WRC and TDC. In all cases, the over-allocation has been addressed primarily by adjusting existing permits to better reflect actual take. Reducing all takes pro-rata or taking allocations from some users has not occurred.

- ARC. For the Omaha aquifer which is highly allocated, users meet once a year to assess their water requirements for the coming season, based on metered readings for the last season and intended crops. A schedule of the allocation to each consent agreed to by consent holders is signed off by ARC each year. This annual review approach is also now being applied to Pukekohe volcanic aquifer users which is also highly allocated.

- EW has adjusted consents at renewal (assessing actual use, applying reasonable use guidelines and the use of a sinking lid policy – 10% reduction at each renewal) and by strict lapsing of unused consents.

- EBOP has seven resources currently considered over-allocated, 6 of which have significant municipal takes. Compliance monitoring of takes from these resources is more frequent than from other resources. District/city councils are actively pursuing alternative sources (groundwater), considering installing meters on each household and promoting water use efficiency. Municipal takes come up for renewal in 2026.

- WRC had six water bodies considered over-allocated prior to 1996. Since then many consents have come up for renewal and were assessed for reasonable use. Now, only one water body is considered over-allocated, and only nominally over-allocated. Allocations from the Lower Hutt groundwater zone have been reduced by implementing an annual allocation for public water supply takes and weekly allocations for industrial takes, and by encouraging industrial users to reduce their allocation to an amount consistent with their actual take. All takes from the Lower Hutt groundwater zone are metered.

- MDC has some groundwater aquifers that appear over-allocated when the "safe yield" is compared to the allocated volume. However, monitoring results indicate that these aquifers are not over-allocated and the safe yield estimates for these aquifers are being revisited. Where monitoring results do show a downward trend, or no winter recovery in groundwater levels, the allocated amounts will be assessed for consistency with actual use records and reasonable use requirements.

- TDC have reduced allocations in many of their previously over-allocated zones. "Bona fide" reviews of existing consents are undertaken on a zone by zone basis. These reviews look at area irrigated, size of pumps, irrigation equipment etc. to assess whether the volume allocated is reasonable. If not, the rate of use is cut-back by review of conditions under a rule consistent with s68(7), s129 and s130 of RMA. Only the Wai-iti zone on the Waimea Plains and possibly Moutere surface water are now considered over-allocated. Options being considered to further reduce allocation are: pro-rata reductions, using A and B permits where A permits have greater security.

8.2 New Applications to Take from Fully or Over-Allocated Resources

In Waikato and Otago, allocation limits are set initially on a default basis. Consents to take once the allocation limit had been reached are therefore considered on a full discretionary or non-complying basis. This is probably also the case for those councils with allocation limits set in policies, where all takes are discretionary.

In Wellington, takes from an over-allocated resource are a non-complying activity. WRC are concerned that RMA amendments to remove non-complying activities as a category will reduce the ability to distinguish between the management of over allocated water bodies and those that have water available for use.

In Auckland, new applications to take from a fully-allocated resource are accepted but applicants are told they will only get water if a full assessment of environmental effects proves more water than ARC have assessed is available. In some cases, applicants are told to approach existing users for water and are shown the actual and consented takes of existing users. In the past, the ARC has operated waiting lists of applicants waiting to gain an allocation if water becomes available.

In Tasman, resource consents for over-allocated resources are declined. If a resource is fully allocated, then TDC keep an informal, unadvertised waiting list which potential or interested parties are told about when they approach council. MDC operate a

comparable system where holders of Class B permits are considered first-in-line for any Class A water that becomes available.

TDC are concerned about the legality and equity of the waiting list approach. As a result of annual reviews, improved resource information or surrendering of permits, there can be a situation at the end of a season where they have a volume of water available in a "fully allocated" zone where demand for more water is very high. People on the waiting list are invited to apply for the water, and applications are considered on a first-in first-served basis, with often a few minutes separating applications. There is also concern that the waiting list should be publicly advertised to ensure all interested parties are aware of its existence and all potential users are treated equally.

8.3 Transferable Water Permits

Permits to take water can be transferred under s136 of the RMA provided transfers are expressly allowed by a regional plan or upon application to the consent authority. Water can be transferred either permanently or temporarily, both of which could help improve the efficiency of water use.

	Transferable water permits provisions in regional plans
EW	A method in plan states *"transferring of permits is allowed provided it is to a downstream point in a catchment, to an area with the same or a less restrictive water class, and written notice must be provided to EW within 14 days"*.
TRC	Policy in plan states that *"will allow on application, transfers within catchments provided it is consistent with plan, minimum flow and has no significant adverse effects"*.
HMW	Oroua Plan (HMW) Irrigation permits can be transferred within sub-catchments during periods of restricted taking. Council must be notified before transfer takes effect.
HBRC	Controlled activity – (Surface water) if within same catchment and to a location at which river flow is the same or greater than original site. (Groundwater) if no significant interference with existing takes, at a location with the same or greater aquifer transmission and storage characteristics and no adverse effects on surface water resources.
MDC	Discretionary if within same catchment or aquifer zone.
ORC	Policy in proposed plan states that "on application … approve the transfer of permits provided it is within same catchment, total take is not increased, and there is no more than minor effects of other takes, rights to store water or on any natural or human use value"

Councils' response to questions confirm the conclusions of an earlier study (McLellan, 1998) that transfer of permits is not widespread, other than that associated with land transfer or subdivision. Only one transfer has occurred under the Oroua plan.

In Auckland, there have been very few permanent transfers, but a number of transfers for a season or less. Such transfers are recorded on consent documents by ARC and applicants charged a consent transfer application fee based on actual costs. ARC is looking at trying to reduce these transaction costs and encourage such transfers. The annual review of allocations to each consent holder that in the Omaha and Pukekohe aquifers facilitates the redistribution of water on an annual basis.

A number of councils do not consider they have a role in water transfer other than keeping track of take locations and ensuring there are no adverse effects of the transfer on other users. Others highlighted that councils do have a role in ensuring that allocations are for reasonable use, and thereby minimising speculation in water. Very few want to have anything to do with money changing hands.

A few councils raised the need to develop a way of encouraging temporary transfers, yet keeping track of take location and volumes for resource and compliance purposes. Only the Oroua and Proposed Waikato plan allow transfer without requiring a consent. Temporary transfers may be discouraged by the transaction costs of making an application each time a transfer occurs. Some resource consent conditions in Gisborne, specify that takes can be transferred upstream/downstream during times of water shortage. Another option suggested was consents that allow water to be used on multiple properties but not concurrently.

McLellan (1998) contains a comprehensive reference list on transferable water permits.

9 SETTING ASIDE WATER

All councils operate on a first-in first-served basis when considering consents to take water. Despite this there are a number of options used to provide for domestic/stock water requirements into future:

- Some public water supply consents have volumes/rates based on projections of future use.

- Many councils work actively with local authorities or water supply authorities to assess long-term water supply strategies and recognise these in allocating water, particularly those councils looking at or using catchment-specific plans/strategies.

- Identification of resources used for public water supply. MDC has an exclusion zone in the Wairau aquifer set aside for Blenheim's water supply. ORC identifies resources used for public water supply, and requires that this is taken into account in resource consent decisions.

There is no setting aside water for purposes other than domestic/stock water or public water supplies. TDC has a rule criteria relating to takes to transfer water out of the zone from which it is abstracted. The criteria states that takes will be allowed to the extent that sufficient water remains during a 1-in-20-year drought to supply existing and potential irrigation within the zone, and community supply needs outside the zones. This reservation of water has yet to be tested as no allocation limit has been set and demand for export is not large enough to begin limiting future in-zone water use. MDC have an aquifer zone where takes for use outside the zone are prohibited.

Establishing a priority of uses and how each is restricted during water short periods is discussed in Section 6.3.

10 MEASURING WATER USE

The most common method of measuring water use is water meters. The following table indicates councils that require water meters and on which takes.

	Situations where water meters are required	Recorded	Collected/ Received
NRC	Groundwater takes >200 m^3/day or if more than 50% of average annual recharge is allocated. Surface water – are putting a condition relating to "provide volume taken on request" which is intended to move all surface water onto meter over the long term.		On request
ARC	On all takes, with the exception of Existing Uses taking surface water	Daily for run-of-river surface water. Weekly for dams and groundwater	Quarterly
EW	On all consented takes.	Daily	Annually
EBOP	On consented takes >400 m^3/day and municipal takes	Consent specific	Consent specific
TRC	On major takes and takes in water-short catchments		
HMW	On consented takes > 3000 m^3/day		
GDC	On all consented takes		Annually
HBRC	On consented takes from resources with an allocation limit set, takes >5000 m^3/week and industrial or public water supply takes		
WRC	On all takes from over-allocated resources, large industrial or public water supply takes		
TDC	In fully or over-allocated zones, with the exception of Riwaka zone where flow recorders are in place upstream and downstream of reach in which abstractions occur	Weekly	Weekly
MDC	Required under plan but only being enforced in under-pressure areas	Fortnightly	Fortnightly

Canterbury and Otago do not have specific guidelines for water metering. In Canterbury, many of their large abstractions are metered. Based on large industrial takes and irrigation schemes, approximately 40% of water in Canterbury will be metered. In Otago, some large abstractions are metered, and metering is occasionally required as a condition of consent. For waters take outside of Canterbury and Otago, 29% of water allocated is metered and around 65% would be metered if all plan provisions were in place and enforced on all consents.

Other methods in use are:

- Checking of flow rates at consent renewal (gaugings or portable flow meters)
- Spot checks of flow rates (as above)
- Assessment of pump size
- Hour meters and calibration of flows
- Power ratings
- Survey of irrigators

Water meter information is used for:

- Checking compliance of individual consents
- Reviewing consents to try and bring allocated volume into line with actual use
- Resource information, particularly for revising groundwater budgets and models
- Information to users. ARC, GDC, TDC and MDC provide users with annual and/or weekly take statistics from a resource. MDC also provide plots of fortnightly water use to users with meters.

Two issues raised by all councils were difficulties with getting accurate meters readings and the resources required to collect and analyse meter information. Accurate meter readings require appropriate installation, meter maintenance and recording of meter readings. The database management needed just to record meter readings, particularly on time scale of less than a year is significant. Councils often use a "risk-based" approach and implement/enforce metering in zones with high demand relative to supply or where there is significant potential for adverse environmental effects.

11 GUIDELINES FOR REASONABLE USE

Reasonable Domestic/Stockwater Use

A variety of values are used for reasonable domestic use ranging from 180 ℓ/day/person to 3000 ℓ/house/day. Department of Health guidelines recommend a daily amount of 250 ℓ/person which includes an allowance for garden watering. Measured rates for Whangarei City are 180-225 ℓ/person/day, for small Northland towns are 400 ℓ/person/day, and for Christchurch are 800-900 ℓ/household/day.

Example stock water guidelines are 40 ℓ/sheep and 60 ℓ/cow/day

Reasonable Industrial Use

There are very few guidelines values for reasonable industrial use. All councils require industrial users to justify the volume of water applied for, and consent conditions sometimes specify water audits or water saving devices. In Auckland, allocation for reasonable use is based on site specific water requirements and/or benchmark water use for generic industries from literature, combined with analysis of the existing water meter database.

Reasonable Irrigation Use

A wide variety of methods are used to assess reasonable irrigation water requirements.

	Methods for assessing reasonable irrigation water requirements
NRC	General guideline 2.5 mm/day (25 m^3/ha/day).
ARC	Guidelines based on soil, evapotranspiration rates, rainfall and crop, assuming 100% irrigation efficiency. Rainfall and evapotranspiration rates are based on "dependable" (80% chance) amounts.
EW	Plan sets out water requirements (daily and annual) for pasture/crops, onions, potatoes and greenhouses on various soils. Applicants must comply with these or prove that higher use is efficient. These were established using, average irrigation efficiency, multi-year simulation of daily rainfall and evapotranspiration and keeping soil moisture levels within specified bounds. Irrigation is a permitted activity provided the application depths do not exceed the daily guidelines values or the water holding capacity of the soil, and that the application rate does not exceed the infiltration rate of the soil.
EBOP	General guideline 3 to 6 mm/day.
TRC	General guidelines based on soil and crop.
HMW	General guideline of 25 to 50 mm/week, depending on soil type.
GDC	General guideline 6 mm/day.

Continued over page

	Methods for assessing reasonable irrigation water requirements
HBRC	Policy in plan, allocate water based on requirement during a 1-in-5 year drought taking into account crop, local rainfall and evapotranspiration, crop climate, and assuming best irrigation management practices
WRC	Policy in plan of 35 mm/wk unless applicant can demonstrate that a higher rate is efficient and necessary.
TDC	Specified in Motueka/Riwaka plan 35 mm/week. For Waimea Plains, there are more detailed guidelines based on crop, soils and climate. These were established using multi-year simulation of daily rainfall and evapotranspiration, assuming standard irrigation practice and complete water supply reliability, and were set to a keep soil moisture levels within specified bounds.
MDC	Policy in plan states that water will be allocated according to weekly and daily guideline values. For all crops, other than grapes, these were established using multi-year simulation of daily rainfall and evapotranspiration, assuming standard irrigation practice and complete water supply reliability, and were set to keep soil moisture full 80% of the time over the last 22 years. For grapes, the allocation is based on optimising yield over the last 22 years.
CRC	General guidelines based on soil, an evapotranspiration rate, irrigation depth and return period. Calculation method is in information booklet given to potential applicants.
ORC	General guidelines based on crop, land area and climate to ensure water taken is no more than that required for the intended use…. having regard to local conditions.

12 COMMUNITY INVOLVEMENT

For all plans, more consultation than that required under Schedule 1 of the RMA has occurred. Issuing and receiving submissions on draft plans prior to a proposed plan is common, as is the use of working parties, sector group input or consultative groups. TDC and CRC currently have Issues and Options documents in circulation. A lot of local resource-specific consultation is associated with catchment specific plans (formal regional plans and informal plans/strategies). Resource consent processes allow further opportunity for public input.

Formal user groups are established in TDC, MDC, CRC, ORC and ARC. These are most often used to implement restrictions during water short periods. TDC are also using user committees to discuss options for water allocation planning. Committees in TDC are elected by water permits holders with TDC councillor and agency (DoC, Fish and Game, Iwi) representation. A council staff member attends most meetings and acts as secretary, organises elections etc. In MDC, groups were very effective during the 1997/98 drought. The groups elected a committee with representative from each user section (horticulture, wine, townships, and potential irrigators). The groups have faded since the drought but MDC are reactivating them in anticipation of a drier than normal summer in 1999/2000. In Otago, members of a water allocation committee are appointed by ORC and are all water users. Consent conditions require consent holders to comply with any directive issued by these committees.

13 OTHER WATER ALLOCATION ISSUES

Managing takes is not the only component of water quantity management. The following table lists other measures mentioned by councils.

Water allocation methods other than managing takes	Number of mentions
Education and advocacy related to water conservation and efficient use. These include: • newsletters • information booklets • field officers • work with user groups	8
Working with water supply authorities	8
Submissions to district plans, annual and strategic plans related to water availability, land-use and regional growth strategies	3
Diversion of stormwater into aquifers	2
Managing effects on water quantity of aggregate quarrying and gravel extraction	2
Riparian planting	5
Financial contribution (rate relief) for riparian planting and/or other mitigation measures	2
Effects of forestry on water yields	3
Effects of urbanisation on water yields	1
Encouraging groundwater use over surface water	4
Control on small dams in catchments or recharge zones	2
Examining augmentation options	2
Research into irrigation efficiency	3

14 MISCELLANEOUS

14.1 Permitted Activities

The following takes are permitted activities under operative, proposed and draft plans. Where such plans do not exist, the permitted takes are those allowed in transitional plans or provisions.

	Water takes classified as permitted activities
NRC	10 m^3/day in summer, 30m^3/day otherwise
ARC	1 m^3/day/ha up to 5 m^3/day
EW	15 m^3/day, larger rivers and groundwater (>100 m spacing) 30 m^3/day
EBOP	15 m^3/day
TRC	50 m^3/day per property
HMW	15 m^3/day surfacewater, 50 m^3/day groundwater
GDC	10 m^3/day
HBRC	20 m^3/day
WRC	20 m^3/day – none from over-allocated resource
TDC	Up to 10 m^3/day
MDC	Up to 10 m^3/day/site, with an additional 100 ℓ/ha/day for the balance of any site over 20 ha (stockwater)
CRC	20 m^3/day, larger properties allowed up to 100 m^3/day of groundwater
ORC	25 m^3/day, larger rivers 1000 m^3/day, some aquifers 10 m^3/day. Permitted takes subject to minimum flow unless for stock or domestic water.

Based on rough calculations and environmental monitoring, the cumulative effects of permitted takes are generally considered minor. In situations where there is a high density of permitted takes on a relatively small resource, councils are keeping a watch on. An issue that is often raised with permitted takes was the ability to record where they are. The location of permitted groundwater takes is usually known through bore permits. NRC use a criteria for permitted takes that users must provide information on take location and volumes if requested.

Most councils have criteria for permitted takes related to intake velocity, fish passage, instantaneous rates, and distance from other bores.

14.2 Over-Taking, Unused and Illegal Takes

Councils are alerted to users taking in excess of their allocated volume either by meter records or by spot checks of instantaneous flow, pump size, etc. Very few abatement notices have been issued. Councils work with users, provide advice on good management practice, recommend leak detection etc. Over-taking is often dealt with by revising the consent to reflect actual use. The attention given to excess taking depends on how highly allocated a resource is.

Lapsing consents under s125 or s126 of the RMA is not widely used, except as a method to reduce allocation in an over-allocated resource. Most water permits are used. Councils who meter will be aware of any unused consents and often approach holders at two yearly intervals and ask if they intend to use the water. Some unused takes were surrendered once s36 charges were imposed.

Illegal takes are most often brought to the attention of councils by neighbours during water short periods. Staff familiar with an area are also useful. Some illegal consents are discovered when properties change hands. Well drillers and irrigation consultants can be useful in referring potential applicants to councils. Other methods that have been used for resource-specific investigations are site-by-site visits and flyover surveys to match irrigated land to water permits.

14.3 Duration of Consents

The duration of water permits varies from 5 to 35 years. Nearly all consents have a review or renewal at 5- to 15-year intervals. Councils using short duration consents are not confident in the legal enforceability of review clauses. Longer terms provide certainty to users and recognise the investment associated with some consents. It is very common to adjust duration and/or review dates to coincide review of all consents from a given resource.

	Duration of Consents
NRC	5 years (renewals for 10 years)
ARC	15 years with 5-yearly reviews
EW	15 years unless resource is considered “under-pressure” then 10 years
EBOP	10 years
TRC	15 years
HMW	5 years, can be 2 years if there is concern about possible effects
GDC	5 years, some smaller takes for 10 years
HBRC	10 years, consider longer if no issues in a catchment
WRC	10 to 15 years for takes other than large public water supply

TDC	historically 6 to 10, now moving to 15 years
MDC	15 years, 30 years from very reliable resources. Resource reviews every 5 to 10 years
CRC	35 years
ORC	15-20 years unless there is a concern about a particular issue or effect

14.4 Funding

All councils charge applicants directly for the costs associated with granting a consent. Some councils also charge an annual amount to water permit holders. The fee can be fixed or a function of allocated volume. Funding policies contain detailed formulae for calculating annual fees. The following table provides an overview of annual charges, what they are based on and what they are used for.

	Annual user levy	Based on	Covers
NRC	✓		Consent monitoring, resource monitoring (hydrological stations)
ARC	✓	Allocated volume, type of use and catchment	50% of investigations, management and resource monitoring, 100% administration of consent databases and compliance monitoring
EW	✓	Allocated volume, compliance records, potential for adverse effects	Consent monitoring and administration of databases
EBOP	✓		Consent and resource monitoring, investigations
TRC	✓		Compliance monitoring
HMW	✓	Allocated volume	33% to monitoring, rest into investigations
GDC	✗	--	--
HBRC	✓		Low flow monitoring, consent administration
WRC	✓	Catchment	Consent monitoring, and resource monitoring in stressed catchments
TDC	✓	Allocated volume and catchment	Funds 30% of investigations and monitoring
MDC	✗	--	--
CRC	✗	--	--
ORC	✗	--	--

In Waikato and Tasman, the amount charged to consent holders increases if users do not provide flow meter records.

14.5 Enforcement

Monitoring can be used to check minimum flows and aquifer levels during water short periods Most councils who have implemented restrictions find that users comply with restrictions. It is easier to enforce a total ban than pro-rata restrictions. Enforcement of allocation limits is through the resource consent process and compliance monitoring. There does not appear to be a high frequency of abatement notices. There is some concern among councils that the fine for non-compliance with consent conditions is insufficient to prevent users taking during bans. This is particularly true for high value crops that require water at specific periods. The high value of some crops means that it is often economic to take water outside consent conditions and pay the fine (even as high as $30,000).

14.6 Measuring Success

A question in the interview schedule asked councils how they would evaluate the success of their water allocation system.

Measures of success	**# of mentions**
Resource and State of Environment Monitoring	9
Consent and Compliance Monitoring	2
User group feedback	1
Public satisfaction and acceptance	4
Improved efficiency of water use	1
Number of complaints	3
Operation of allocation system in a drought year	4
No inquiries to take from an over-allocated resource	1
Consent processing straightforward	1
Flexibility of system – no need to vary plan	1

15 RESOURCE AND INFORMATION NEEDS

15.1 Obstacles

The following is a list of obstacles to successful implementation of water allocation systems raised by councils in interviews:

- Insufficient resourcing and funding for investigations and monitoring
- Lack of staff continuity
- Insufficient information on resources
- Insufficient information on actual use
- Cost of collecting and analysing water meter information
- Lack of resources needed to manage information
- Working with uncertain and inaccurate information to make defensible decisions
- Working with a political framework
- Insufficient resources and political commitment to compliance monitoring and enforcement
- Uncertain legality of some measures such as waiting lists, control of land use
- Complexity of integrating water allocation with other issues such as water quality and land-use
- Complex nature of aquifer systems
- Lack of public awareness of water issues
- Difficulty with obtaining science funding for big local issues, compared to small more widespread issues
- Lack of economic instruments
- Insufficient fines available under the RMA
- Proposed removal of non-complying activity category from the RMA
- Mining privileges

15.2 Research Needs

Some councils stated that there were enough technical tools and methods available for water allocation and the issue was more about having the time to implement existing methods. National research can help prevent each council having to "reinvent the wheel" on some issues but final management decisions will always be based on local knowledge and politics.

The following research and tools were suggested in interviews.

Technical issues

- Practical methods for assessing groundwater availability and how much to allocate
- Extrapolating site-specific results (waiora ifim) throughout a catchment
- Temperature modelling,
- Practical methods for assessing instream effects of flow variabililty
- Practical equivalent to ifim for small streams
- Tools for assessing catchment scale forestry effects
- Tools for assessing and managing surface water/groundwater interactions

Data management

- Databases for hydrogeological data that are designed for spatial analysis of water use and water availability
- Interactive database tools for recording and analysing water use

Water use efficiency

- Guidelines/work on efficient irrigation based on crop, irrigation practices and other relevant factors
- Efficiency of municipal supplies
- Improving guidelines on the amounts of water needed for particular activities
- Better ways of reconciling actual with consented takes

Reliability of supply

- Risk-based drought analysis
- A method for reliability of supply and a set of criteria to take into account
- Options for setting allocation limits

Evaluation of existing practice

- A review of how minimum flow guidelines have been implemented
- Method for evaluating a minimum flow. Is it working? Is it too conservative?
- Evaluation of existing plans and their implementation

Broad water allocation frameworks

- An approach to integrating water allocation with other catchment issues
- An ecosystems approach to water allocation that combines social and economic needs with biophysical
- A national guideline on water allocation options and the pros and cons of alternatives
- Identification of options for addressing over-allocated resources
- National indicators relating to water availability and allocation

Cultural issues

- Approaches to incorporating cultural aspects of surface water
- Approaches to iwi involvement in water allocation

Economic issues

- Guidelines for establishing financial contributions towards mitigation costs
- Tools for valuing water - social and economic values

Other

- Exploring potential for water re-use
- Raising of profile of water allocation issues nationally
- Fund for smaller councils to get money from
- Rationalising of access to contestable science funding
- Options for management of dam released vs natural water
- Assessment of options for managing damming and abstractions from ephemeral streams and streams that recharge groundwater

Legal issues

- Ability to control land-use
- National support for councils who take an issue to the environment court and set precedent or perhaps requesting a declaration on a scenario
- Clarification on legality of water allocation options in use or intended use.

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APPENDIX

Page

NORTHLAND REGIONAL COUNCIL
RESOURCE SUMMARY

Total quantity of water allocated per week (direct takes) 3,315,154 m^3
(Equivalent to a flow of 5.5 m^3/s taken continuously)

Total quantity of water taken from storage (weekly) 1,430,161 m^3
(Equivalent to a flow of 2.4 m^3/s taken continuously)

Maximum volume that can be taken in a year 190,993,087 m^3
(Assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take 10.9 m^3/s
(Take if all consents were used fully and simultaneously)

Water Sources

Direct Takes Only

Surface Water (direct takes)	% of total weekly allocation	Mean Flow (m3/s)
Wairua River	58%	60.4
Waipapa Stream	7%	0.4
Waipu Stream	4%	3.0
Ahuroa River	3%	1.8
Waiarohia Stream	3%	0.32
Awanui River	3%	5.64
Waitangi River	3%	7.85
Hakaru River	2%	
Hatea River	2%	0.95
Waihou River	2%	
Whangarei Harbour streams	2%	
Tirohanga River	1%	1.3
Other East Coast streams	2%	
Ruakaka River	1%	0.7
Other Bay of Islands streams	0.5%	
Other North Cape streams	0.5%	
Other West Coast streams	0.5%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
North Cape groundwater	1%	>60
Other groundwater – coastal	2%	>0.35
Other groundwater	2%	>29.2

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Sources of water taken to storage

75% from catchments draining to the east coast
12% from Wairua/Wairoa catchment
12% from other streams/rivers draining to west coast
1% from lakes

Uses of Allocated Water

Water use (% of total allocation) by type and source

	From surface water	From groundwater	All sources
Domestic/stock/ municipal	30%	1%	31%
Industrial	3%	1%	4%
Irrigation	61%	3%	65%
TOTAL	95%	5%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Uses of takes from storage dams is 64% for domestic, stock, or community water, 34% is for irrigation and 2% for industrial use.

Irrigation Allocation

Irrigation allocation per week (including takes from storage) $2.81 \times 10^6 m^3$
(Equivalent to 4.6 m^3/s taken continuously)

Allocation from groundwater per week $0.12 \times 10^6 m^3$

Allocation from surface water per week $2.20 \times 10^6 m^3$

Allocation from storage per week $0.49 \times 10^{\wedge} m^3$

Irrigated area based on 1997 MAF Irrigators Survey 4000 ha

Water allocated is equivalent to $702 m^3$ per ha per week
or: 70 mm per week

Using NRC guidelines for reasonable use of 2.5 mm/day (17.5 mm/week), irrigated area works out at 16,000 ha

Percentage of weekly irrigation allocation by type and source

	Groundwater	Surface water	Storage	Total
Arable		2%		2%
Pasture	<1%	54%	1%	70%
Horticulture	4%	23%	16%	28%
TOTAL	4%	79%	17%	

Note: Water allocation is used as a surrogate for irrigated area

Planning Background

In 1997, Northland Regional Council released a variation to its Proposed Regional Water and Soil Plan. The variation added water quantity, beds of rivers and lakes and integrated catchment management to an original plan, which dealt with discharges and land management. The Plan as adopted by the Council following submissions was released in November 1998. In total 18 parties have appealed provisions in the Plan, there are 7 parties that have lodged appeals on the water quantity provisions to the Environment Court. These appeals relate to the setting of minimum flows, the identification of flow sensitive rivers, protection of dune lake water levels and allowing additional volumes particularly for road maintenance activities.

Under the Plan, catchment management plans for specific catchments will be considered if there is significant conflict or potential for conflict between use, development and protection, or if a catchment that is of significant concern to tangata whenua, or where significant benefits from restoration or enhancement could occur. Groundwater management plans will be prepared if there is a noticeable decline in either levels or quality. There have been a number of informal requests for such plans, and the timing and priorities will be decided through the annual and strategic planning process. A pilot catchment management plan is being carried out for the Wairua catchment. Consents in this catchment are due for renewal soon and the pilot study will help resolve the scope, content and implementation of catchment specific plans.

For the surface water quantity, there are three classes of rivers used throughout the Plan:

- Outstanding Value Rivers – these have largely unmodified catchments dominated by indigenous vegetation, or are recognised by judicial authorities (or Iwi and NRC) as taonga, or are part of an outstanding natural feature or landscape that would be adversely affected by changing flow. A list of rivers is contained in the plan and can only be altered by a plan change or variation. Only very minor takes for domestic water are permitted from these rivers, all other takes are non-complying activities.

- Flow Sensitive Rivers of High Ecological Value (FSRHEV) – these have catchment with predominantly indigenous vegetation, or have a high diversity aquatic life, rare aquatic life, or a MALF of less than 300 l/s. These rivers are not identified in the plan, and the class of a river will be determined through the resource consent process – all information held by NRC will be made available to applicants.

- Other rivers

For groundwater, “at risk” aquifers are identified based on the suitability of overlying soils for water intensive land uses, the availability of surface water resources, the presence of springs or geothermal activity, the likelihood of sea water intrusion, and the type of land uses, development or activities in the recharge area.

Environmental Bottom Lines

Surface water

For FSRHEV, the design minimum flow is the MALF. For other rivers, the design minimum flow is the 7-day, 1 in 5 year flow low. An appendix to the plan outlines a flow correlation method that can be used to provide these statistics for rivers with no flow records.

These design minimum flows were selected based on comprehensive monitoring of riparian and bed conditions, habitat and macroinvertebrate communities over a summer during which river flows were at or close to the 5 year low flow for substantial periods of time.

Minimum flows above or below the design minimum flow will be considered, provided an applicant can demonstrate an absence of adverse effects. The design minimum flows approach is used as a conservative/precautionary approach to setting an environmental bottom line in the absence of detailed investigations.

Groundwater

Groundwater levels and quality are monitored, but there are no trigger levels set for restricting groundwater takes. Consent applications to take groundwater must assess the effects on groundwater quality, existing bores, geothermal and surface water resources. Trigger levels or other measures to restrict pumping could be considered if a management plan was prepared for an aquifer. Recharge estimates are made for all aquifers with computer models (MODFLOW) used in some cases.

Values protected

The design minimum flows protect aquatic life and habitats. Under water quality provisions in the plan, it is proposed to identify water bodies that will be managed for: aquatic ecosystems, contact recreation, water supply, aesthetic and cultural values. This information will be used if a variation from the design minimum flow is considered.

Implementation

All water takes, other than permitted takes, are discretionary activities. Surface water takes will have a condition specifying the river flow at which abstraction must cease.

Limits on Total Allocation from Resource

Surface water

Traditionally, the total amount allocated from a surface water body was limited to 60% of the 1 in 5 year low flow. The Plan moves away from this to a minimum flow system. An approach to ensuring security of supply to existing users is not yet determined but will be considered during specific catchment planning.

Groundwater

Allocation limits are not set for groundwater, but the allocated volume is compared to the average annual recharge and reviewed every 5 years.

Storage

Water harvesting, and storage of rainfall or runoff are encouraged. There are some consents to take water only over the winter months. An assessment of alternative water sources must accompany consents to take water.

Allowing for future domestic/stockwater

A policy in the plan gives priority to existing and foreseeable (reasonable) domestic, stockwater and public water supply needs. However, consents will be considered on a first-in first served basis. District/city council long term water supply strategies will be taken into account in establishing water allocation measures within catchment management plans.

Reducing Takes in Water-Short Periods

Over time most consents will contain minimum flow provisions. Public water supply authorities will be allowed non-compliance provided significant water conservation measures, such as hosing bans, are in place.

If there is insufficient water to meet the needs of all existing authorised users, the Plan sets priorities for implementing water shortage directions under s329. The order of priorities is: public health; animal health; long term/irreversible ecosystem damage; animal health; horticultural irrigation and other uses for which water is essential for primary business; pasture, lawn or domestic garden irrigation; swimming pool and other commercial uses for which water is non-essential.

Water Use

Water meters

All surface water takes are required to provide to NRC, on request, the volume of water taken, the location where the water is taken from and the purpose for which it is taken. All groundwater takes that are either >200 m^3/day, likely to adversely affect surface water, or are from an aquifer where more than 50% of the average annual recharge is allocated, must install a flow meter with $\pm$5% accuracy. If they are enforced, these requirements mean that most users need to install water meters. Water meters are fitted to all houses in Whangarei City and are being brought in in other small towns.

Guidelines for reasonable use

An irrigation guideline of 25 m^3/ha/day is used. Crop and climate will be taken into account in assessing reasonable use.

Domestic use, based on records from Whangarei city meters, is 180 to 225 ℓ/person/day. These values do not appear to apply in small towns, where meters readings are up to 400 ℓ/day.

Reasonable dairy washdown is 60 ℓ/cow/day.

There are no guidelines for reasonable industrial use.

Review of existing consents

Consents will be reviewed at renewal for reasonable use and brought in line with any minimum flow requirements.

Permitted takes

- From all rivers, up to 2 m^3/day for domestic use and up to 30 m^3/day for stock water
- From all but rivers of outstanding value, up to 30 m^3/day during June–November, otherwise 10 m^3/day, for any use.
- From some identified rivers, up to 30 m^3/day any day of the year, but not exceeding 100 m^3/week

Users must notify the council of the location of permitted takes, and these are recorded on a GIS database. This information will be used during preparation of catchment management plans to estimate the cumulative permitted take.

Illegal takes are discovered by complaints or field staff.

Takes in excess of allocation are identified based on water meter records. No enforcement action has been taken to date and it is felt that the fine is insufficient to deter non-compliance.

Unutilised takes have not been lapsed.

Other Methods

- Promotion of water conservation
- Promote diversion of (clean) storm water into aquifer recharge areas of "at risk aquifers"
- Submissions to district plans, particularly recommendations for water supply from rainfall/ storage
- Work with interest groups or groups of users

Community Involvement

- Through the formal plan process.
- A consultative group was used in the preparation of the proposed plan
- Significant community involvement is envisaged in the development of catchment specific plans
- Promotion of user groups

Administration

Duration of consents

Generally 5 years, renewals are for 10 years. Consent duration will be adjusted to try and bring all consents within a catchment to a common expiry date.

Funding

Consent holders are charged an annual levy which covers compliance monitoring, and an administrative charge which covers database maintenance, and a proportion is allocated to maintenance of hydrological stations. Each water permit is assessed based on the size of the allocation in relation to the size of the resource and the overall level of allocation from that resource. The emphasis is on the water availability and the effect on the resource rather than the actual quantity. For larger abstractions, however, which require a higher proportion of monitoring than other abstractions, a scale of quantity to charges has been determined.

Enforcement and administration

Enforcement is not seen as high priority.

Obstacles

- Resourcing and funding
- Not yet enough monitoring to complete information feedback loop – and it is therefore difficult to assess the effectiveness of policies and plans

What is Needed Now?

There are now sufficient tools available or under-development (IFIM, LOWFAT, MCI Ecotyping, VMODFLOW) for setting minimum flows and managing groundwater. Significant data and resources to collect this data are now needed to utilise these tools.

One area that would be useful is work on efficient irrigation.

Total quantity of water allocated per week (direct takes) 2,236,688 m^3
(Equivalent to a flow of 3.7 m^3/second taken continuously)

Total quantity of water allocated per week from storage dams 2,763,815 m^3
(Equivalent to a flow of 4.6 m^3/second taken continuously)

Geothermal water allocation per week 17,626 m^3
(Equivalent to a flow of 0.03 m^3/second taken continuously)

Maximum volume (cold water) that can be taken in a year
(direct takes) 75,429,871 m^3
(from storage) 131,353,069 m^3
(Either as given in consent database or assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Water Sources

Surface Water	% of total weekly allocation (incl both direct takes and takes from storage)	Mean Flow (m3/s)
Lower Waikato River catchments	25%	Storage catchment
Wairoa Catchment	14%	3.0
Huia catchment	5%	Storage catchment
Big Muddy Creek Catchment	5%	Storage catchment
Pahurehure Inlet Catchments (Manukau Hbr)	2%	
Hoteo Catchment	2%	6.4
Waitakere River catchment	2%	
Matakawau Stream	1%	Storage catchment
Kaipara River Catchment	1%	2.8
Taihiki River catchment	0.8%	
Whangaparoa Peninsula	0.9%	Storage catchment
Waiuku Catchment	0.8%	
Puhea Creek	0.6%	
Other surface water (each source <0.5%)	6%	

Continued next page

Water Sources - continued

Groundwater	% of total weekly allocation	Average annual recharge (million m^3/yr)
South Auckland Groundwater	13%	16.3
Auckland Isthmus Groundwater	12%	23.2
Kumeu-Hobsonville	2%	1.6
Manakau Groundwater	1%	4.3
Clevedon Groundwater	1%	0.9
Hoteo Groundwater	1%	
Other groundwater north west of Auckland (each <1% individually)	2%	
Other groundwater south-east of Auckland (each <1% individually)	1%	
Gulf Island Groundwater	<1%	

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Geothermal Takes

70% from Wairewa, 30% from Parakai

Uses of Allocated Water (by type and source)

Water use (% of total weekly allocation) by type and source

	From surface water	From groundwater	Takes from storage	All sources
Domestic, municipal and stockwater	5%	13%	47%	65%
Industrial	1%	6%	<1%	8%
Irrigation	5%	14%	7%	26%
TOTAL	12%	34%	54%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

All geothermal water is used for spas and swimming pools

Measured Water Use

70% of takes are metered.

Records available for year ending on 31 May 1999 show total take was 29% of annual allocation.

Percentage of allocation taken in year to 31 May 1999 by source and use

	Domestic	Industrial	Irrigation	Total % used
Groundwater	8%	39%	50%	18%
Surface water	32%	48%	37%	37%
Storage	42%	100%	25%	41%
Geothermal				51%

Note: Only includes those consents where annual usage was recorded in consents database. Seasonal allocations are as given in consents database or calculated for assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes).

Irrigation Allocation

Irrigation allocation per week — $1.33 \times 10^6 m^3$
(Equivalent to 2.2 m^3/s taken continuously)

Allocation from groundwater per week — $0.72 \times 10^6 m^3$

Allocation from surface water per week — $0.24 \times 10^6 m^3$

Allocation from surface water per week — $0.38 \times 10^6 m^3$

Total irrigated area — 6,833 ha

Irrigated by direct takes — 5,097 ha

Irrigated from storage — 1,736 ha
(Based on irrigated areas reported in consent database)

Water allocated is equivalent to — 195 m^3 per ha per week
or: — 19.5 mm per week

Percentage of irrigated area by type and source

	Groundwater	Storage	Surface water	Total
Arable				<1%
Pasture	4%	9%	7%	20%
Horticulture	51%	17%	12%	80%
TOTAL	55%	25%	20%	

Note: Based on irrigated areas reported in consent database

Planning Background

Water resource allocation management in the Auckland region is guided by Chapter 9 of the Auckland Regional Policy Statement (ARPS) titled "Water Conservation and Allocation". The ARPS gives policies, methods, and reasons for managing the effects of land use on quantities of water in water bodies, the quantity of water that can be made available for abstraction from streams and aquifers, consents to take and dam water, competition between users, and promoting conservation and efficient use of water. Under the ARPS, the Auckland Regional Council (ARC) will identify catchments and aquifers for priority investigations and prepare non-statutory Water Resource Assessment Reports (WRAR). The scope of these reports, the consultation required and a process for dealing with unresolved issues are all set out in the ARPS. If issues remained unresolved, either appropriate provisions will be included in a regional plan or any consent applications relevant to the study will be notified.

There are currently 11 surface water WRARs and 13 for groundwater. Preparation of these plans is a very consultative process with a lot of input and buy-in from water users and communities. A WRAR examines the availability of water, existing and potential demand, and the cumulative effects of use on the resource and values associated with it. The methodologies used in WRARs are being refined, particularly in relation to setting minimum flows. A recommended methodology may be included in the Land, Air and Water Regional plan, which is in preparation. The level of detail that the plan will contain is still under debate.

Also underway is the preparation of a catchment management plan for the Wairoa River catchment. These catchment plans have a broader scope than a WRAR and combine water allocation alongside land-use, water quality and other relevant issues. Like the WRARs, preparation of these plans is very consultative.

The Auckland region does not have extensive river catchments or aquifers. Water bodies are relatively limited in relation to the demands placed upon them by the large population and intensive use. Groundwater resources include alluvium, sands, fractured sandstone (which can require 200-300m deep bores to give adequate water supply) and volcanic aquifers. Geothermal groundwater exists at Waiwera and Parakai. Over the last few years, there has been some intensification of irrigation water use, as users have changed from orchards to high value crops grown in glass/plastic houses. Both market demand and increasing land prices have driven this change.

Environmental Bottom Lines

Methods - Surface water

Historically, surface water allocation for irrigation use has been managed by limiting the maximum daily volume allocated to a set percentage of the 1 in 5 year low flow. Other uses have been allocated on a case by case basis. A revised approach, which recommends a minimum flow based on environmental indicators such as dissolved, oxygen, habitat space, ammonia and/or temperature, is now being used. WaiOra and other tools are used to assess the impact of abstraction during periods of low flows, and this information is combined with

canvassing of local concerns, issues and values. In many cases, the minimum flow is negotiated through a consultative process, which sometimes involves appeals to the Environment Court on specific consents.

Minimum flows are usually set to protect some or all of the following: native fish, water quality, Maori values and recreational values.

Method - Groundwater

For groundwater, trigger levels/pressures for restricting groundwater takes are used where demand is close to water availability. Some individual consents have water quality or level triggers for preventing salt-water intrusion. Preventing cold water intrusion or temperature declines are important for geothermal aquifers. A network of monitoring bores provides an indication of long-term trends in aquifer levels/pressures, and allocated amounts would be reviewed if downward trends were identified.

Limits on Total Allocation from Resource

Method - Surface water

Historically, the total maximum daily volume allocated from run of stream flow for irrigation use was limited to a fixed percentage of the 1-in-5-year low flow. The revised approach uses a minimum flow in place of a fixed allocation. An approach to dealing with the effects of increasing use on the reliability of supply (risk) to existing users has still to be worked through. A band system where new users are subject to higher minimum flows is one option. The "risk" area is seen as new territory and is being developed further.

Surface water consents (from run of stream) contain maximum instantaneous pumping rates, daily allocation and annual allocations.

Method - Groundwater

Groundwater is predominantly managed by setting allocation limits. MODFLOW computer software, annual water balance calculations and flow net methods are all used to calculate allocation limits for an aquifer. Maximum annual volumes are used for all groundwater consents, with daily and sometimes weekly limits. Instantaneous limits may be set if required to achieve particular environmental outcomes.

The spatial distribution of takes is also important in some aquifers, so the allocation limit may need to be apportioned to a number of small sub-zones.

In some aquifers, where allocation is close to water availability, allocations to consent holders are reviewed annually.

Storage

Water harvesting and storage is common in the Auckland Region due to the small streamflows. Some water harvesting is carried out by pumping from periods of high flows to storage. Dams on perennial streams are discouraged, but where they are unavoidable, bypass flows and fish passes are required.

Fully and Over-Allocated Resources

A number of aquifers are considered fully allocated but reduction of orcharding has helped demand drop off in some areas. Some surface water resources are also considered fully allocated. Over-allocation has only occurred in limited areas, and is mainly historical. If a resource was over-allocated, consents would be reviewed based on actual take and reasonable use. In one instance, three farmers who were unable to be granted their full water requirements from a stream, sorted out amongst themselves who needed water most, with two farmers surrendering most of their previous allocations.

New applications to take from a fully-allocated resource are accepted but applicants are told they will only get water if a full assessment of environmental effects proves more water than ARC have assessed is available. In some cases, applicants are told to approach existing users for water and are shown the actual and consented takes of existing users. In the past, the ARC has operated waiting lists of applicants waiting to gain an allocation if water becomes available.

Transferring of water permits occurs occasionally as allowed by Section 136 of the Resource Management Act. There have been very few permanent transfers, but a number of transfers for a season or less. Such transfers are recorded on consent documents by ARC and applicants charged a consent transfer application fee based on actual costs. ARC is looking at trying to reduce these transaction costs and encourage such transfers. Whether or not money is exchanged between users is irrelevant to the council, but it needs to keep track of transfers for resource management and compliance monitoring. Letting transfers happen without application to ARC would require significant knowledge of the resource to set guidelines for allowable transfers. The public do not like the speculation suggested by water pricing. Experience with water transfer is that the big users in small communities have a community-minded attitude and are often prepared to share water allocation at no cost.

Resources that are not Fully-Allocated

Generally consents to take water are issued on a first-in first-served basis. However, under the RPS, water allocation is closely linked with land-use and urban and rural growth strategies. Strategies for addressing priority of allocation can be included in WRARs.

Reducing Takes in Water-Short Periods

Reducing takes in water short periods has not been required since 1983. Some informal rationing (one day on – one day off) has been used but only in a small number of situations. Methods for reducing takes can be included in WRARs. Telemetered sites and real time information could potentially be used for restricting takes.

Water Use

Measuring method

Water meters are required on all takes (with the exception of Existing Uses taking surface water). Considerable political support was needed to originally implement metering (in the 1980's) and ARC were active in trialling and recommending meter brands and arranged bulk

purchase of meters for some groups. Surface water "run-of-streamflow" users are required to record daily readings, while takes from dams and groundwater users record weekly use. Results are sent to ARC quarterly through a "self monitoring" programme. The information is useful for compliance, evaluating efficiency of use, reviewing consent allocations, and resource quantification (particularly groundwater).

Quartile returns are checked and any users who have taken significantly more than a fixed percentage above their annual allocation are warned. ARC undertake spot checks to ensure readings are accurate and check the accuracy of meters. Takes that use hour meters (these are rare and discouraged due to inaccuracy) are required to calibrate flow once a year. The accuracy of meters and ensuring that they stay accurate has been a big issue, with many older meters only achieving $\pm$ 20% accuracy. Council can request that a meter be serviced. A lot of effort is going in to improving the accuracy of information gathered through the self-monitoring programmes.

Guidelines for reasonable use

Irrigation – ARC use guidelines (developed by HortResearch) for crop water requirements which assume 100% efficiency and take into account soil, evapotranspiration rates, rainfall and crop type. Rainfall and evapotranspiration rates are based on "dependable" (80% chance) amounts. There has been some debate and discussion with users groups as to whether the amount allocated should be crop specific or an average value across crops. The guidelines do not take account of the risk to production if abstraction is turned off. Consent applicants are allocated an annual quantity based on realistic irrigation and not using 365 times maximum daily use.

Industry – allocation for reasonable use is based on site specific water requirements and/or benchmark water use for generic industries from literature, combined with analysis of the existing water meter database.

ARC have prepared guidelines for water audits of industrial and horticultural takes. These audits can be required to be carried out by consent applicants as a part of their Assessment of Environmental Effects.

Review of existing consents

All consents have a review condition, usually at 5-yearly intervals. All consents in an aquifer or catchment are reviewed at the same time. For the Omaha aquifer which is highly allocated, users meet once a year to assess their water requirements for the coming season, based on metered readings for the last season and intended crops. A schedule of the allocation to each consent agreed to by consent holders is signed off by ARC each year. This annual review approach is also now being applied to Pukekohe volcanic aquifer users which is also highly allocated.

Permitted activity takes

Permitted Activity takes include minor water use of 1 m^3/day/ha up to 5 m^3 per day. Other permitted activities to take water include dairy shed washdown, the majority of which are taken from groundwater sources.

The ARC Transitional Regional Plan allows for water meters on permitted activity groundwater water takes. Permitted activity takes are taken into account during the preparation of a WRAR and also in any resource assessment. Council must be notified of certain permitted activity takes so it can keep track of numbers and locations, and assess cumulative effects.

Illegal takes

ARC conducts land-use surveys, (aerial photos and visiting every property), normally focussing on one catchment each year as part of WRAR data collection. These are often useful in identifying illegal takes. Neighbours and ARC field staff also may report unauthorised users.

Taking in excess

Users who take a significant amount above their allocated annual volume will be contacted by ARC officers to discuss the usage. Where necessary an abatement notice is issued or they are asked to apply for a variation to their consents. The level of follow up will depend on how highly allocated the resource is. Instant fines are seen as a useful tool in the future.

Unused consents

Unused consents show up on the meter reading database. Users will be asked every two years if they are still expecting to use the water. Very few consents have been lapsed under Section 125 of RMA, but unused consents are unlikely to be replaced, unless applicants can justify it.

Community responsibly

There is a lot of peer pressure from user groups to improve water use efficiency. Instances such as irrigation water spraying onto roads are no longer accepted by communities, and some water users are moving towards highly technical and efficient irrigation systems.

Other Issues

- Consideration of water availability in land-use and regional growth
- Submissions to annual/strategic plans for district/city councils re water supply provisions
- Riparian planting. Often used as a condition on big consents and has a lot of support from iwi.
- Looking at financial contributions to restoration/mitigation by users
- Effects on recharge areas of urbanisation and forestry
- Urban stormwater issues – disposal into ground
- Education and advocacy – efficiency of water use

Community Involvement

ARC puts a lot of emphasis and effort into community involvement in water management.

- Users groups, facilitated by council staff, have been very successful and are actively involved in many decisions, including advising on annual plan programmes and setting annual consent users fees. Some groups have been around since the early 1980's.
- Consultation with Tangata whenua in policy development and consent processing.
- Education of consent holders about efficient use is closely tied in with use, collection and analysis of water meter data.
- Public education on water use and efficiency (communities and schools)

Administration

Duration of consents

Generally consents are granted for 15 years with 5-yearly reviews. Consents that involve major infrastructure investment such as water supply and power stations are usually given a 35-year term. Review and expiry dates are co-ordinated within a catchment or aquifer so that all consents competing for the resource can be reviewed simultaneously.

Funding

Consent holders are charged an annual fee under Section 36 of RMA. All consent holders pay for administration costs. A "functions, powers and duties" fee is also charged based on the maximum daily allocation, a use type factor (e.g. if irrigation only takes place for part of year), and on the catchment or aquifer (dependent on the amount of investigations, management and monitoring expenditure). The functions, powers and duties fee varies from a minimum $100 up to $30,000 for some individual consents.

Resource investigations, management, and monitoring are 50% funded by consent holders and 50% by general rate. Consent administration and compliance is 100% funded by consent holders.

Enforcement

Enforcement is difficult due to procedures required and the time delay between a breach and enforcement action. Instant fines will be useful in overcoming these problems.

Obstacles to water management

- Resourcing of adequate compliance monitoring
- Limited understanding of water issues by the wider community
- Complex aquifer systems
- Complexities of managing water allocation in an integrated manner with other issues such as water quality and land use. It is difficult to isolate the effects of different water allocation regimes on environmental indicators.

Measures of success

- Resource monitoring
- Consent monitoring
- Consent holder and user group feedback
- Feedback from politicians
- Customer satisfaction surveys (land-use surveys include an open ended question)

What is Needed Now?

- Methods for applying WaiOra model from a specific analysis point to cover a whole catchment i.e. cumulative effects of multiple takes throughout a catchment.

- A review of how minimum flow guidelines have been implemented. What instream management objectives are being used and how are flows set to protect them?

- Implementation of riparian planting and shading to mitigate effects of abstractions.

- Databases for hydrogeological data that are designed for spatial analysis of water use and water availability or other information that is needed to understand and evaluate performance of groundwater systems.

- Guidelines on establishing reasonable contributions to mitigation costs. This involves techniques for the economic valuation of water, how to set a defensible financial contribution, and assessing how and where the money can be used.

- Exploring the potential for water re-use. How does water quality influence/restrict reuse?

- An integrated assessment of water use efficiency, which incorporates crop, irrigation system, risk to production quantity and quality and economic aspects.

- Work on efficiency related to municipal supply.

- A risk-based drought analysis. What is a drought? What influences the availability of groundwater, run of stream flow, or water for storage? What aspects of availability influence horticultural/agricultural production and other users? How does it vary throughout the region?

Total quantity of (cold) water allocated per week 6,215,465m^3
(Equivalent to a flow of 10.3 m^3/second taken continuously)

Total quantity of geothermal water allocated per week 58,954m^3
(Equivalent to a flow of 0.097 m^3/second taken continuously)

Maximum instantaneous take of cold water 11.3 m^3/second
(Take if all consents were used fully and simultaneously)

Water Sources Cold Water

Surface Water	**% of total weekly allocation**	**Mean Flow (m3/s)**
Waikato River catchment (downstream of Lake Taupo)	43%	337.7
Waihou River catchment	11%	41.9
Kaueranga River catchment	3%	6.5
Lake Taupo catchment	2%	
Coromandel surface water	1%	
Other all individually <1%	1%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
Coromandel groundwater	9%	
Hamilton Basin groundwater	9%	
Hauraki Plains groundwater	6%	
Lower Waikato groundwater	5%	
Taupo groundwater	3%	
Pukekohe Groundwater	3%	
Tokoroa groundwater	2%	
Pututaruru groundwater	1%	
Other groundwater	<0.5%	

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Uses of allocated water (by type and source)

Cold Water use (% of total weekly allocation) by type and source

	From surface water	From groundwater	All sources
Domestic	15%	11%	26%
Industrial	19%	23%	42%
Irrigation	27%	5%	32%
TOTAL	61%	39%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Irrigation allocation

Irrigation allocation per week *(equivalent to 0.5 m^3/second taken continuously)*	1,793,331m^3
Allocation from groundwater per week	232,764m^3
Allocation from surface water per week	1,560,567m^3
Total Irrigated area	4500 hectares
Water allocated is equivalent to or:	398.5 m^3per hectare per week 40 mm per week

Percentage of Weekly Irrigation Allocation by type and source

	Groundwater	Surface water	Total
Arable	2%	2%	4%
Pasture	<1%	10%	10%
Horticulture	2%	3%	4%
Unidentified irrigation	9%	73%	81%
TOTAL	13%	87%	

Note: Allocations are used as a surrogate measure for irrigated area.

Planning Background

The Proposed Waikato Regional Plan was released in September 1998. It has attracted lots of submissions, over half of which relate to the water module. The top three issues appearing in submissions are water quality, water allocation and land-use.

The approach to water takes in the plan is to outline key principles and specify a consistent approach to water allocation, including delineation of permitted, controlled, and discretionary activities. As a follow on from the plan, catchment plans and/or water allocation strategies will be prepared to provide more detail and manage discretionary activities on a catchment-by-catchment basis. The water module establishes a system of water management classes, predominantly for water quality, but will be used in managing abstractions. Classes are: natural state, contact recreation, fishery and general.

The majority of takes in the Waikato region are for surface water (2/3 of total volume), whereas groundwater makes up over 90% of the freshwater resources. Most of the pressure for water is therefore on surface water, or on shallow groundwater which influences stream flows. For groundwater, the focus has generally been on water quality issues. Water demand has doubled in the last 5 years in some parts of the region due to dairy expansions, bigger dairy herds with increased stocking rates, and horticultural development moving south. Irrigation is now widely considered as essential for economic horticulture/agriculture.

Environmental Bottom Lines

Methods - Surface water

Minimum flows are not set formally in the plan, with the exception of the Mangatawhiri River (water supply catchment for Auckland) and its tributaries. On the Mangatawhiri, minimum flows were set to maintain water quality and fish habitat using IFIM. For other surface water, takes are managed by setting a limit on the total amount that can be allocated (see next section). However, there is a system for restricting and eventually ceasing takes from Pukekohe surface water. This is an area considered close to full allocation and the system used essentially puts in place a minimum flow at 70% of the 5-year low flow (Q5).

Method - Groundwater

Some groundwater consents contain trigger levels related to salt-water intrusion.

Limits on Total Allocation from Resource

Method - Surface water

A table in the plan sets allocable flows for surface water. The allocable flow is expressed as a percentage of Q5. The default value, used in the absence of adequate information, is 10% of Q5. Other values range from 5% to 40% of Q5. Use of Q5 to set allocable volume has been in place for year within catchment management plans prepared pre-RMA. Its choice

was backed up by significant scientific analysis, that was reviewed by EW during plan preparation.

Takes which fall within the allocable volume are controlled activities. Applicants can apply to take more as a discretionary activity, but the onus is on the applicant to prove that there are no adverse effects of taking more. Issues relating to discretionary takes and how they are managed will be contained in catchment-specific plans.

Method - Groundwater

Allocation limits from groundwater are set on a case-by-case basis as driven by demand and monitoring results. There have been no measurable declines in groundwater levels. As yet no limits have been placed on total takes from groundwater resources. Groundwater models which link groundwater abstraction to surface water flows or other environmental effects would be used to work out a sustainable limit.

A study to map groundwater abstraction and effective recharge is currently underway to provide an indication of pressure on groundwater resources. For some groundwater resources, there is so much water relative to demand that putting effort into an allocation system seems unwarranted.

Storage

Storage or water harvesting is actively encouraged, but not allowed for specifically in the plan.

Fully and Over-Allocated Resources

A number of resource were found to be over-allocated (relative to allocable volume) as a result of revised gaugings. Shallow groundwater in Pukekohe was also considered over-allocated. In Pukekohe, new applicants have been directed to deeper groundwater (Kawa Foundation). Cut-back have been achieved in other over-allocated resources by adjusting consents at renewal (assessing actual use, applying reasonable use guidelines and the use of a sinking lid policy – 10% reduction at each renewal) and by strict lapsing of unused consents. Renewals in these resources are only for 5 years, and EW has tried to get all permits expiring on the same date. New applications are declined.

Transferable water permits

Water permits can be transferred under the plan, provided it is to a downstream point in a catchment, to an areas with the same or a less restrictive water class, and written notice must be provided to EW. Temporary transfers create more of an issue for EW – such transfers increase the efficiency of water use, and should be easy and cheap to do, but council still needs to keep track of them for compliance and resource information. One option is to refer to both properties within consent conditions but not allow the take to be used in both places concurrently.

Resources that are not Fully-Allocated

Generally consents are dealt with on a first-in first-served basis. If an application was to take all remaining allocable volume, it would be publicly notified. In one instance, when granting a consent would have fully allocated the catchment, EW advertised for other applicants and received 20. A lengthy consultation process revised the allocation limit and 12 applicants were granted water. Half of these have still to exercise their permits and these will be lapsed. Unsuccessful applicants will be contacted to see if they still want the water.

District/city council water supply strategies indicate where water might be needed in future. EW has considered putting a consent condition onto irrigation takes which required takes to be reduced if the catchment is required for water supply in the future. The legality of such a condition is unknown.

Reducing Takes in Water-Short Periods

Restricting takes during water short periods has only ever been required in Pukekohe. As stream/river levels approach Q5, then no take days are introduced and a gauging made while all takes are off. If the natural river flow is at or below Q5, then 1-day-on 1-day-off system would be implemented. If the natural flow dropped further a full irrigation ban would be considered. No take days have occurred in Pukekohe, but alternative days off has never been required. Letters were ready to send out and a press advertisement prepared last year, but were not required. If possible, two weeks notice of potential cut-back will be given to irrigators.

Water Use

Measuring method

Water meters are required on all consented takes. EW provide forms for recording daily meter readings. Returns must be sent in annually, and a lot of effort has been made in the last two years to ensure returns are sent in. 80% now come in, and those that don't are collected by EW staff and the consent holder charged for staff time. If forms are not filled in properly, EW staff will also visit and charge for time. A visit costs around $200.

EW have prepared a pamphlet "Water Meter Guidelines" which explains why users need to fit meters, and gives instructions for fitting and reading meters.

Guidelines for reasonable use

Irrigation – The plan sets out irrigation water requirements (daily and annual) for pasture/crops, onions, potatoes and greenhouses – these are a function of soil type and where established using daily rainfall and evapotranspiration data, average irrigation efficiencies and keeping soil moisture levels within specified bounds. Users must comply with these guidelines or satisfy EW that the use is efficient.

Irrigation – The irrigation water requirements are also used to guide irrigation application. Irrigation is a permitted activity provided the application depths do not exceed the daily guidelines values or the water holding capacity of the soil, and that the application rate does not exceed the infiltration rate of the soil. This rule promotes efficient use of water and also

addresses non-point source nitrate pollution. (A further rule specifies that irrigation is only permitted if there is a less than 10% increase in peak background levels of nitrate-nitrogen.)

Industrial – No guidelines are used for industrial takes, although the amount applied for must be justified. Industrial users are required to do annual compliance reports for all their consents.

Domestic and stockwater use – A rough guideline is used of 5000 ℓ/week per person, stock use is 60 ℓ/day per cow and 40 ℓ/day per sheep.

Review of existing consents

Consents will be reviewed at renewal for efficient use. Two takes for border-dyke are coming up for renewal soon, and will require more water than the irrigation guidelines. EW are discussing methods to improve efficiency with the applicants.

Measured water use is assessed each year. If the volume taken is considerably less than that allocated, the consent holder will be asked why, and whether they want to reduce their allocation. There are often genuine reasons for taking less. If the volume taken exceeds the allocated amount, the consent holder will be phoned and asked to explain. If the resource is not fully allocated, overtaking can often be addressed by revising the consent. Educating consent holders on ways to use water more efficiently have played a strong role. There have been about 70 cases of over use, only five of which have required abatement notices. Continued non-compliance will be chased up.

Illegal takes

Illegal takes are usually brought to EW attention by neighbours or seen by field officers. Well drillers and irrigation designers can help alert users to the need for a permit.

Permitted takes

15 m^3/day can be taken without consent. For the mainstem Waikato and Waipa Rivers, and for groundwater wells over 100 m from any other well, the permitted take is 30 m^3/day.

The cumulative effect of permitted takes is taken into account in resource assessment. It is unlikely to be an issue until catchments get close to full allocation.

Other Methods

- Education – "Using water wisely" pamphlet

- Riparian planting is becoming commonly required as mitigation for water takes. NIWA have undertaken a study on the values of riparian planting in the Mangatangi catchment. EW offer rate relief for riparian planting for upper catchment landowners who are rated for flood control in lower catchment (the flood control rating is currently before the Environment Court).

- Encouraging groundwater use in preference to surface water

Community Involvement

A draft plan was prepared prior to the proposed plan, and substantial consultation undertaken. In many cases, over 90% of community discussion was directed at the water module. The proposed plan is going through the formal RMA process.

EW staff meet each month with all major Iwi to discuss any relevant issues.

EW want to encourage greater community input and responsibility for water allocation issues by environmental education, consultation and promoting water user groups.

Administration

Duration of consents

Consents are issued for 15 years unless a resource is close to full allocation when a 10-year term will be used. Large consents such as Kinleith mill are issued for 25 years. 10 to 15 years is used on the basis that it is a reasonable time frame for predicting land-use.

Funding

Consent holders are charged an annual fee to cover monitoring and administration. The monitoring charge is for actual costs, with the number of compliance visits per year set on a ranked scale according to the allocated volume, the potential for significant effects, and compliance record. The administration fee is $300 for takes between 50 and 200 ℓ/s and $650 for takes above 200 ℓ/s. A more detailed or sliding scale is being looked at as an incentive to reduce takes.

Consent applications are user pays with a minimum fee of $400.

Enforcement

Consents ranked at the bottom of the monitoring scale are visited once a year, consent ranked at the top are visited four times. Any instance of non-compliance will be followed up by a revisit within a month.

The high value of some crops means that it is often economic to take water outside consent conditions and pay the fine (even as high as $30,000).

Obstacles

- Sufficient information to defend decisions
- Inability to prosecute consultants, drainlayers and irrigation designers/installers who consistently don't inform takers of requirements to obtain permits. At the moment, only the would-be applicant can be prosecuted, even though they were acting on professional advice.
- Public attitude

Measures of success

- Stream monitoring
- Improvements in the efficiency of water use
- SoE monitoring

What is Needed Now?

- Tools for valuing water

- A method for assessing the effects of changing flow variability, which is practical to carryout within the timeframe of resource consent applications.

- Integrating water allocation with land-use controls and water quality. Improving understanding of effects and also testing legal limitations to control of land-use.

- National support for councils who take a situation to the Environment Court for the first time and thereby set precedent. Perhaps a role for developing scenarios and asking for declarations from the court.

- Legal assessment of provisions in plans

- National guidelines for assessing efficient irrigation based on irrigation practices, crops and other relevant factors.

Total quantity of water allocated per week 2,033,567m^3
(Equivalent to a flow of 3.36 m^3/second taken continuously)

Maximum instantaneous take of water m^3/second 4.3 m^3/second
(Take if all consents were used fully and simultaneously)

Maximum volume that can be taken in a year 98,323,900 m^3
(Either as given in consent database or assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Water Sources

Direct takes from surface and groundwater

Surface Water	**% of total weekly allocation**	**Mean Flow (m3/s)**
Waiwakaiho River	21%	8.0
Tangahoe Stream	18%	3.5
Kaupokonui Stream	15%	3.2
Patea River	8%	29.0
Waitara River	7%	129.0
Kapuni Stream	5%	1.4
Waiweranui Stream	4%	
Waiongana Stream	4%	1.8
Waingongoro Stream	3%	9.7
Taungatara Stream	2%	
Waiaua Stream	1%	
Kaihihi Stream	1%	
Other surface water (each source <1%)	7%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
Waitara Groundwater	1%	
Other groundwater (each source <1%)	2.5%	

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Uses of allocated water (by type and source)

Water use (% of total weekly allocation) by type and source

	From surface water	From groundwater	All sources
Domestic, municipal and stockwater	45%	1%	46%
Industrial	39%	2%	41%
Irrigation	12%	1%	13%
TOTAL	96%	4%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Irrigation allocation

Irrigation allocation per week $0.27 \times 10^6 m^3$

(equivalent to 0.4 m^3/second taken continuously)

88% of irrigation allocation is for pasture irrigation

12% is for horticultural irrigation

ENVIRONMENT BAY OF PLENTY
RESOURCE SUMMARY

Total quantity of (cold) water allocated per week — 5,362,066 m^3
(Equivalent to a flow of 8.9 m^3/s taken continuously)

Total quantity of geothermal water allocated per week — 141,783 m^3
(Equivalent to a flow of 0.2 m^3/s taken continuously)

Maximum volume (cold water) that can be taken in a year — 230,025,345 m^3
(Either as given in consent database or assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take of cold water — 18 m^3/s
(Take if all consents were used fully and simultaneously)

Maximum instantaneous take of geothermal water — 0.4 m^3/s

Water Sources Cold Water

Surface Water	**% of total weekly allocation**	**Mean Flow (m3/s)**
Kaituna River catchment	18%	30.4
Waimapu River	12%	2.0
Tarawera River	12%	26.3
Rangitaiki River	10%	71.2
Waitahanui River	5%	
Whakatane River	4%	57.3
Waihi Estuary streams	3%	
Katikati streams	2%	
Waioeka/Otara Rivers	1%	
Other streams/rivers into Tauranga Harbour (all <1% individually)	3%	
Other surface water (each source <1%)	1%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
Tauranga Groundwater	8%	
Te Puke-Maketu Groundwater	7%	
Rangitaiki/Tarawera Plains groundwater	5%	54[a]
Rotorua groundwater	6%	
Galatea groundwater	1%	
Whakatane groundwater	1%	
Waioeka groundwater	<1%	
Other groundwater	<1%	

[a] - Hodges et al Rangitaiki Plains Groundwater Resource Evaluation, Tech. Pub no 2 1991 and Pang, L. - Groundwater resources of The Lower Tarawera Catchment Environment Report 94/3

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Water Sources Geothermal Water

	% of total allocation
Tauranga Harbour and surrounding	70%
Rotorua Tarawera Lakes	19%
Other coastal (Papamoa to Maketu)	11%

Uses of Allocated Water (by type and source)

Cold water use (% of total weekly allocation) by type and source

	From surface water	From groundwater	All sources
Domestic	30%	12%	42%
Industrial	18%	1%	19%
Irrigation	23%	17%	40%
TOTAL	71%	29%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Geothermal water use (% of total weekly allocation)

14% for domestic use and heating
24% industrial use and heating
62% for swimming and thermal pools

Irrigation Allocation

Irrigation allocation per week — $2.13 \times 10^6 m^3$
(Equivalent to 3.5 m^3/s taken continuously)

Allocation from groundwater per week — $0.89 \times 10^6 m^3$

Allocation from surface water per week — $1.24 \times 10^6 m^3$

Total irrigated area — 9435 ha
(Based on irrigated areas reported in consent database)

Water allocated is equivalent to — 225 m^3 per ha per week
or: — 23 mm per week

Percentage of irrigated area by type and source

	Groundwater	Surface water	Total
Arable	0%	<1%	<1%
Pasture	3%	20%	23%
Horticulture	43%	32%	76%
TOTAL	47%	53%	

Note: Based on irrigated areas reported in consent database

Planning Background

Environment Bay of Plenty are currently developing a combined land and water regional plan. A Consultation Draft Water Plan, which described resources, outlined issues and gave management options, was released in 1997. A draft regional water and land plan is expected to be released in mid 2000. There is currently an operative Transitional Regional Plan that contains two relevant general authorisations for the take of water up to 15 m^3 per day, limiting the total surface water take to 30% of the 5-year low flow.

Environmental Bottom Lines

Methods

There is currently a project underway to develop minimum flows for surface water. The method will be based on an IFIM approach, and possibly river ecotyping. It aims to develop a regional approach/framework for minimum flow assessment that can be incorporated as a policy in the regional water and land plan. At present surface water take is managed by setting an amount that can be allocated (up to 30% Q5 7-day low flow), although some municipal takes and dams have residual flow requirements. IFIM methods have been used by some holders of large consents to establish residual flows.

There are monitoring bores for groundwater, but no trigger levels set for restricting groundwater takes. Consent applications to take groundwater above the general authorisation level of 15 cubic metres per day must be accompanied by pump test results and are assessed on a case-by-case basis. There is no long-term downward trend in groundwater levels.

Values Protected

Instream minimum flows will initially be set to protect aquatic life. The Environment B·O·P Heritage Project will identify significant instream values that will need to be taken account of in setting minimum flows. Higher minimum flows may be established to protect heritage values where they are affected by water abstractions.

Limits on Total Allocation from Resource

Method

On an instantaneous basis, the total amount allocated from a surface water resource cannot exceed 30% of the Q5 7-day low flow. This limit is historical and was in place prior to the RMA. On an instantaneous basis, no single take can be greater than 5% of the Q5 7-day low flow.

No limits have been placed on the amount that can be abstracted from groundwater resources. Investigations into the Rangitaiki Plains groundwater (1991) and the Tarawera Plains (1994) indicate that groundwater is abundant enough to adequately meet existing and potential demand.

Takes to storage

Water harvesting is not widely used, but is encouraged.

Fully and Over-Allocated Resources

Based on the 30% of Q5 allocation limit, 7 surface water resources are currently over-allocated. Of these, 6 have municipal takes on them. District/city councils are actively pursuing alternative sources (groundwater), considering installing meters on each household and promoting water use efficiency. Municipal takes come up for renewal in 2026.

A decision on how the over-allocation will be addressed will be made a part of finalising the draft regional water and land plan.

New applications to take from these resources are declined, or encouraged to find an alternative source, to augment water from alternative source, or to take at a lower rate of take and combine storage options if possible. If a consent to take is granted, the take may be metered.

Water takes from those catchments which are under pressure are subject to a compliance review (including a field visit) every two years.

Resources that are not Fully-Allocated

Water is allocated on a first-in first-served basis. The amount of water that could be required for municipal takes in high density areas is assessed.

Reducing Takes in Water-Short Periods

Water takes have never been restricted as the region has not been subject to long periods of drought. High groundwater base flows are attributed with keeping river flows above concern levels. Until minimum flows are in place, falling levels flows would trigger higher frequency monitoring and takes could be stopped using a s329 order.

New applications to take from these resources are assessed on a case by case basis, and consenting also considers the type of activity.

Water Use

Measuring method

- Water meters
- A rough estimate of actual irrigation use was made based on crops, irrigated area and climate. The actual use of consented takes for irrigation is estimated to be around 50% of the allocated amount.

Water meters

Meters are required on all consents to take more than 400 m^3/day and on municipal takes.

Guidelines for reasonable use

A guidelines of 3 to 6 mm water coverage per hectare per day is used for irrigation takes, taking into account soil type, evapotranspiration, land-use type and the irrigation regime proposed.

For small community schemes, reasonable use is based on water required for reasonable domestic needs, stock-watering, small scale irrigation and garden use (15 cubic metres per day). For municipal takes, the buffering effect of any storage /reservoir capacity and whether individual users were metered would be considered.

For industrial takes, the applicant company would need to show a water budget for the plant and detail water management and any conservation measures.

Review of existing consents

If an existing consent is known to take in excess of its allocation as a result of compliance monitoring, the consent conditions are then vigorously enforced.

Permitted takes

The permitted take is 15 m^3/day in relation to specific conditions being met. Permitted takes are not taken into account in assessing the total volume abstracted from a river or stream.

Other Methods

- Promoting takes at nightime to reduce effects on water temperature
- Promoting efficient use in conjunction with district/city councils

Community Involvement

The Consultation Draft Water Plan (1997) was followed by a series of sector group and public meetings. In 2000 a draft regional water and land plan will be issued and widely consulted upon. A proposed plan will then be prepared which will go through the formal RMA process.

Administration

Duration of consents

Most are issued for 10 years to give certainty/security back to the consent holder to allow an adequate return for their capital expenditure.

Most water permits expire 1 October 2026, due to these permits not having an expiry date when the RMA came into being. Only a few were authorisations prior to the enactment of the RMA that resulted in an expiry 1 October 2001.

Funding

Consent holders pay a resource management charge that is made up of a compliance fee and a monitoring fee. The fee goes towards the Compliance Section who carry out site visits, auditing of water use records and compliance related issues. The fee also goes to the Environmental Investigations and Environmental Data Services Sections for on-going monitoring of the resource by the environmental monitoring network, and specific research projects.

Enforcement and administration

Conditions relating to residual flows are enforced by either gaugings downstream of the take or a flow meter.

Abstractors in catchments under pressure are monitored by compliance checks every two years, and in other areas compliance checks are made every five years unless the take is greater than 1000 m^3/day.

Preparation of scientifically defensible annual reports on consent compliance and on the health of the region's environment is carried out. Originally this was done on 5-yearly intervals for all 700 irrigation consents.

Obstacles

- Time and money to do investigations
- Inability to get hold of WaiOra

Measures of success

State of the Environment reporting.

What is Needed Now?

- Practical methods for assessing groundwater availability and how much to allocate
- Addressing cultural aspects for surface water
- Methods for setting minimum flows throughout a catchment from top to bottom (reach specific)
- Temperature modelling

Total quantity of water allocated per week 855,204 m^3
(Based on seven times daily allocations, equivalent to a flow of 1.4 m^3/s taken continuously)

Maximum volume that can be taken in a year 22,204,000 m^3
(Either as given in consent database or assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take 2 m^3/s
(Take if all consents were used fully and simultaneously, based on maximum rate given in consents database.)

Water Sources

Surface Water	**% of total weekly allocation**	**Mean Flow (m3/s)**
Waipaoa River	56%	35.4
Te Arai River	5%	2.1
Whakaahu Stream	3%	
Hangaroa River	2%	16.5
Waimata River	1%	
Other surface water	1%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
Makauri groundwater	14%	
Te Hapara groundwater	7%	
Shallow Fluvial groundwater	5%	
Waipaoa groundwater	3%	
Local groundwater	2%	
Matokitoki groundwater	1%	

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Uses of Allocated Water (by type and source)

Use of allocated water (% of total weekly allocation) by type and source

	From surface water	From groundwater	All sources
Domestic	11%	3%	14%
Industrial	<1%	<1%	1%
Irrigation	57%	28%	85%
TOTAL	69%	31%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Measured Water Use

Meters required since 1990 – estimated take 40% of allocation even in hottest part of summer. Actual annual use is reported annual in State of the Environment report.

Irrigation Allocation

Irrigation allocation per week $0.73 \times 10^6 m^3$
(Equivalent to 1.2 m^3/s taken continuously)

Allocation from groundwater per week $0.24 \times 10^6 m^3$

Allocation from surface water per week $0.49 \times 10^6 m^3$

Estimated irrigated area 5,500 to 7,500 ha
(Based on 1997 Survey of Irrigators [Lincoln Environmental])

Water allocated is equivalent to 100 to 130 m^3 per ha per week
or: 10 to 13 mm per week

Percentage of weekly irrigation allocation by type and source

	Groundwater	Surface water	Total
Arable	1%	1%	2%
Pasture		8%	8%
Horticulture/ Grapes	32%	58%	90%
TOTAL	33%	67%	

Note: Water allocation is used as a surrogate for irrigated area

Planning Background

A lot of GDC's approach to water allocation is based on (government funded) work done in the early 1980s in response to the kiwifruit boom coinciding with dry years. Minimum flows and water meters have been in place for over 15 years. The existing take is estimated to be less than that during the height of kiwifruit boom, in part due to the increase in grape growing, which uses less water than kiwifruit. Two significant industrial takes both sourced from Gisborne city reticulation system have closed down (tomato processing and freezing works). Demand for water is growing and there have recently been applications for consents to take large volumes of water for grape and process vegetable growing. During the kiwifruit boom, there was indication that some water resources were over-allocated and GDC want to ensure that this does not happen again.

A "Water Strategy" will be prepared that will formalise the approach to water allocation. The strategy is seen as the first phase in the preparation of a formal plan under the RMA. The use of a "strategy" developed with a lot of public input, has been used successfully in soil conservation. Implementing the strategy tests the approach on an informal basis, and educates users, before it is adopted in a formal plan.

Environmental Bottom Lines

Methods

Minimum flows have been set since the early 1980s on the Waipa0a River and the more recently in the Whakaahu Stream.

For groundwater, there is a network of monitoring bores, but there are no trigger levels set for restricting groundwater takes. Applications for new consents to take large volumes of groundwater must be accompanied by pump test results and an assessment of effects on the aquifer system.

Values protected

Minimum flows are likely to have been set to protect groundwater recharge and stock water requirements. The rivers are very sediment laiden, only run clear at very low flows and have little value as fish habitat. Native fish exist in the upper catchments where there are no water takes. Native fish assessments for species have occurred only recently and are ongoing.

Limits on Total Allocation from Resource

There are no limits set on the total amount of water that can be allocated from a resource. This will be reviewed during the development of the water strategy. On the Whakaahu Stream, a priority system of high and low flow rights exists.

Reducing Takes in Water-Short Periods

Takes from the Waipaoa and Te Arai are cut-back in two stages when rivers flows drop. At the first trigger flow, increased gauging of river flows is initiated and cut-backs are most often implemented by having alternative sides of the river irrigate on alternate days. If the river flow reaches the second trigger, abstractions (other than municipal or domestic supply) must cease.

GDC have instigated a drought line (1999). Abstractors can phone for information on the monthly level of rivers and likelihood of restrictions if the current weather pattern continues without rain. This drought line will be additional to the existing mailout system that is used to inform abstractors of imminent restrictions.

In drought years irrigators often work out the most appropriate system of cutbacks for a river or stream, that takes into account the water requirements of different crops. On some rivers, abstractors are allowed to transfer their take to an upstream user.

On the Whakaahu Stream, once the second flow trigger is reached the take can be transferred in full or in part between users (with a specified time lag between one take turning off and transferred take starting). This system of transferable water takes has been in place since the early 1990s.

Enforceability

It is reasonably easy to enforce with gaugings and flow meters. Compliance with restrictions has been good in the past.

Water Use

Measuring method

Water meters are installed on about 95% of water takes. GDC has collected the water meter readings annually (using students) and reported annual use in its State of the Environment report.

Water meters

Since 1990, consent conditions have specified the type, accuracy and installation of water meters. Compulsory installation of water meters was implemented in the early 1980s during the kiwifruit boom. There was significant opposition but they are now widely accepted, and seen as beneficial by most irrigators.

Guidelines for reasonable use

An unofficial guideline of 6 mm per day per hectare is used. This could potentially be incorporated into the water strategy.

Review of existing consents

Consents are reviewed at renewal and water take records taken into account. The take is adjusted if required.

Permitted takes

There is a permitted take of 10 m^3 per day per property under the Transitional Regional Plan. Most permitted takes will be from groundwater and for stock, garden irrigation or washdown. Because surface water has too much sediment and groundwater is hard and high in iron, rainwater is the major source of drinking water in the Gisborne region.

Illegal takes are usually bought to the attention of council by the public or by council staff working on the rivers. Drilling companies are reasonably good at informing clients of the need for consents. Some illegal or unconsented takes have been discovered when a property is sold.

Other Methods

Forestry in the catchment may become an issue but at the moment the soil conservation benefits outweigh water yield issues. Gravel extraction is not an issue as most rivers are aggrading, so gravel abstraction has positive benefits.

Community Involvement

The preparation and implementation of a water strategy will involve consultation.

Administration

Duration of consents

Most water permits are issued for 5 years, with some smaller takes issued for 10 years. It is expected that there may be some complaints about the duration, given the requirement to perform a pump test for each application. The short duration is used because of a lack of confidence in review clauses given that no review clause has yet been legally challenged.

Funding

Everything is funded from general rate, except for consent administration which is covered by a $300 fee per application. New applicants are charged actual and reasonable cost. The water strategy will investigate the cost of monitoring and the possibility of funding monitoring from other than the general rate.

Enforcement and administration

The existing system is easy to enforce and administer.

Obstacles to successful implementation

- Funding
- Resources - all water issues addressed by a team of three people
- Staff changes – a formalised approach would help ensure consistency in approach when staff change
- Lack of time to spend on preparing water strategy
- Cost of collecting and analysing water meter data

Measures of success

- Maintain flows in rivers
- Lack of complaints
- Performance of water allocation system in a drought year

Aims and objectives of the allocation system will be set out in the water strategy.

What is Needed Now?

- Information on approaches used in other councils
- Exploring potential of groundwater models as a management tool for groundwater

HORIZONS.MW (MANAWATU-WANGANUI REGIONAL COUNCIL)
RESOURCE SUMMARY

Total quantity of water allocated per week 3,118,453 m^3
(Based on seven times daily allocations, equivalent to a flow of 5.16 m^3/s taken continuously)

Maximum volume that can be taken in a year 133,970,306 m^3
(Either as given in consent database or assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take 5.3 m^3/s
(Take if all consents were used fully and simultaneously, based on maximum rate given in consents database)

These allocations do not include takes for hydroelectric power, some of which discharge water into another catchment or regions.

Water Sources

Surface Water	**% of total weekly allocation**	**Mean Flow (m3/s)**
Manawatu Catchment	23%	116.6
Ohau River	7%	6.4
Rangitikei River	5%	63.1
Whanganui River	4%	216
Whangaehu River	3%	39
Okehu Stream	2%	
Other surface water (all <1%)	1%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
Manawatu Catchment groundwater	32%	
Kai Iwi Catchment groundwater	8%	
Rangitikei Catchment groundwater	5%	
Whanganui groundwater	3%	
Koputara groundwater	2%	
Ohau groundwater	2%	
Mowhanau groundwater	1%	
Whangaehu groundwater	1%	
Other groundwater (all less than 1%)	3%	

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Uses of Allocated Water (by type and source)

Use of allocated water (% of total weekly allocation) by type and source

	From surface water	From groundwater	All sources
Domestic	18%	23%	41%
Industrial	5%	15%	20%
Irrigation	20%	18%	39%
TOTAL	44%	56%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Irrigation Allocation

Irrigation allocation per week — 1.19×10^6 m^3
(Equivalent to 1.97 m^3/s taken continuously)

Allocation from groundwater per week — 0.56×10^6 m^3

Allocation from surface water per week — 0.63×10^6 m^3

Estimated irrigated area — 7,000 ha
(Based on 1997 Survey of Irrigators [Lincoln Environmental])

Water allocated is equivalent to — 170 m^3 per ha per week
or: — 17 mm per week

Percentage of weekly irrigation allocation by type and source

	Groundwater	Surface water	Total
Horticulture	14%	4%	18%
Pasture	11	19%	31%
Unknown	21%	30%	51%
TOTAL	47%	53%	

Note: Water allocation is used as a surrogate for irrigated area.

HORIZONS.MW (MANAWATU-WANGANUI REGIONAL COUNCIL)
OVERVIEW OF WATER ALLOCATION

Planning Background

Historically the focus of water management in Manawatu-Wanganui Region has been on water quality rather than water quantity. Investigations, compliance and state of environment monitoring have all focussed on water quality and water quantity issues have been given a lower priority. The Region is fortunate to receive a plentiful rainfall that provides the resources that can generally cope with present demands in all but the very dry of summers. Areas on the East Coast and on the Rangitikei and Manawatu hinterlands can, however, be prone to water deficits during summer.

Water use is greatest where significant populations are located and where alluvial soils require irrigation of pasture and crops. Water takes are not spread evenly throughout the region and are concentrated in these areas. The last two dry summers have led to an increased demand for irrigation, and a noticeable increase in the volumes of water being applied for. This demand is particularly evident for abstractions related to dairy conversions.

The greatest use of surface water in the Region, however, is for hydropower generation. The headwaters of several streams and rivers are dammed for hydro-electricity and water supply.

There is no formal approach to water allocation in the Region apart from the in the Oroua Catchment which has an operative Water Allocation Regional Plan. The Council has recently notified its Proposed Land and Water Regional Plan, which sets permitted takes for water abstractions. This is the final plan that the Council proposes to release and will instead puts its efforts into developing non-regulatory methods. The preparation of a water allocation policy has been identified as a necessary tool to help guide consents and non-regulatory methods in the future. The preparation of such a document is to commence in 2001.

Oroua Catchment Water Allocation and River Flows Regional Plan 1995

There are currently 20 permits for water abstractions from the Oroua River (8 permits) and its tributaries, the Kiwitea (4) and Makino (4) Streams. Most of the abstractions are for the irrigation of pasture or crops. A town and two rural water supply schemes, and a freezing works/meat packers also abstract water from the Oroua River. The Feilding water supply abstraction is the largest single take from the River. Effluent from Feilding's Wastewater Treatment Plant and the Works also discharge to the River.

Following concern about water quality and availability in the Oroua River, a Voluntary Water Management Agreement (1991) was negotiated and operated by the water users in the catchment. This agreement was replaced by the more formal Oroua Catchment Water Allocation and River Flows Regional Plan in 1995. The plan sets minimum flows for the Oroua River and the Kiwitea Stream and requires rostering and staged reductions in water abstractions. At the minimum flow thresholds all abstraction other than those for domestic, stock and public water supply purposes are banned. The Plan also allows the transfer of water permits (tradeable permits) between members of the irrigators group within the catchment only at times of low flow restrictions.

Since the plan was implemented the Affco operated Beef Packers Works has rationalised its use of water and its dependence on the River – water demand is substantially reduced and wastewater is discharged to land at times of low flows. The Manawatu District Council is also looking at options to augment Feilding's water supply, which at present is totally sourced from the Oroua River. Groundwater and abstraction from a neighbouring catchment are considerations for the Council.

The implementation and enforcement of the plan has not been straightforward due to complications with the flow-monitoring site, and lack of a clear monitoring/enforcement framework in the plan.

Since 1995 there has been only one instance of the exercise of the tradeable water permit provision – transfer from a berry-fruit irrigator to a dairy farmer.

The minimum flow provisions of the Oroua plan are due for review this year (1999/2000). The minimum flows in the Oroua River and its tributary, the Kiwitea Stream were set using the Modified Montana method. The adequacy of the minimum flows to protect the life-supporting capacity and in-stream values will be assessed using the Instream Flow Incremental Methodology (IFIM) along with information collected from invertebrate and fish surveys.

Environmental Management

Surface water

There are National Water Conservation Orders (NWCO's) on two Rivers in the Region – the Manganui-o-te-ao River (1988) and the Upper and mid sections of the Rangitikei Rivers (1993). The orders protect the outstanding characteristics and features of the two Rivers and set minimum flows. They also prohibit the damming of the rivers or their tributaries for hydropower.

Three other rivers in the Region have Local Water Conservation Notices - the Hautapu River (1990), Makuri River (1990) and the Mangatainoka River (1991). The notices identify the rivers as regionally significant and allow for the management of the rivers for their fishery (trout) value as well as their scenic and wildlife habitat characteristics. The clauses for the maintaining the features and characteristics of the rivers have now been included in the proposed Land and Water Regional Plan.

The Tongariro Power Development (TPD) Scheme operated by Genesis Power diverts the headwaters of the Whanganui River (Western Diversion) and the Whangaehu and Moawhango Rivers (Eastern Diversion) for power generation. All this water is diverted out of the Region via Lakes Rotoaira and Taupo into the Waikato River catchment. Following a long court sitting the Planning Tribunal (now the Environment Court) fixed minimum acceptable flows for the Whakapapa River (at the Footbridge site) and the Whanganui River at Te Maire were set for the period 1 December to 31 May inclusive. These clauses are now incorporated in the Proposed Land and Water Regional Plan. There is a voluntary minimum flow on the Moawhango River (below the Moawhango Dam) which is monitored by Genesis (formerly ECNZ), **horizons.mw** and the local community.

It is intended that for other surface waters in the Region, any minimum flows setting will be based on IFIM information. **horizons.mw** has an ongoing programme to complete IFIM studies on all larger streams/rivers in the Region. The Oroua catchment and the upper Manawatu River surveys have been completed with a programme for streams originating from the south-east Ruahine Range to be undertaken this summer. Alongside each IFIM study, is work to identify fish species and their diversity in the particular river or stream. This helps in assessing and selecting particular species for environmental managed purposes.

Implementation

IFIM surveys are time consuming and only a few studies will be done each year. However, given the time it takes to assimilate and use information from an IFIM study, a few rivers/streams a year is an appropriate target. An IFIM study is only the first step in developing a minimum flow and the work needs to be followed by robust analysis and consultation.

Problems with IFIM, Montana Method

Coping with flow regimes under the Modified Montana method (as in the Oroua Catchment Water Allocation Regional Plan) has created some problems for some resource users. The regimes are more restrictive in some months than others (caused by high flow events skewing the mean flows in some months)

Groundwater

There are no environmental bottom lines set for groundwater allocation. The "sustainability" of each consent application is assessed and, if there are reservations, the consent will be granted for a limited term (2 years) allowing for investigatory studies to be done over this period. There is little potential for salt-water intrusion in this Region.

Groundwater levels near Feilding have declined with some existing users experiencing reduced well yields (up to 10% reduction). It is not known how much further water levels can decline before well yields, effects on surface water and/or ground stability become unacceptable.

Limits on Total Allocation from a Resource

There are currently no 'formal' limits set on the total amount of water than can be allocated from a particular resource. Allocation is made on an ad hoc basis that reflects the hydrology, in-stream and recreational value of the resource and the potential adverse environmental effect. The capability of the resources in the Region has not yet been established. A project to map the water resources of the Region is currently logged in the Annual Plan process.

Reducing takes in water-short periods

The only formalised system for cutting back takes is that contained in the Oroua Catchment Water Allocation Regional Plan. This system has been difficult to enforce, and ensure compliance. One of the reasons is the inappropriateness of cutting off a town supply. Once the Territorial Authority has implemented garden watering bans and other water conservation measures (fixing dripping taps, promoting dual-flush toilets etc), further restrictions cannot

be imposed. Other measures such as public education, reducing leakage in pipe system are being encouraged.

Enforceability

The fine for breaking a low-flow provision are unlikely to prevent irrigators from irrigating as the fine is often less than the value of water, particularly for high value intensive cropping. The Oroua Plan has yet to be tested in a significant drought.

Water Use

Measuring method

State of the Environment reporting on water use assumes that all abstractors take their maximum allocation. Most recent consents for large takes have a condition relating to the provision of water use records to **horizons.mw.** However, reality is that this information is often not collected, and very rarely analysed. Some have conditions requiring that a water meter be installed – but this is seldom carried out.

Water meters

Groundwater abstractions involving volumes of greater than 3000 m^3/day are metered. Most new consent holders do not question the metering requirement. However, there is considerable public suspicion of meters and little recognition that water meters provide valuable information to users.

Water metering for surface water abstractions would require considerable resources to collect and collate the information. How this information is to be gathered and used would need to be carefully considered before meters were considered further. Meter accuracy is also an issue. The practicalities of meters and other monitoring within the non-regulatory approach have still to be worked through.

Guidelines for reasonable use

A general guideline of an irrigation depth of 25 to 50 mm per week is used for pasture, with variations for different soil types.

Permitted takes

Permitted takes figures for the Region are 15m^3/day for surface water and 50 m^3/day for groundwater. The groundwater figure is a proposed increase from 15 m^3/day – the new figure is documented in **horizons.mw's** Proposed Land and Water Regional Plan (notified May 1999). Of the 12,000 groundwater takes in the region, 11,700 are permitted takes.

The cumulative impact of permitted surface water takes is recognised as a potential issue particularly for small streams with a high density of permitted takes. The number and location of permitted surface water abstraction is unknown.

Illegal takes

Illegal takes are generally brought to the attention of **horizons.mw** by complaints. Illegal takes are not considered as much of an as issue as people taking more than they are allocated.

Other methods

Small farm dams are frequently used as a source of farm water. Most of these are permitted activities and the cumulative effect of these dams on surface water yields needs to be investigated.

Horizons.mw has recently joined into an Irrigation Efficiency Project with Hort-Research which will potentially highlight how much water can be saved by incorporating risk management techniques and improving irrigation practice.

Community involvement

Community involvement in the preparation of the voluntary agreement and subsequent plan on the Oroua was quite high and included the irrigators, DoC, Fish and Game, and Iwi.

Administration

Duration of consents

Most permits to take natural water are issued for terms ranging from 5 to 10 years. There are a few permits in the Region which have terms in excess of 25 years. If there is some concern about the environmental effects of a take, the consent will be issued for 2 years pending the results of investigations.

Funding

There is an annual charge on water takes that is proportional to the daily-allocated take (a $30 base charge plus 24c per cubic metre for surface water or 15c per cubic metre for groundwater). A third of this money goes into resource monitoring programmes with the remainder used to fund investigation work.

Enforcement and administration

Given the emphasis on non-regulatory methods, there is not much effort put into enforcement of the water allocation regime. There is some concern that there is little incentive for irrigators to comply and that relying on interest groups such as the Fish and Game Council or DoC to draw attention to breaches will not protect the environment.

Without plans, it is difficult to see how resource investigations, consents, compliance, data management and state of environment reporting can be combined to manage water resources in an integrated manner. The preference for policy tools that apply over a whole region rather than on a catchment basis leads to very general measures that do not recognise the specific features of a catchment/water body. Public education and advocacy can be successful tools for encouraging efficient water use, but there is some doubt if they can be used to successfully implement minimum flows and allocation limits.

What is Needed Now?

- A practical equivalent to IFIM for small streams
- Ability to take into account the effects of temperature when setting minimum flows
- Effective use of GIS systems
- National indicators relating to water availability and allocation
- Raising profile of water allocation issues to politicians, water users and to public
- A national guideline on what to consider in a water allocation framework and options for addressing. There is no need for all councils to reinvent the wheel.
- The effect of farm dams on small streams

Obstacles

- A significant decrease in funding in water resource area. Previously there was NAWSCO funding for catchment studies, and advice from government-funded scientists was available free of charge.

- Contestable science funding requires that multiple councils support a project. However, from a local standpoint, the issues that are common with other councils are not necessarily the most important.

Total quantity of water allocated per week 10,140,868 m^3
(Equivalent to a flow of 16.8 m^3/s taken continuously)

Maximum volume that can be taken in a year 371,760,000 m^3
(Either as given in consent database or assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take 47 m^3/s
(Take if all consents were used fully and simultaneously)

Water Sources

Surface Water	**% of total weekly allocation**	**Mean Flow (m3/s)**
Tukituki River catchment	15%	50
Ngaruroro River catchment	9%	45.5
Esk River catchment	1%	5.47
Tutaekuri River catchment	1%	16.1
Waiau River catchment	1%	70.7
Other surface water (each source <1%)	6%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
Heretaunga groundwater	58%	187.9[a] (1994/95 calculation)
Ruataniwha underground	6%	
Esk underground	1%	
Moteo underground	1%	
Otane underground	1%	
Other groundwater (each source <1%)	1%	

[a] – Dravid, P. N. and Brown, L. J 1997 Heretaunga Plains Groundwater Study. Hawke's Bay Regional Council and Institute of Geological and Nuclear Sciences.

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Uses of Allocated Water (by type and source)

Water use (% of total weekly allocation) by type and source

	From surface water	From groundwater	All sources
Domestic	8%	13%	21%
Industrial	1%	10%	11%
Irrigation	23%	45%	68%
TOTAL	33%	67%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Measured Water Use

Heretaunga Groundwater Study – Water Use 1994/95

All abstractions for industrial and the major public water supplies from the Heretaunga Plains aquifer are metered. In 1994/95 summer analysis of pump power consumption was made to estimate actual water used for irrigation.

Analysis of actual use in the 1994/95 year

Domestic/urban water use was 43% of yearly allocated volume
Industrial use was 37%of yearly allocated volume
Irrigation use was 23% of allocated volume
Overall use was 28% of allocated volume.

Surface Water Assessment – 1994/95

A survey of irrigators by HBRC in the 1994/95 season indicated that surface water consents representing 12% of the allocated surface water volume were inactive.

For those surface water consents where there was sufficient information to make an assessment of actual irrigated area, on average 64% of the consented area was actually irrigated.

135 of the 316 surface water consents included in the survey results had sufficient information to estimate weekly use. The total weekly volume used was 50% of the weekly allocation.

Irrigation Allocation

Irrigation allocation per week — $6.84 \times 10^6 m^3$
(Equivalent to 11.3 m^3/s taken continuously)

Allocation from groundwater per week — $4.56 \times 10^6 m^3$

Allocation from surface water per week — $2.27 \times 10^6 m^3$

Total irrigated area — 23,242 ha
(Based on irrigated areas reported in consent database)

Water allocated is equivalent to — 294 m^3 per ha per week
or: — 29 mm per week

Percentage of irrigated area by type and source

	Groundwater	Surface water	Total
Arable	22%	13%	35%
Pasture	5%	11%	16%
Horticulture	39%	9%	49%
TOTAL	66%	33%	

Note: Based on irrigated areas reported in consent database

Planning Background

HBRC released a draft Hawke's Bay Regional Resource Management Plan in May 1999. This will replace the Regional Water Resources Plan (1998). The new plan will build on measures contained in the Water Resource Plan, and further develop water allocation policy. While the draft plan released in May sets out many aspects of the water allocation framework, staff are still working through a number of issues.

A statutory plan provides a clear and defensible statement of the Councils intentions and provides certainty for the public and markets. The legal backing and enforceability provided by a statutory plan under the RMA is important to the council and all other interests. Preparation of a statutory plan requires public debate and increases public understanding and "buy in".

Water allocation measures will be reviewed as part of the plan review process and will be closely linked to a State of Environment report in the year prior to plan review.

There is growing demand for water in Hawke's Bay, particularly for grapes and dairying.

Environmental Bottom Lines

HBRC are currently conducting a "Low Flow Project" that will set minimum flows on all surface waters. Analysis has been carried out on the major rivers. In some cases, the recommended minimum flow is above the current minimum flow and consultation with users is underway.

There is not yet sufficient analysis of groundwater resources to enable setting of environmental bottom lines. Monitoring of Heretaunga Plains groundwater levels over the last 20 years indicates a slow decline in levels of 5 cm per year (for a 130 m thick aquifer). Monitoring of Ruataniwha Plains since 1992 indicates a more noticeable downward trend but the rate of decline has still to be accurately determined. Some areas are identified as water short areas but it is not clear whether wells go dry in these areas due to lack of water in the aquifer or to poorly designed wells. Modelling of the Heretaunga Plains aquifers, and investigations of the Ruataniwha aquifers, are underway to address groundwater management issues.

Methods

- IFIM combined with measures of water quality, dissolved oxygen and temperatures, and allow for landscape and cultural values.
- Are working on developing a simplified method for smaller streams.

Values protected

The choice of IFIM was driven by the Water Resources Plan which identified an objective of sustaining existing aquatic ecosystems. The Plan also recognised landscape, recreational and cultural values. Generally, providing for aquatic habitat fulfils other requirements but the minimum flow can be set higher than that needed for habitat to allow for other values. Flows that provide for macroinverterbrate and eel habitat are used as a starting point to quantify flows needed for Maori cultural values.

Problems with method

IFIM is time consuming and the window for carrying out IFIM is small given the fast weed regrowth in the wide gravel bed rivers. Realistically IFIM studies can be done on only one river each year and a standardised, easy to apply method is needed for smaller streams, similar to the Montana Method but adapted for Hawke's Bay catchments.

It is also difficult to adequately determine and take account of cultural values when setting environmental bottom lines.

Limits on Total Allocation from Resource

Method

For surface water, the maximum amount of water that can be allocated from a resource is the 7-day average flow that is exceeded 95% of the time over the summer months (less the minimum flow). The limit is set based on weekly volumes allocated during the summer.

For groundwater, pump tests are used to indicate whether a new abstraction will exceed the safe yield of the aquifer. The sustainable yields of the aquifers are not yet calculated.

There is only minor storage of water occurring. There is some interest in abstracting water above the allocation limit during times of high summer flow. HBRC are considering how to approach this issue.

Reason

The setting of allocation limits is a new measure contained in the draft plan. It is used to provide a specified risk and security of supply to existing and potential irrigators. The allocation limit provides certainty to users and recognises the large investment required for the sophisticated irrigation systems that are being installed. Another consideration is the need to ensure sufficient flushing flows for removal of weed growth. The allocation limits allow the continuation of existing water permits in the case of most rivers.

Setting an upper limit is simpler to administer and enforce compared to a priority system or a system of step-wise cut-backs.

Reconciling Allocation Limit with Current Allocation

Over-allocated resources

Addressing over-allocated resources is an issue that HBRC will debate over the next couple of months. It is only in the last year that allocation limits have been set and the implications have yet to be realised by water users. Closely related to the issue of over-allocated resources is the difference between allocated volumes and actual use.

Transferable water permits are definitely an option, particularly as demand begins to exceed supply. One of the biggest obstacles will be overcoming public opposition to individuals apparently owning a resource. Another issue is ensuring sufficient planning control is maintained over where and how water is abstracted.

Resources that are not fully allocated

Council operates a first-up first-served approach to new applications to take water and is opposed to priorities being set for particular activities.

Reducing Takes in Water-Short Periods

When a river reaches its minimum flow all water permit holders must stop abstraction. Abstracters are warned by fax/phone/email about 48 hours in advance. Keeping abstracters informed of summer river flows is being addressed as part of an information strategy. River flows will be published in newspaper and on website. Resource consent conditions give the minimum river flow at which abstraction must cease.

Work is still required on methods to work out connectedness of groundwater takes to surface water and to what extent connected groundwater takes are subject to irrigation bans.

HBRC have tried to establish water-users groups (for surface water) so that rostering could be used to extend the time that water was available. Groups haven't established and setting up successful groups would require substantial input from council staff.

Enforceability

The system is easily enforceable/monitored and means that Council does not need to resort to a s329 notice. Once the minimum flow is reached no-one should be irrigating. Some unconsented takes have been picked up during irrigation bans.

Water Use

Measuring method

Only a few takes are currently metered:

- Water meters – currently on some big takes and proposed for other takes (see below)
- Some one-off studies
- Farm survey of surface water actual takes (1994/95)
- Power consumption records for Heretaunga groundwater (1994/95)

Water meters

It is proposed to put water meters on:

- All takes from rivers where an allocation limit has been set
- All takes greater than 5000 m^3/week – on the basis that metering these takes (30% of takes) will measure 70% of water allocated.
- Industrial and public water supply takes – already metered

For those takes that require water meters, a condition requiring water meters will be added when the consent comes up for renewal. Takes from all the major rivers are due for renewal in the next few years.

Water metering is not popular, particularly retro-fitting meters on to existing irrigation systems. The additional expense of adding a water meter to a new system is small, compared to the cost of irrigation equipment etc.

Guidelines for reasonable use

Water is allocated on weekly basis taking into account crop and climate and based on providing enough water for 1 in 5 year drought. A Land Management Officer specialising in irrigation advice has just been employed by the Council and will promote efficient water use, and in the case of groundwater takes – efficient wells.

Review of existing consents

All consents contain statements that conditions can be reviewed, but there are no routine reviews of consents. It is a reasonable assumption that irrigators will not take more than they reasonably require, particularly with groundwater where there are costs associated with pumping.

Permitted takes

Up to 20 m^3/day can be taken without consent except from water short areas. Permitted takes are not subject to any minimum flows. Estimates of the volume abstracted by permitted takes will be calculated for State of Environment reporting.

Illegal takes are usually bought to the attention of council by neighbours and are not considered to occur enough to be a concern.

Other Methods

- Encouraging district/city councils to limit subdivision and intensification in water short areas.

- The issue of forestry in catchment has been discussed, however, forestry is seen as advantageous in a catchment due to land-stabilisation.

- Land Management Officer specialising in irrigation advice to promote efficient water user.

Community Involvement

Community involvement will be through the formal RMA consultation process. An Issues and Options document was released earlier to introduce new concepts such as allocation limits.

Administration

Duration of consents – Normally 10 years, some non-notified consents are issued for 20 years. If there are very few issues in a catchment then consents will be issued for longer. Similarly fully allocated catchments may have shorter duration permits.

Funding

Investigations and State of Environment Reporting are funded from the general rate.

Water permit holders are charged an administration charge and a low-flow monitoring charge.

Enforcement and administration

Easy to administer and enforce particularly due to legal backing of a statutory plan that has been through the public consultation process.

Obstacles

- Funding
- Need for a well-defined approach to all aspects of water allocation – is being developed
- Lack of information on resources and actual take

Measures of success

- State of Environment programme will pick up some measures related to water allocation
- Compliance monitoring programme
- No inquires to take water from over-allocated resource
- Straightforward consent processing

These are all measures of whether the allocation system is doing what it is supposed to (e.g. maintain minimum flow) but how do you evaluate whether minimum flow was too conservative or not conservative enough in the first place?

What is Needed Now?

- Method for IFIM equivalent in small streams that can be easily applied to multiple streams
- Further understanding of catchment scale forestry yield effects
- Incorporating Maori cultural values into a water allocation system
- Increased understanding and management of groundwater/surface water interactions
- Method for coping with rivers that go dry
- Approach to evaluating whether an environmental bottom line works and how conservative it is.
- a process for review of both (existing) over allocated resources and for reviewing the minimum flows upwards and the allocable volumes downwards if that should be the case under a monitoring programme.

A national standard or method for water allocation is inappropriate given the variety of resources, values, communities, and council staff/resources. However, the identification and development of options for addressing common issues such as over-allocated resources or how to set upper allocation limits would be a useful and effective national study.

Total quantity of water allocated per week 5,908,450 m^3
(Based on seven times daily allocations, equivalent to a flow of 9.8 m^3/s taken continuously)

Maximum volume that can be taken in a year 253,900,000 m^3
(Either as given in consent database or assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take 11.8 m^3/s
(Take if all consents were used fully and simultaneously, based on maximum rate given in consents database.)

Water Sources

Surface Water	**% of total weekly allocation**	**Mean Flow (m3/s)**
Ruamahanga catchment	33%	84.0
Hutt River	12%	25.2
Wainuiomata River	3%	2.5
Orongorongo River	3%	2.0
Other Wairarapa streams (each <1%)	2%	
Other western streams	<1%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
Hutt catchment groundwater	19%	89
Lower Ruamahanga groundwater	8%	78[b]
Lake Wairarapa groundwater	2%	incl above
Kapiti Coast groundwater	5%	32[a]
Waiohine groundwater	4%	27[b]
Masterton groundwater	4%	37[b]
Ruamahanga groundwater upstream of Martinborough	2%	33[b]
Upper Ruamahanga River flats	2%	18[b]
Tauherenikau groundwater	1%	58.2[b]
Other groundwater		

[a]Cussins 1994 - Estimation of Safe Aquifer Yields for the Kapiti Coast Area and Wainuiomata Catchment, Wellington Regional Council
[b]Butcher, 1996 Safe Yield Estimates for Identified Aquifers in the Wairarapa Valley, Wellington Regional Council

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Uses of Allocated Water (by type and source)

Water use (% of total weekly allocation) by type and source

	From surface water	From groundwater	All sources
Public water (incl stock water)	36%	20%	56%
Industrial	1%	3%	4%
Irrigation	16%	24%	40%
TOTAL	53%	47%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Measured Water Use

60 to 65% of the weekly volume allocated has meters.

Groundwater use from the Hutt aquifer in 1996/97 was 21,100,000 m^3 , which is about 37% of the allocated volume.

Irrigation Allocation

Irrigation allocation per week — 2.37 x 10^6 m^3
(Equivalent to 3.9 m^3/s taken continuously)

Allocation from groundwater per week — 1.41 x 10^6 m^3

Allocation from surface water per week — 0.96 x 10^6 m^3

Total irrigated area — 9,273 ha
(Based on irrigated areas reported in consent database)

Water allocated is equivalent to — 261 m^3 per ha per week
or: — 26 mm per week

Percentage of irrigated area by type and source

	Groundwater	Surface water	Total
Pasture/Arable	10%	6%	16%
Horticulture/ Wine	6%	<1%	7%
Unidentified	44%	34%	77%
TOTAL	60%	40%	

Planning Background

The need for a comprehensive approach to allocating water in the Wellington Region was given a high priority by the Wellington Regional Council about six years ago. At that time conflicts were arising in some water bodies. Some catchments had water strategies or informal or draft plans in place. It was decided to address water allocation issues through the development of a statutory regional freshwater plan. The preparation of a region wide statutory plan was considered by the Council to be the best option for it to address water allocation issues in a comprehensive and consistent way. A lot of resources went into finding a satisfactory approach. These efforts have resulted in the provisions of the Regional Freshwater Plan ("the Plan"). It provides for flows and water allocation in specific rivers in the Region where there is the potential for water to be over allocated. The Plan also includes safe yields for groundwater resources of the Region.

Following technical work and consultation, the Plan was notified. The Plan is consistent with historical plans and strategies and with differences among catchments in important values and management approaches. There were only six submitters on river flows, safe groundwater yields and water allocation. These were all on matters of detail rather than principle. All these submissions have been resolved and the Plan is now operative. The approach taken in the Plan has the support of the community. It also works well in practice. It has been implemented in a number of big resource consent applications (e.g. Masterton water supply, Wellington water supply, Waikanae water supply) as well as applications for smaller takes.

Now that the Council has established a satisfactory approach to water allocation for the Region its priorities are to implement the Plan and to develop, through non-statutory methods, greater user awareness of water conservation and more efficient means of using water.

Environmental Bottom Lines

Method - Surface water

For larger rivers in the western part of the Region (the Otaki, Waikanae, Hutt at Kaitoke, Wainuiomata at Leonard Wood Park, and Hutt at Birchville) the minimum flow is based on habitat methods. For smaller rivers in the western part of the Region (the Waitohu, Mangaone, and Orongorongo,) the minimum flow is based on maintaining 60% of the 1 in 20 year low flow. Some of these smaller rivers are subject to drying up under natural low flow conditions but the frequency and duration of dry periods is increased by water use. The minimum flows in the Plan represents an enhancement of flows present at the time the Plan was notified.

For some larger rivers in the eastern (Wairarapa) part of the Region (Tauherenikau, Waiohine, Waingawa, Kopuaranga) the minimum flow is based on water allocation plans prepared prior to the Act being passed into law by Parliament. Minimum flows for the first three of these rivers are based around historical methods using the one in five year low flow. The minimum for the Kopuaranga River is based on achieving a 150 mm depth in the river at its confluence with the Ruamahanga River, for the migration of trout. The minimum flow for the Ruamahanga at Waihenga, is based on water quality requirements. The flows for all

these rivers in the Wairarapa are greater than habitat methods would provide because significant losses to groundwater can occur in the beds of these rivers.

As well as using habitat or historical methods as a basis for arriving at the minimum flow, other relevant matters have been considered such as losses to groundwater (where that information is available) and the views of interested people during consultation in the preparation of the Plan.

For streams/rivers where there is insufficient information to set minimum flows, the Plan contains a policy that they shall be managed by having regard to the significance, scale/magnitude and reversibility of effects on natural, amenity and tangata whenua values. Historical flow methods are recommended as a general guide for minimum flows with habitat methods to be considered if the mean annual low flow is greater than 1 m^3/s.

Policies in the Plan provide various purposes for the management of all surface water bodies. Purposes relate to natural character, nationally threatened indigenous fish or aquatic plants, trout habitat, significant recreation/amenity values, or water supply. These purposes are relevant when flows are considered.

Method - Groundwater

Groundwater trigger levels have been set in two aquifers. In the Lower Hutt groundwater zone a level is set to maintain flows in undersea springs and prevent salt water intrusion. In the Moroa aquifer, groundwater takes will be restricted to ensure water can still be abstracted in all areas of the aquifer. "Safe yields" have been established for all aquifers in the Region based on annual water balance calculations. Safe yields for ground water are intended to:

- Protect aquifers from any physical damage;
- Ensure availability of the resource;
- Avoid saline intrusion; and
- Maintain spring flows.

Implementation

Policies in the plan state aquifer safe yields and minimum flows for those rivers where there is sufficient information and the potential exists for water shortages. Rules state that groundwater abstraction shall cease at the specified trigger levels in the Hutt and Moroa aquifers.

Minimum flows will be developed for other rivers where there is currently insufficient information to include them in the Plan and the potential exists for water shortages – these rivers are identified in a method in the Plan and investigations are incorporated into the Regional Plan Implementation Programs. The Council has already begun addressing river flows and water allocation for some of these rivers in ways that are consistent with the approach already used in the Plan. In due course they will also be included in the Plan.

The majority of consents within the region have or will come up for renewal before 2001 and conditions include or will include minimum flows.

Limits on Total Allocation from Resource

Policies in the plan contain safe yields for all groundwater resources and "core allocation" and "supplemental allocations" for all rivers where there is sufficient information to set a minimum flow.

Method - Surface water

The core allocation for surface water sets the quantity of water that is available to be taken in all but low flow conditions. It was originally set as the difference between a historical flow statistic (e.g. the 1 in 5-year low flow or 50% of 1 in 10 year) and the minimum flow, and adjusted, if appropriate, following consultation. In some cases, the core allocation was set equal to the existing allocation.

Policies in the Plan also identify a flow at which "supplemental" allocations can be taken from surface water. This is intended to allow abstraction to storage facilities during time of high flow. There is no upper limit on the supplemental take, and procedures for reducing supplemental takes have yet to be developed (have not been needed as yet). At the moment they would be considered on a case by case basis.

Maximum allocation for a river was set after consideration of the following:

- Hydrological characteristics of the river;
- Current and potential water uses and needs; including reliability of supply;
- The availability of water storage; and
- Information on losses to groundwater (including groundwater abstractions) and groundwater recharge, when it is available.

Method - Groundwater

The "safe yield" for groundwater is calculated using an annual water budget based on estimated average annual recharge in the Western region, and the average of average annual recharge and estimated throughflow in the Wairarapa. The allocation limit for the Lower Hutt groundwater was calculated with a computer model (MODFLOW).

Time periods for setting allocations

For surface water bodies, allocation limits are for instantaneous takes. For groundwater, allocation limits are for a combination of instantaneous, daily and annual takes.

Fully and Over-Allocated Resources

This issue has been addressed, to some extent, during the preparation of the Plan. When the Plan was notified, five water bodies in the Region were over allocated. Since then, the process for renewing resource consents has enabled the Council to reduce the number of over allocated resources. Now that the Plan is operative, only one water body in the Region, Lower Hutt Groundwater, is regarded as over-allocated. It is only nominally over allocated.

Allocations have been reduced through reviewing consents when they come up for renewal. A lot of consents came up for renewal in 1996 – five years after the RMA. If a resource is found to be over-allocated now that the plan is operative, it can be altered by a plan change or

at the time the Plan is reviewed. Review of the amount allocated is provided for in Section 35 of the Act and in the Plan itself.

Allocations from the Lower Hutt groundwater zone have been reduced by two methods. Firstly, implementing an annual allocation for public water supply takes, and weekly allocations for industrial takes. Secondly, the WRC as the bulk water supplier, approached industrial users and paid for their consents to be renewed provided industrial users were prepared to reduce their allocation to an amount consistent with their actual take. All takes from the Lower Hutt groundwater zone are metered.

For an over-allocated resource, both new applications and renewals for water are non-complying activities if the abstraction rate exceeds the amount allocated. Therefore, consents can only be granted if the effects of the abstraction are less than minor. For other water resources, new applications or renewals are discretionary activities that must have regard to the policies of the Plan.

Transfer of water permits

The use of tradeable permits was considered when the Plan was prepared. Chris Liversey of Tonkin and Taylor prepared a report for the Council on the use of tradeable permits in the Region. His report did not recommend their use but made some suggestions for ongoing work that might lead to their use. These included ensuring there is sufficient information on an under-pressure resource and its users, and assessing for at least two water bodies whether it is worthwhile to develop methods for facilitating transferable water permits.

Resources that are not Fully-Allocated

Consents are dealt with on a first-in first served basis. However, consents to take for public water supply are often for more than is currently taken and sometimes allow for increased demand.

Reducing Takes in Water-Short Periods

Policies in the Plan provide for core allocations to be "stepped down" when minimum flows are reached in rivers. For most rivers, two step down allocations are included. In other rivers, where the user is able to provide storage, abstractions are cut off at the minimum flow. For some rivers there are specific cut-back systems that are not detailed in the plan. Irrigators work out the best method of reducing takes, including only irrigating 12 hours a day or on alternate days. Groundwater users must cease taking in the Lower Hutt groundwater zone or the Moroa aquifer once the aquifer reaches its minium operating pressure.

In practice, when rivers approach the flow when consent holders need to "stepdown" their takes, they are advised of the state of the river and notified further when "stepdown" needs to occur. If possible, two to three days warning is given saying that if weather pattern continues then the river is expected to drop below the trigger flow. Where the majority of abstraction is for large public water supply, the supply authority often has an internal control system, which will reduce the take as the limits are approached. In river and streams not yet addressed in the Plan, emergency provisions of the Act (s329) would apply.

Enforceability

The stepdowns and minimum flows are detailed in resource consent conditions. Older consents state that the abstractor will comply with any rationing implemented by the Council. As consents are renewed this will be replaced with quantitative values.

User-input

User Groups have had a lot of input during the preparation of the Plan. A method in the Plan looks at the feasibility of employing "user committees" to assist in minimising the effects of any water restrictions on consent holders. There are no formal groups as yet.

Water Use

A Discussion Document on Water Permit Metering Options was prepared in 1995. It looked at options for metering including which takes to meter, type of meters, accuracy, data management and possible consent conditions. It recommended meters for water supply takes and takes in fully-allocated catchments.

Currently, actual use is measured for large water supply or industrial takes and all takes from the Lower Hutt groundwater zone. An emphasis is placed on applicants only applying for water that they use. Finding cost effective ways of reconciling actual takes with consented takes is one area of further investigation that we support. Using the allocated volumes to assess pressure on a resource, when actual use is not known, errs on the side of caution. Approximately 60% of the allocated volume is metered.

Groundwater use from the Hutt aquifer in 1996/97 was 21,100,000 m^3, which is about 37% of the allocated volume.

Water meters

The need for water meters is based on whether water allocation is an issue in the water body and the size of the take. In practice, metering is usually only required for large water users, such as water supply takes, and for industrial users. The use of water permits raises issues related to the time and resources needed to collect and analyse data.

Guidelines for reasonable use

A guideline of 350 mm/ha/week is used as reasonable irrigation use. At present, Victoria University are doing further work for the Council in this area. Auckland Regional Council's Wastewater Approach (TP 58) is sometimes used when considering water volumes for waste disposal. This is an area where the Council supports further research.

Review of existing consents

The amount of water taken can be reduced when applications are made for resource consents but, to a large extent, the Council has to rely on information provided by the applicant. Metered takes provide appropriate information. Otherwise, estimates are made or other information used such as pump size.

In the Wairarapa a portable water meter has been used to assess flows in most takes greater than 20 ℓ/s. The one take that was over-abstracting was asked to apply for a variation in consent conditions. It was not in an over-allocated resource.

Illegal takes/Unutilised takes

Complaints from the public are sometimes made. Some unutilised takes were surrendered when s36 charges were implemented. Targeted resource investigations can also provide relevant information. Also, takes are inspected when resource consent renewals are made.

Permitted takes

Under a rule in the Plan, permitted abstractions are 20,000 ℓ/day at a rate of no more than 2.5 ℓ/s. The Lower Hutt groundwater zone is excluded and all takes require a consent. The amount is based on what has been allowed historically through General Authorisations under previous legislation. The main justification is that adverse affects have not occurred in the past and the Council receives no complaints about adverse effects at present.

The Council is currently targeting areas for investigation where problems might arise. The intention of these investigations is to establish whether the assumption is correct that permitted takes of 20,000 ℓ/day do not have cumulative adverse effects.

Other Methods

The Wellington Regional Council is responsible for managing and operating the wholesale water supply for the Wellington metropolitan region. This involves collection, treatment and delivery of water to the cities of Lower Hutt, Porirua, Upper Hutt and Wellington. This operational arm of the Council is managed separately from the administration of Resource Management Act functions. A number of initiatives relating to water conservation and efficient use of water are carried out when water is supplied.

There are a number of methods in the Plan relating to water conservation and efficient use of water. A document looking at water conservation issues and prioritising the available methods has been prepared and is being implemented through the Council's Implementation Program for its Regional Policy Statement. High priority tools recommended were common expiry dates for a catchment, encouraging reduced takes on consent renewals, develop stepdown systems for restricting take in low flow periods, compliance inspections, low flow monitoring, consumption targets (reasonable use guidelines), water meters, encouraging groundwater over surface water, education newsletters, investigating permitted activities and user committees.

Community Involvement

The approach taken in the Plan relies on community involvement and the application of scientific methods (e.g. IFIM). A key factor has been obtaining consensus within communities before notifying any statutory documents. This has involved:

- Ensuring there is sufficient technical information;
- Consultation with agencies and groups; and
- The preparation of, and feedback on, discussion documents and draft plans.

User Groups have had a lot of input during the preparation of the Plan. This has resulted in only a few submissions on the Plan. User groups will also have the opportunity to be further involved during the implementation of the Plan, including looking at the feasibility of employing "user committees" to assist in minimising the effects of any water restrictions on consent holders.

Administration

Duration of consents

Generally, for water bodies where information about the resource is satisfactory:

- 20-35 years for large public water supply takes; and
- 10-15 years for other water takes.

Where there is insufficient information on the resource, consents are granted for 2-3 years.

Funding

A water levy is charged to cover compliance monitoring and consent administration. In stressed catchments, a charge is added for state of environment monitoring. The charge covers a percentage of the cost of information gathering and each user is charged proportional to their rate of take.

Water resource investigations and water resource monitoring are largely ratepayer funded (general charge), other than the State of the Environment charge. Water resource planning comes entirely from ratepayer (general) funding. Applications for resource consents and consents compliance are fully user pays.

Enforcement and administration

Reasonable easily. The consideration of cumulative takes rather than individual takes is more complex.

Obstacles

For groundwater and rivers where flows and allocations have been established, there are no obstacles. For other rivers, the main obstacle is obtaining appropriate information to establish flows and allocations according to the methodology used by the Plan. A successful allocation system relies on informed users and decisions made on good information.

The removal of non-complying activities from the Act would be an obstacle because it would remove an appropriate tool for managing over allocated water resources.

Measures of success

- Consent compliance;
- Monitoring the effectiveness of regional plans; and
- State of the environment reporting.

What is Needed Now?

There is already sufficient information on various methodologies for regional councils to allocate water and establish minimum flows in rivers. These methodologies require:

- Sufficient data on physical (e.g. hydrology) or biological characteristics of rivers, which will differ from river to river;
- Sufficient consultation;
- Establishing the purpose for which a river is to be used; and
- Above all, a commitment by decision makers to establish water allocations and flows for rivers.

Information and research on methodologies for rivers is not a priority for the Council. Our current emphasis is on implementing the methodology used in the Plan. This includes collecting information and consulting on rivers identified in the Plan where there is not yet enough data to establish flows and allocations. The Council is also giving priority to non-statutory approaches that promote more sustainable practices, such as water conservation and more efficient use of water.

Notwithstanding, it is acknowledged that there are benefits in researching and collecting information on better ways of allocating water for future consideration. The following particular items emerge:

1. Improving and adding to guidelines on the amounts of water needed for particular activities (e.g. irrigation);
2. Finding better ways of reconciling actual takes vs consented takes;
3. Improving methodologies for establishing sustainable groundwater yields; and
4. Improving methodologies for assessing stream water depletion resulting from groundwater abstraction.

Total quantity of water allocated in direct takes per week — 3,732,721 m^3
(Equivalent to a flow of 6.2 m^3/s taken continuously)

Total quantity of water allocated from storage per week — 315,047 m^3
(Equivalent to a flow of 0.52 m^3/s taken continuously)

Maximum volume that can be taken in a year — 129,143,654 m^3
(Assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take — 19.5 m^3/s
(Take if all consents were used fully and simultaneously)

Water Sources

Surface Water	**% of total weekly allocation**	**Mean Flow (m3/s)**
Waimea Catchment	16%	16.5
Moutere River	9%	0.54
Motueka River	8%	60.3
Takaka surface water	2%	>29.5
Riwaka River	2%	4
Marahau surface water	<1%	
Westland surface water	<1%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
Waimea groundwater	31%	840[a]
Motueka/Riwaka Plains Groundwater	18%	120[b]
Upper Motueka Groundwater	6%	
Moutere groundwater	3%	
Takaka groundwater	2%	
Marahau ground water	<1%	
Westland groundwater	<1%	

[a] Fenemor, A, 1988. A three dimensional model for management of the Waimea Plains aquifers, Nelson. Publication No 18 of the Hydrology Centre, Department of Scientific and Industrial Research, Christchurch

[b] Robb. C. 1999. Groundwater model of Motueka/Riwaka Plains Aquifer System. Lincoln Environmental Client Report 2325 to Tasman District Council

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Uses of Allocated Water

Water use (% of total allocation) by type and source

	Direct from surface water	Takes from storage	From groundwater	All sources
Domestic	1%		6%	7%
Industrial	3%		3%	6%
Irrigation	26%	8%	53%	87%
TOTAL	30%	8%	62%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Measured Water Use

Analysis of flow meter readings

TDC have weekly use for zones in Motueka/Moutere and Waimea where water meters are required. Weekly measured takes from various zones are available. Analysis of use during 1997/98 summer (November to April):

- Moutere zone – only one week in which use exceeded 40% of allocation
- Waimea zones – two weeks when use exceeded 60% of allocation , in general water use is 40 to 60% of allocation
- Motueka zones – in one week use was 95% of allocation
- Significantly less water used in March and April

Motueka groundwater analysis

Based on metered flow records and knowledge of actual irrigation practice, simulated daily irrigation demand throughout a 20-year drought and estimated that:

- The most water used in any one day was equal to 95% of daily allocated volume
- The volume of water abstracted from 1 January to 31 March equated to 60% of the amount allocated

Irrigation Allocation

Irrigation allocation per week — 3.54×10^6 m^3
(Equivalent to 5.9 m^3/s taken continuously)

Allocation from groundwater per week — 2.16×10^6 m^3

Allocation from surface water per week — 1.38×10^6 m^3

Total irrigated area — 11,270 ha
(Based on irrigated areas reported in consent database)

Water allocated is equivalent to — 359 m^3 per ha per week
or: — 35.9 mm per week

Percentage of irrigated area by type and source

	Groundwater	Surface water	Total
Arable	9%	2%	11%
Pasture	1%	<1%	2%
Horticulture	12%	4%	16%
Unspecified	38%	32%	70%
TOTAL	61%	39%	

Notes:
1) Based on irrigated areas reported in consent database or on weekly allocated divided by 350 (250 for Moutere) if no area is reported in database
2) Consent database does not record area irrigated from storage. (i.e. trapping of surface runoff, damming of small unnamed streams or filling from rivers during high flows)

Planning Background

There are currently two regional plans and three informal plans dealing with water issues within the Tasman District:

- Moutere Water Management Plans (1992)
- The Motueka/Riwaka Plains Water Management Plan (1995)
- Part of the Motueka-Riwaka Catchments Water Management Plan (1989) relating to the upper Motueka catchment (informal plan)
- Waimea Catchment Management Plan (1991) (informal plan)
- Tadmor Water Wanagement Plan (1989)~~0~~ (informal plan)

These existing plans include measures such as allocation limits, requirements to install water meters, rationing regimes and reliability of supply information. They were initially started pre-RMA in response to local, small-scale issues, and the need to have policy in place to help in the water permit renewal process. The local scale of these plans has been key in getting local buy in and the plans (or draft versions) were used extensively in the preparation of the Regional Policy Statement. Local water-users groups, with elected committees, were established under these plans. Both council staff and local communities have been dealing with water allocation issues for a considerable period of time. Despite the change in philosophy from prior legislation to the RMA, there has been consistency in the tools and processes used in water allocation which has enabled a more fluid and accepted transition that has happened in land issues.

TDC is currently reviewing all water policy and intends to notify a new part of the Proposed Tasman Resource Management Plan dealing with water takes, damming, use and diversions. The part will replace all existing water plans. An Issues and Options document has recently been sent to all interested parties, and a water allocation policy paper prepared for councillors. The process of preparing the water part will review all measures currently contained in the three existing plans.

There are substantial efficiencies to be gained by incorporating all plans into a single document that covers water alongside land-use and other responsibilities. The new plans will establish policy for areas outside the existing three plans. However, it is seen as very important to keep the historic communities of interest and allow them to deal with their local issues. Water user committees will continue to be very involved in both developing and implementing water management policy under the plan.

A statutory plan is preferred to an informal plan because it provides certainty to the community, it allows contestable views to be properly resolved (i.e. has appeal rights), and is enforceable. The public process involved in preparing or reviewing a statutory plan is seen as key to getting user buy-in.

Environmental Bottom Lines

Methods

- IFIM for Motueka, Riwaka, Waimea Rivers
- Visual assessment of natural character in Roding.River
- Rules of thumb for other streams
- Computer models or technical knowledge of aquifers for groundwater

Values protected

Surface water – IFIM methods looked at brown trout habitat, native fish and benthic invertebrates. Also considered flushing flow to remove algae for improving swimming and other passive waterside activities in the Waimea, natural character/amenity value in the Roding (NCC). Trout habitat often dominates but not because it is the most important value, but because it has the highest flow requirements and providing for trout generally provides for native fish and some recreational uses.

Groundwater – Protect hydraulic and contaminant features of the aquifer, limit salt water intrusion, avoid excessive drawdown, maintain spring and river flows, protecting shallow bores. Quantifying effects depends on good technical information on the nature of the system and its connectedness to surface water.

Implementation

IFIM, computer models, etc. only describe the relationship between flows and effects and do not give an answer. Once these methods have been applied, a community negotiation process must be used to determine the appropriate balance among instream values and out of stream uses. For example, salt water intrusion in Motueka/Riwaka Plains aquifers will be flushed out once groundwater levels recover. If abstractors near the coast accept some salt in water or if they abstract from further inland, larger amounts of water could be abstracted than if no salt water intrusion is acceptable. From an environmental (biophysical) viewpoint, these options are all sustainable, but have different economic implications for abstractors, and the community must resolve. Aspects such as historic patterns of extraction, the type of sectoral interests involved, have a major influence on final decisions.

Problems with IFIM

- Habitat curves for native fish vary considerably among species, once superimposed it is very difficult to draw a conclusion as to desired flow.
- IFIM does not cater well for recreation, canoeing and algal growths.
- Uncertainty as to what fish and other instream faunae require in a karst system.

Limits on Total Allocation from Resource

The water resources of the Tasman District are managed in zones based on hydraulic properties of the resources and communities of interest. Allocation limits, minimum flows or levels etc. are set on a zone-by-zone basis and apply to both surface water and groundwater within a zone. The choice of zones as a management tool deals with the spatial features of groundwater systems and in some cases reflects the strong interaction between surface and groundwater.

Most management zones have allocation limits. Limits are not set in zones where the supply significantly exceeds demand, where there are no significant values associated with a resource, or where there is insufficient information to set limits (which usually coincides with resources that are not under pressure).

Allocation limits are set in litre per second but based on weekly allocation. The limits apply to the summer period only (November–April irrigation season). During winter higher volumes could be abstracted (but there isn't demand). There are a few consents to fill storage dams during winter.

Method

Allocation limits are set to provide a specified security of supply to abstracters – the security of supply is expressed as a level of drought and % cutback in that specific drought. For example, 35% reduction in water availability during a 10-year drought. Reliability figures are historical and accepted by abstracters, however, they are not based on any economic analysis of farm/horticultural economics. A question of whether the existing security of supplies are acceptable has been posed in the Issues and Options document.

Reason

Setting a maximum allocation makes for a transparent process, that clearly indicates how much water is used and how much is still available for use. Setting an upper limit makes management more straightforward, but may stop access to water available above that limit at high summer flows.

Fully and Over-Allocated Resources

An over-allocated resource is considered to exist where the security of supply is unsatisfactory, and is based on either the face value of existing permits exceeding allocatable volume or where reliability is unsatisfactory due to natural events (e.g. river or aquifer going dry during summer).

Wai-iti zone is over allocated by about a factor of 2, and possibly Moutere surface water. The Moutere plan prohibits further low flow takes and states that current permits "cannot dry up the river or have adverse effects on aquatic life", which is too vague/qualitative to assess level of allocation.

Allocation in Wai-iti zone has been reduced by reviewing and adjusting rate of use of existing permits (refer section on Water Use). Options being considered to further reduce allocation are: pro-rata reductions, using A and B permits where A permits have greater security. Split between A and B permits could be based on a number of variables such as distance from source, arbitrary split of all permits into two parts A and B, priority in time or type of use (last two options not listed in Issues and Options document). A related option is augmentation of flow with a storage dam. Cutting back based on level of actual use is not appropriate for the Wai-iti given that many users are running out of water naturally.

Resource consents for over-allocated resources are declined or in some cases new takes are a prohibited activity. If a resource is fully allocated (i.e. existing allocation equals allocatable volume), then TDC keep an informal, unadvertised waiting list which potential or interested

parties are told about when they approach council. Anyone on this waiting list is informed if water becomes available as a result of annual reviews of water permits, improved resource information or surrendering of permits. Then the water is given to first in with consent application (if approved) which is the only option allowed under RMA. Although users seem reasonably happy with this approach, the approach is not considered equitable or satisfactory from TDCs point of view. Applications all come in on one day and "someone who gets stuck at traffic lights" is penalised. People who put in minimal applications and then do detailed works under "further info" request" get in before those who do a thorough job in first place. It is considered that there is not an objective test of deciding when exactly an application is "received", as what constitutes a complete application is a matter of judgement. There is also concern that the waiting list should be publicly advertised to ensure all interested parties are aware of its existence and all potential users are treated equally. However, there is no legal effect of a waiting list under the RMA, And queue-jumping or administrative difficulties can arise with high competition for available water, where judgement is needed to sort whose application would be considered ahead of others. Options for waiting lists are given in the Issues and Options document.

TDC struggle with how they are supposed to deal with this situation (water becoming available at one time in a fully-allocated resource for which demand significantly exceeds supply). TDC has requested amendments to the RMA that may allow other methods that first-in first-served. Alternatives include balloting, tendering, priority based on location relative to source or use, or priority based on the end-use of the water. Similar issues arise with gravel extraction and coastal space (coastal tendering can be used for coastal space but only if implemented by Minister of Conservation).

Resources that are not Fully-Allocated

Water is not being set aside for any specific end use with one exception. In the central zone of the Motueka/Riwaka Plains, there is more than enough water available to meet current demand and there has been interest in export of water out of this zone to other water short areas. TDC will consider permits for export but want to ensure there is sufficient water left for irrigation of Maori reserved land and domestic water use for existing and potential residents in the zone (including Motueka township). This reservation of water has yet to be tested as no allocation limit has been set and demand for export is not large enough to begin limiting future in-zone water use.

Reducing Takes in Water-Short Periods

Three triggers are used to implement rationing or rostering within a zone:

- River or spring flows
- Salinity levels in a specified well
- Groundwater level/pressure in a specified well

A stepped rationing system is used:

- At the first trigger users are required (either individually or as a group) to cutback to a specified % of allocated volume (often 80%) and are notified by a newspaper advert and individual letters,
- At the second trigger, users are cut back to 60% of allocation and notified by newspaper

- The system does not specify triggers at which abstraction must cease. The maximum reduction is 60% and what happens after this point is a bit vague as the situation has never gotten to that point.

Generally, step 1 cutback can be easily absorbed by abstracters, particularly given that actual use is seldom as high as allocated amount. Step 2 cutbacks have only been implemented once in one zone and were noticed by abstracters.

In the Riwaka zone, where most takes are surface water, a pre-determined and very detailed rostering schedule has been established by the 32 users taking into account pump size, crop type and irrigation system. In most other zones rationing is implemented on an individual basis. Consent conditions require that users comply with rostering schedule.

Enforceability

Water meter records are used to check whether abstracters complied with rationing. In the Riwaka, flow recorders upstream and downstream of the reach where abstractions occur are used to measure combined flow abstracted. If minimum flows in the Riwaka are contravened, the water user committee is relied on to address who is not complying with roster. An audit report giving flows in the Riwaka over a season is prepared by council and sent to users and other groups such as Fish and Game.

Threats to prosecute have been made to users who consistently overtook. The rationing system works better if there is another interest involved, other than irrigators and regulators. Abstracters know that if they break rules, then TDC will be chased by Fish and Game (or others), and there will be more pressure to address and compensate for the breach.

Reason

The rationing/rostering system sets out clear guidelines for users as to what will happen during drought conditions. The alternative, using s. 329 notices, is very reactive and creates "hothouse" situations. Rationing cut-backs that are stated in consent conditions and have been established via a formal planning process are unlikely to be subject to legal challenges.

Water Use

Measuring method

- Upstream and downstream recorders for surface water takes
- Water meters – weekly water meter readings must be sent to council at the end of each month

Water meters

Water meters are required in some zones. The rationale for deciding whether to implement water metering or not needs to be formalised but will be a function of demand, assumed pressure on resources, the values associated with a resource and the consequences of over-stepping an environmental bottom line. When there is an insufficient reliability of supply (where river or aquifer goes dry naturally), meters are not required. All fully or over-allocated zones are currently metered. One option is to implement meters once a resource reaches a % of full allocation.

Metering is a lot more accepted now, compared to when it was originally introduced. In some zones, where the cost of installing a well is around $60,000, the additional cost of a water meter is insignificant. The Water Plans specified dates, synchronised with renewals where possible, by which users had to install water meters.

Water meters are predominantly a method of ensuring compliance, but are also used to measure actual use. From a resource understanding perspective, it would be good to have all takes metered, but the cost of data management (2000+ permits) would be too high. Hence meters are in those zones that are under-pressure.

Guidelines for reasonable use

For irrigation, a standard amount of 35 mm/week (or 350 ℓ/s per ha) has been used. A review of these allocations for Waimea (Lincoln Environmental) gives recommended weekly amounts based on soil type and crop ranging from 20 mm to 35 mm per week. These values will, on average, result in 90-95% of maximum production. The method uses daily climate (rainfall and evapotranspiration data).

There are no guidelines for other uses, although water resource managers work closely with asset managers on reasonable planning horizon and water conservation measures (unitary authority). Planning horizons are not formalised in a plan, but perhaps should be. Typical urban use is 200 ℓ/head/day excluding gardening watering. Urban takes are subject to rationing system but have interconnected pipe systems that generally allow supply to switch to an alternative, unrationed zone. For industrial takes, charges for discharging wastewater are the incentive to use reasonable amounts of water. Industrial guidelines would require indepth knowledge of process technologies etc. Also important in promoting reasonable use is the provision of good practice information and environmental education.

Review of existing consents

There is a "use it or lose it" policy, based on the power of TDC to cancel unexercised resource consents. Plan rules enable renewals and permit reviews to be based on "bona fide" use (full exercise or good reason why not). Although this approach could encourage people to waste water, there is good support for the approach by water users. It stops prospectors saving water for another use. Using actual take records as a basis for cutting back is not sufficient since use can change from year to year for valid reasons. It would also be unfair on those users who lost water due to naturally dry streams etc. Bona fide reviews of existing consents are undertaken on a zone by zone basis. These reviews look at area irrigated, size of pumps, irrigation equipment etc. to assess whether volume allocated is reasonable. If not, the rate of use is cut-back by review of conditions under a rule consistent with s68(7), s129 and s130 of RMA. This has been the major mechanism used to reduce takes in the Wai-iti zone.

Illegal takes are picked up visually or by reports form neighbours. Some unused takes were surrendered once s36 charges were imposed.

The use of transferable water permits would replace both the need for a "use it or lose it" approach and bona fide reviews (the bona fide review condition could still apply in a transferable permit system to ensure there is no "unreasonable" saving up of water).

Permitted takes

Takes of up to 5 m^3/day, or 10 m^3/day for farm use, are permitted. In most zones, the effect of the permitted take is insignificant (based on coarse calculation). But in some zones which are fully or nearly allocated with a high level of lifestyle development, the cumulative effects of permitted takes is becoming increasingly significant. Options considered include excluding some catchments from permitted take rule, limiting the ability to take for domestic use given in Section 14 of the Act, requiring meters in order to quantify take, including domestic takes in rationing regime, and measures to encourage domestic users to rain storage (control of subdivision). The method used needs to recognise the provision given to domestic water takes under the RMA. The approach to permitted takes is under review and could include increasing the permitted flow in some catchments.

Other Methods

- Land-use controls in catchment. In the Moutere catchment, TDC has implemented land-use controls which limit the extent of new forestry in the groundwater recharge zone. A recent Environment Court decision has essentially confirmed TDC's approach. This is an example of how the organisation responsible for water allocation can be put in a position of making inter-sectoral trade-offs (between forestry and irrigation). TDC's decision was to protect existing infrastructure/investment in both irrigation and forestry and apply roughly equal constraints to both industries into the future.

- Gravel extraction to maintain river bed levels and hence aquifer water levels.

- Riparian planting to help mitigate temperature increase as a result of abstractions.

- Education and good practice advocacy. A sheet detailing 37 water saving tips for domestic users has been produced and TDC are supporting the Nelson Focus Orchard Project which will provide weekly values of water uptake for various crops in local papers. This area needs further development and upgrading of delivery.

- Transferable Water Permits. These are a new tool introduced by the RMA. A number of concerns have been raised by users but there are ways of controlling/constraining transfers that can address many of the concerns raised by submitters. However, the philosophical issue related to individuals benefiting from or perceived to be owning a public resource, may be more problematic to overcome. Despite the fact that TWPs are only formalising and making explicit through a price mechanisms what happens already in practice, (that if you have a permit you have defacto ownership), the distinction between the right to take water and ownership is too subtle to be widely accepted.

- Examining augmentation options such as storage dams. – can help provide increased public benefits as well as increased reliability of supply and reduced pressure on a resource.

Community Involvement

Water users groups are a key point of contact for the community and are encouraged in the Regional Policy Statement and the two regional plans. Committees are elected by water permit holders with TDC councillor and agency (DoC Fish and Game and Iwi)

representation. A council staff member attends most meetings and acts as secretary, organises elections etc. Water user groups become closely involve in rationing decisions in water short years.

The recent Water Management - Issues and Options document has been sent to all potentially interested parties and will be followed up with a series of public meetings. Individual groups have requested meetings with council staff to discuss. The water-users committees will be used for ongoing consultation with users. A draft of the water part of the Tasman Resource Management Plan will be circulated to water-user committees and agencies later this year and a proposed plan variation publicly notified and taken through the process in the RMA First Schedule.

An Issues and Options approach but without recommendations was selected because providing recommended options has been criticised in the past. However, staff are now being informally asked for their recommendations. Water allocation is a complex issue and community members have difficulty assimilating and responding to all issues, and are prepared to be guided on most issues.

The current system of consultation does not deal well with future users, or recreational or urban users. There is potential for existing irrigation users to have too much say in deciding the allocation system.

Administration

Duration of consents

—Historically 6 to 10 years but now moving to 15 years with the certainty provided by plans and ability to review. New consents will be issued for a duration that brings the expiry date in line with existing permits in a zone.

Funding

A levy is charged on water permits according to a formula based on rate of take and a catchment management factor, which depends on level of expenditure in a catchment. A standard level is around $75 to $110 per take. Recent changes mean that an extra $100 levy will be charged in the following year if water meter records are not provided as required to the council. The levy funds around 30% of water resource investigations and monitoring.

Enforcement and administration

Administering and enforcing the system have been and are expected to be straightforward.

Obstacles

- Limited council resources – time and money. The resource investigations and information management needed to implement effective water management are time consuming and expensive, particularly given small rate base. It is important that investigation work keeps ahead of demand as it is easier, and more cost effective, to manage demand when the environmental constraints are already in place than it is to reduce existing abstracters. An effective information management system is also critical to successful plan implementation and review.

- Legal obstacle related to legal ineffectiveness of waiting lists and ability to allocate water that becomes available in a fully-allocated high demand situation.

- Issues related to iwi involvement and ownership – if river ownership claims succeed, then RMA will need to be rewritten.

- Lack of clarity and legal guidance on the ability to allocate water among competing sectors, such as required in Moutere catchment (forestry and irrigation industries), or as may be required in a tradeable water permit situation, where acceptability may require that water can only be transferred for a specific end use.

Measures of success

- The aim is to deliver processes and outcomes that are acceptable to the existing and future community in relation to essential resource values.
- Acceptability is given by indicators of community satisfaction with process and outcomes, such as the number of complaints, compliance issues and appeals to Environment Court, and by the willingness of parties to negotiate solutions.

What is Needed Now?

- Money – would be good to have a fund where smaller councils can get money from for direct costs, information technology costs etc.

- Assistance with adopting an ecosystem approach to investigations that combines social and economic needs with biophysical needs.

- More knowledge on social and economic values of water to the community, so council can increase its ability to assist the community to optimise the value of water (both instream and abstractive). Suggested work includes social survey work on value of water similar to work by Paul Whites (IGNS) on contingent valuation of spring water, river water, and value of irrigation on the Waimea. Also understanding from a users perspective what is an economically reasonable reliability of supply for each use. Do all users need the same reliability of supply?

- Increasing understanding of annual surface water yields and how they are influenced by land cover and use. Adopting an integrated catchment management approach.

Total quantity of water allocated per week — 4,964,581 m^3
(Equivalent to a flow of 8.2 m^3/s taken continuously)

Maximum volume that can be taken in a year — 118,227,035 m^3
(Assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take — 8.2 m^3/s
(Take if all consents were used fully and simultaneously)

Water Sources

Surface Water	**% of total weekly allocation**	**Mean Flow (m3/s)**
Awatere River	16%	14.8
Wairau Plains surface water (drains and creeks)	5%	
Upper Wairau River	2%	26.8
Waihopai River	2%	15.4
Opawa River	1%	
Tuamarina River	1%	
All other surface water (individually all <0.5%)	2%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (millions m3/yr)**
Wairau Aquifer	58%	
Lower Waihopai Aquifer	6%	
Omaka River Valley Aquifer		
Havelock Aquifer		
Omaka Aquifer	1%	
Shallow aquifers associated with rivers	1%	
Other Southern Valley Aquifers (each <0.5% individually)	1%	
Other groundwater (each source <1%)	1%	

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Uses of Allocated Water

Water Use (% of total allocation) by type and source

	From surface water	From groundwater	All sources
Domestic/ Stock	2%	7%	9%
Industrial	1%	11%	12%
Irrigation	26%	53%	79%
TOTAL	29%	71%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Measured Water Use

Water meters are required in water-short groundwater areas. Fortnightly readings are recorded on a database. Annual figures for the Omaka aquifer are shown in Figure 1 of the main report.

Irrigation Allocation

Irrigation allocation per week — $3.94 \times 10^6 m^3$
(Equivalent to 6.5 m^3/s taken continuously)

Allocation from groundwater per week — $2.65 \times 10^6 m^3$

Allocation from surface water per week — $1.29 \times 10^6 m^3$

Total irrigated area — 6,269 ha
(Based on irrigated areas reported in consent database)

Water allocated is equivalent to — 203 m^3 per ha per week
or: — 20 mm per week

Percentage of irrigated area by type and source

	Groundwater	Surface water	Total
Arable	5%	5%	10%
Pasture	3%	1%	4%
Horticulture	7%	2%	9%
Wine	15%	5.5%	20%
Unspecified	38%	19%	57%
TOTAL	68%	32%	

Note: Based on irrigated areas reported in consent database

Planning Background

The Proposed Wairau/Awatere Resource Management Plan, and the Proposed Marlborough Sounds Resource Management Plans were released with decisions on submissions in 1998. Both plans have been appealed to the Environment Court, with one appeal relating to water quantity (asking for a review of the A,B,C permit approach).

Because most of Marlborough's water is abstracted from the Wairau and Awatere catchments, there is very little water quantity management in the Marlborough Sounds Plan. In 1996, MDC released a draft water allocation section of the Wairau/Awatere Resource Management Plan. This 100 page document was condensed for inclusion in the proposed plan, and contains more explanation and justification of policies, rules etc.

Water is at a premium in the Wairau valley, with increasing demand for water for vineyards, both large companies and boutique wineries. A deep aquifer underlying the Wairau Plains (requiring wells at depths >200 m) has recently been discovered and pumped. MDC are examining options for controlling use of this aquifer to minimise effects on users of the shallower aquifers above.

Environmental Bottom Lines

Surface water

Minimum flows (called Sustainable Flow Regimes) have been set on the Awatere, Waihopai and Wairau Rivers. These rivers have either a high level of actual/potential use, or have been identified as important by Fish and Game or the Department of Conservation. Minimum flows in the Awatere and Waihopai were set by negotiation with Fish and Game and DoC. The Wairau River minimum flows were set by MDC staff. IFIM was used on the Awatere River for trout habitat, but results were questionable given that water clarity and temperature are not suitable for trout. Habitat considerations are generally for whitebait and native fish. Water quality classification under the plan specify rivers managed for fishery purposes, fish spawning, contract recreation, aquatic ecosystems, aesthetics, drinking water and "in its natural state".

Groundwater

Groundwater levels are monitored in all aquifers, but abstraction is not currently restricted by the use of trigger levels or pressures. However, trigger levels is one of the options for controlling take from the deep Wairau aquifer. Under a policy in the plan, "sustainable flow regimes" can be established to prevent compaction, salt water intrusion, spring/surface water flows, or to protect water quality. As most of the highly used aquifers are away from the coast, there is little likelihood of salt water intrusion.

Implementation

The minimum flows are contained in the Proposed Plan and have been through the associated consultation process. Under a policy in the plan, sustainable flow regimes will be determined

based on monitoring information and in consultation with Iwi, DoC, Fish and Game and water users. An upcoming project will examine small streams within the Marlborough Sounds area, where the cumulative effect of lots of small water supply takes could become an issue. Amendments to existing minimum flows would be achieved through a plan change.

Limits on Total Allocation from Resource

Surface water

On four rivers, - Awatere, Wairau, Waihopai and Gibson Creek – a system of Class A, B and C permits (set in litre per second) is established under the plan. Class A permits will only be restricted when the flow falls below the 1-in-5 year 7-day low flow (93 to 97% availability). The limit to Class B permits is based on the 80 percentile flow, and provides a moderate degree of certainty. Class C is for storage and for power generation. For Class B and C permits, a 2:1 sharing rule operates between instream uses and abstraction, for every litre allocated, half a litre will be left in the stream. This flow sharing is intended to stop Class B abstraction from keeping streams at low flow for long periods. Flow restrictions will start when the river reaches the A permit limit plus 1.5 times the flow allocated to B permits.

The limit of Class A permits is only just being exceeded in some cases, and only a few Class B permits have been granted. Holders of Class B permits are considered to be next in line (on a waiting list) for Class A permits. Implementing restrictions on B permits has not yet been required.

Groundwater

Allocation limits have been calculated for groundwater resources where demand is considered at or close to the available amount, and there is sufficient information. These limits are expressed in the plan as Total Class A allocations and are expressed as cubic metros per day. The limits are calculated on an annual safe yield basis, from storativity and drawdown calculations.

Annual analysis of actual takes and trends in groundwater levels are used to give a more accurate assessment of the pressure on an aquifer. Results indicate that some aquifers are not showing a downward trend even though the "safe yield" was abstracted, whereas other show a downward trend when less than the "safe yield" was abstracted. This information is sent to users each year and will help refine the allocation limits.

Implementation

Takes for Class C permits are controlled activities, subject to monitoring and rationing provisions. Takes less than 500m^3 /day from other than the Wairau Aquifer or <3000 m^3/day from the Wairau Aquifer, are discretionary activities. Larger takes are non-complying activities. The plan contains a list of surface water bodies from which all takes are non-complying, and another list from which all takes are prohibited. Takes from the Southern Valley Aquifer Management zone for use out of the zone are prohibited activities.

Fully and Over-Allocated Resources

Generally, current takes are within the allocation limits set in the plan. However, monitoring results indicate some aquifers could be over-allocated. The safe yield estimates for these aquifers are being revisited and consents assessed for compatibility of allocated volume, actual use records and reasonable use requirements. If water became available in a zone that was previously fully allocated, the water would be offered to B permits holders on a first-in first-served basis and any consents to take this water would be notified.

Transferable water permits are discretionary activities under the plan, provided it is within the same catchment or aquifer zone. Any other transfers are non-complying.

Resources that are not Fully-Allocated

Water is allocated on a first-in first served basis. There is an exclusion zone in the Wairau aquifer to protect Blenheim's water supply. Water is moving to more profitable uses, through conversion to grapes as wine makers buy land from pastoral and other farming types.

Reducing Takes in Water-Short Periods

Restriction during water-short periods is only required for surface water takes. Groundwater is often self-limiting as water levels drop. Rationing has not yet been required but will be a pro-rata reduction based on allocated volume. The logistics have still to be worked through.

During the 1997/98 drought, users groups were active, with groundwater users were sent fortnightly plots of groundwater levels. In one case, users agreed to a voluntary reduction in take (they were already experiencing reduced well yields). Users were advised in advance of the volume that could be taken in the following week, although this was difficult to enforce where there were no meters. DoC also agreed to allow the minimum flow on one river to drop below the agreed value for a week. In the past, total take has been lowered because different land uses have peak requirements at different times of the season. The trends towards grapes may mean this balancing of water use is not as possible in the future.

Water Use

Water meters

A policy in the plan is "to require water meters on all permits involving the taking and use of water". This policy is being enforced in water short groundwater zones, which is where information is needed for water balance equations, model calibration and determining safe yields. For surface water, total take is not as relevant to the resource as instantaneous readings.

Users with meters are sent a self-addressed envelope every two weeks. The data is entered into a database (linked to the consent database) and the resulting plot sent to each user annually. There are about 160 metres in place and the effort required to enter and analyse this data is considerable.

Guidelines for reasonable use

A policy in the plan contains a table of weekly allocation for various crop types, domestic use and rural residential allotments.

The weekly allocations for irrigation are the amount required to keep soil moisture full 80% of the time over the last 22 years. For grapes, the allocation is based on optimising yield assuming no rainfall. A field study is underway to assess the water required for various crops.

Review of existing consents

A policy in the plan is to "set water permit volumes either at review or renewal on the basis of the water allocation guidelines". A review of all consents is not anticipated, although some users who are known to have high allocations (such as vineyards with an allocation for pasture) have been approached. Adjusting takes back to reasonable use levels will be looked at as part of assessing options for over-allocated resources.

Permitted takes

Up to 10 m^3/day/site (15 m^3/day for Wairau aquifer), with an additional 100 ℓ/ha/day for the balance of any site over 20 ha (stockwater). When rationing is in place, permitted take must be limited to domestic use of 1 m^3/day/site.

The cumulative permitted takes is considered very small in comparison with irrigation takes.

Unused takes

Each consent has a monitoring officer assigned, who will visited the consent holder after a two year period, and again two years later if the consent had not been taken up. In general people take up water consents, and only one consent was lapsed, with the agreement of the owner.

Other Methods

- Riparian management
- Linking with land-use planning and water supply availability
- Education, public newspaper

Community Involvement

Water groups were very effective during the 1997/98 drought. The groups elected a committee with representative from each user section (horticulture, wine, townships, and potential irrigators). The groups have faded since the drought but MDC are reactivating them in anticipation of a drier than normal summer in 1999/2000.

Administration

Duration of consents

Water permits are usually issued for 10 years. From reliable resources, such as the Wairau Aquifer, are issued for up to 30 years terms, but subject to resource reviews every 5 to 10 years. The duration and/or interval of resource review is related to the level of understanding of a resource and the potential for adverse effects.

Funding

There is no annual levy on consent holders. All monitoring and investigations are funded from the general rate.

Obstacles

- Ability to enforce
- Robust monitoring network
- Lack of economic instruments
- Lack of time and data

Measures of success

- How well the allocation system works in a dry year

What is Needed Now?

An approach to dealing with:

- Groundwater-surface water interactions
- Ephemeral streams
- Storage dams in recharge areas
- Takes from streams that recharge an aquifer
- Quantification of aquifer resources

National research can help prevent each council having to "reinvent the wheel" on these issues but final management decisions will always be based on local knowledge and politics. Many decisions, such as controlling takes from the deep Wairau aquifer, are equity issues and can only be dealt with locally.

Total quantity of water allocated per week — 151,093,920 m^3
(Equivalent to a flow of 249.8 m^3/s taken continuously)

Maximum volume that can be taken in a year — 5,013,781,000 m^3
(Assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take — 322 m^3/s
(Take if all consents were used fully and simultaneously)

Water Sources

Surface Water	% of total weekly allocation	Mean Flow (m3/s)
Waitaki River	20%	372
Rangitata River	12%	102
Ashburton River	8%	20.18
Rakaia River	6%	203.7
Waiau River	6%	99.3
Waimakariri River	5%	123
Hurunui River	3%	52.8
Opihi River (including Opuha River)	2%	19.22
Small plains streams south of Rakaia River	1.6%	
Orari River	0.7%	10.7
Lake Ellesmere catchment (incl Selwyn River	0.7%	
Hinds River	0.6%	
Waipara River	0.6%	3.06
Rivers/streams between Timaru and Waimate	0.5%	
Ashley River	0.3%	12.7
Kaikoura surface water	0.2%	
All other surface water combined	<0.1%	
Other surface water (each source <1%)	6%	

Continued next page

Water Sources - continued

Groundwater	% of total weekly allocation	Average annual recharge (m3/yr)
Lake Ellesmere/Waihora groundwater	9%	736[a]
Groundwater between Rakaia and Ashburton Rivers	7%	866[b]
Christchurch-West Melton groundwater	7%	451[c]
Groundwater between Ashburton and Rangitata Rivers	4%	
Groundwater between Rangitata River and Timaru	3%	
Groundwater water between Waimakariri-Ashley Rivers	2%	285[d]
Groundwater between Timaru and Waimate	0.7%	>215[e]
Groundwater sources north of the Plains	0.5%	>89[f]
Waitaki groundwater	0.2%	
Plains groundwater north of the Ashley River	0.2%	
Banks Peninsula groundwater	<0.1%	

[a] CRC 1996. The Natural Resources of Lake Ellesmere (Te Waihora) and its Catchment. Ed. K. Taylor. Canterbury Regional Council

[b] Scott, D. M and Thorpe, H. R. 1986. Groundwater Resources between the Rakaia and Ashburton Rivers. Publication No. 6 of the Hydrology Centre, Christchurch.

[c] From Chrischurch West Melton groundwater model (pers. comm D. Scott)

[d] Sanders, R 1997 Groundwater of the Waimakariri-Ashley Plains. A Resource Summary Report Canterbury Regional Council Report No. U97(43)

[e] Level Plains only, pers. comm. P.

[f] Kaikoura only, Sheppard, G. M. 1995. The Hydrogeology of the Kaikoura Plains, North Canterbury, New Zealand. Engineering GeologyThesis. University of Canterbury.

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Uses of Allocated Water

Water use (% of total allocation) by type and source

	From surface water	From groundwater	All sources
Domestic/Stock	9%	4%	13%
Industrial	2%	1%	3%
Irrigation	56%	28%	84%
TOTAL	67%	33%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Measured Water Use

Three year survey of groundwater use on Canterbury Plains 1994-1997

Based on power use. Developed power-water use ratings for 59 irrigators representing different crops, climatic conditions and soil types. Amalgamated with total power use.

Results table (from CRC U97[39], R. Sanders)

	Estimated Use as a percentage of allocation				
	1996/97	**1995/96**	**1994/95**	**1993/94**	**1992/93**
Ashley to Waimakariri	29%	48%			
Waimakariri to Rakaia	38%	35%			
Rakaia to Rangitata	39%	34%	65%	46%	42%

Irrigation Allocation

Irrigation allocation per week — 127.2×10^6 m^3
(Equivalent to 210.3 m^3/s taken continuously)

Allocation from groundwater per week — 41.62×10^6 m^3

Allocation from surface water per week — 85.58×10^6 m^3

Total irrigated area — 400,091 ha
(Based on irrigated areas reported in consent database. Includes 154,138 ha in irrigation schemes)

Water allocated is equivalent to — 329 m^3 per ha per week
or: — 33 mm per week

Groundwater allocation 24 mm per week, surface water 40 mm per week

Percentage of irrigated area by type and source

	Groundwater	**Surface water**	**Total**
Arable	20%	5%	25%
Pasture	17%	44%	61%
Horticulture	2%	1%	3%
Unspecified	7%	4%	11%
TOTAL	45%	55%	

Notes:
1) Based on irrigated areas reported in consent database
2) 38% of irrigated area is in irrigation schemes, 37% of the area is pasture irrigated from schemes.

Planning Background

CRC have just released (October 1999) "Water – our future", a report which discusses management issues and options for Canterbury's water bodies, including options for water allocation. Submissions close in December and will contribute to the development of the Natural Resources Regional Plan (NRRP), Part C: Water. A separate issues and options document for the water management in the Christchurch area will be released in a few months. Parts A and B of the NRRP deal with air (draft released in 1998), and soils and land use (draft due for release about June 2000). The intention for the water chapter of the NRRP is to set generic policies and rules for the region, with specific provisions for each water body contained in schedules to the plan. This approach is administratively efficient and puts a set of basic principles in place, yet still allows consultation on a catchment by catchment basis.

The regional policy statement and strategic planning process identified some priority water bodies. The process of preparing the schedules for these water bodies will be worked through as part of ongoing plan development. Because there are other rivers that will need minimum flows set, another possibility is to use the expert panel approach to develop flow management regimes for those rivers where there is little information. These would provide some certainty to resource consent applicants prior to detailed investigations/consultation in a catchment. Overtime all water bodies will be incorporated into the plan. This process will require significant time and money for investigations and consultation.

There are two other statutory plans relating to water: the Proposed Opihi River Regional Plan and the Proposed Waimakariri River Regional Plan. The Opihi plan is at consent-order stage and hearings on the Waimakariri Plan were held in September. These catchment specific plans are expected to be consistent with the NRRP, and will continue as stand-alone plans until they are due for review. There are also a number of pre-RMA non-statutory plans used to guide consent decisions for some of the larger rivers.

Answers to the questions below are based predominantly on current practice, with some mention of options posed in "Water – our future". All questions raised in the interview have been thought through and many are covered in the issues and options. Readers wanting a full description of the options being considered by CRC should refer to "Water – our future".

Environmental Bottom Lines

Methods - Surface water

Minimum flows have been set on 149 surface water bodies, 80% of which were set through the resource consent process. A recent *draft* review of council records noted that the method used to set the minimum flow was clearly recorded for 50% of the rivers/streams.[1] Of these, 43% were set using an expert panel, 42% were set on a statistical basis, and 15% using a habitat method. Experts, usually including representative from Fish and Game, DoC and Iwi, are often consulted when setting minimum flows during the consent process.

[1] Harvey, MC: The setting of minimum flows in the Canterbury region. Draft report to CRC.

The instream values identified in the setting of minimum flows were: ecological (63%), recreation (30%), tangata whenua fishery and mahinga kai (5%) and landscape/scenic (2%).

The Regional Policy Statement sets a two-stage process for considering minimum flows. In step one the flow regime required to satisfy the following values must be identified: drinking water supplies, life-supporting capacity, natural character and Tangata Whenua values. In step two, the requirements of amenity/recreation values and consumptive uses are considered. If warranted a higher minimum flow may be set than step one. Protection of flows to wetlands is also given a high priority.

Methods - Groundwater

Christchurch City's water supply comes from the Christchurch West Melton aquifer system. It feeds spring-fed streams that flow through the city, and it is also an important source of irrigation water. Groundwater trigger levels have been set in the – West Melton aquifer immediately west of Christchurch via consents processes. However, management measures are needed for the complete system and as a priority, the Council is preparing an issues and options report in 1999. Computer modeling of the Christchurch aquifers is currently being undertaken by CRC, and will help define how this resource should be managed, including the review of the trigger levels. These measures will be included in the draft plan due out about June 2000.

Groundwater that is hydraulically connected to surface water is also subject to minimum flow provisions. "Water – our future" puts forward a number of options for addressing connected groundwater issues for permanently flowing and ephemeral streams/rivers. Options include: using a specified set-back distance to delineate connected groundwater, using an analytical method, and promoting use of deeper aquifers.

Sharing rules

Under the Rakaia Conservation Order, there is a 1:1 sharing rule between the amount of water abstracted and the amount left in the river above the minimum flow. Non-statutory plans for the Hurunui and Waiau Rivers contain similar provisions. These sharing systems are intended to mimic natural variation in flow patterns, but are very difficult to implement and enforce.

Limits on Total Allocation from Resource

Surface water

The Rakaia River is the only water body for which an allocation limit is set. It is set under the National Water Conservation Order, and was set based on the water demand for potential Ministry of Works Irrigation Schemes. On other rivers, reliability of supply issues are taken into account through the resource consent process. Existing users are protected under the Regional Policy Statement for the term of their consent and new users are often subject to higher minimum flows in order to ensure supply to existing users. In the two regional river plans, a band system with specified allocation limits (in litre per second) for each band are used.

Groundwater

There are no limits currently set to the amount of water that can be allocated from groundwater resources.

The issue of reliability of supply is raised in "Water – Our future". Options put forward included setting an allocation limit, formalising a band system (A, B and C permits), and continuing the status quo. If allocation limits are set for groundwater, limits may be set on a seasonal basis to prevent users who take most of their water early in the season from capturing an unequal share in water short years.

For surface water, allocation limits could be based on providing ecological flushing floods (sediment and perphyton) and the impacts of abstraction on flow regime. Potential demand could also be considered.

Fully and Over-Allocated Resources

Although there are no allocation limits set, instream conditions during dry summers indicate that the Ashburton River is close to its allocation limit. All consents to take from the Ashburton River are publicly notified.

Transferable water permits is an option put forward in "Water – our future". Transferable permits won't happen until allocation limits are set (and reached), although the existing system of setting bands for surface water allocation could encourage trading once the reliability of supply for the next user on becomes limiting. Council does not need to get involved in the financial/tradeable part of transferring water permits, but needs to keep track of where the water it is taken from. Councils can, however, set some parameters that will discourage speculation in water (acting as an honest broker). For example, ensuring that permits are lapsed if not used within 2 years (not as straightforward as it sounds) and only issuing permits based on reasonable use.

Resources that are not Fully-Allocated

Consents are dealt with on a first-in first-served basis. Options, which give preference to certain end-uses, are posed in "Water – our future", for example reserving blocks of water for community water supply, or giving priority to end-users with higher economic returns. Long-term provisions for water supply to Christchurch City are being considered in the current review of the Christchurch-West Melton aquifers.

Reducing Takes in Water-Short Periods

Consents specify the minimum flow at which abstraction must cease. Some also specify reducing rates of takes (e.g., pro rata) as the flows approach the minimum flow. Consents provide for user groups to be formed so that abstractors can ration water amongst themselves if for example they cannot operate within the pro-rata system. In some cases, user groups are used to reduce total take from a resource. If restrictions are required, letters are sent to consent holders once restrictions greater than 50% are required. Flow information is available through the CRC website and an 0800 number.

Section 329 – Water shortage directions – have not been used, despite pressure to do so over the last summer. Such directions must be supported by adequate information on the effects of the abstraction.

Domestic and stock water takes have first call on water, and are not always subject to minimum flow restrictions. "Water – our future" raises the issue of whether domestic and stock water takes should be restricted. This poses a number of equity issues particularly relating to urban and rural takes. For example, having irrigators and industry with individual supplies subject to restrictions, while garden watering and industrial takes from municipal supplies remain unrestricted. An option put forward is that community water supplies are cut-back to (say) 250 l/s/person per day – a guideline value required for maintenance of public health - once a resource reaches its environmental bottom line.

The flow rates given on most consents relate to peak demand. This raises some equity issues as it can deny other users water and means that restrictions do not apply equally.

"Water – our future" also raises an option for groundwater restrictions - restricting seasonal take based on groundwater levels at the beginning of the season.

Enforceability

Minimum flows are enforceable, but pro-rata reductions or reducing takes are not. Pro-rata cutbacks are also difficult for irrigators to implement, so user groups are the best, and perhaps only, option. It is difficult to see how seasonal cut-backs could be implemented without meters.

Water Use

Measuring method

Power ratings and total power consumption were used to estimate actual take from groundwater resources between the Ashley and Rangitata rivers from 1993 to 1997. Actual takes varied from 29% to 65% of the allocated seasonal volume.

Water meters

Large abstractors are required to meter (e.g. ECNZ, irrigation schemes). There appears to be growing recognition among irrigators of the benefits of meters and the financial saving associated with measuring water use. It doesn't seem appropriate to require meters on all takes, particularly when demand is much less than supply. A consent condition is being used which requires that a consent holder "must provide records upon request within certain accuracy". If these conditions were to be actioned, these conditions would effectively require water meters.

Unused permits

Property-by-property surveys have been used for groundwater investigations as an input to detailed investigation of some resources. Unused consents have not been lapsed under RMA provisions. Unless there is high demand for a resource, there doesn't seem much point in chasing up unused takes. Not suspending unused takes errs on the side of caution for protecting instream values. When there is a band system operating, unused takes can reduce the reliability to other users. In one instance, this situation has been addressed by allowing a new surface water user to be included in a higher reliability band provided water is not taken concurrently with an unused permit.

Consents that take more than allocated amount

The rate of take is checked for some consents as part of compliance. A number of spot checks/field surveys of flow rate have been made to ensure abstractors are taking within their consent conditions. At consent renewal time, applicants are required to provide proof of actual rate of take. Council applies what it calls its reasonable use test. Applicants taking too much would receive a smaller allocation

Illegal takes

Illegal takes are often reported by neighbours during water shortages. A flyover survey was undertaken in South Canterbury to relate green areas to irrigation consents.

Guidelines for reasonable use

For irrigation, an insert is placed in consent application forms that gives a calculation for daily water use based on soil, evapotranspiration rate, and irrigation management. This tends to calculate a peak requirement. Applicants need to justify use if it differs from the calculated amount. Irrigation application systems such as border-dyke are taken into account. There is little demand for border-dyke on new applications.

Department of Health guidelines for domestic use are 250 ℓ/day per person for core use, excluding garden watering and car washing. In Christchurch over the summer, peak is 800 to 900 ℓ/day per person. The amount granted in consents varies across the region from 200 to 1200 ℓ/day per person. It is a difficult issue to resolve given the variation and also Christchurch City Council's belief that unrestricted water supply is one of the attractions of the city.

For industrial takes, there are limited guidelines. Considerable expertise on processing technologies is needed to assess reasonable use. If available, metered records could be used to develop guidelines. Industrial takes may be required to undertake water audits, as a condition of their consent. A water audit methodology is available but is expensive to carry out.

Review of existing consents

The rate of take and volume allocated to existing consents could be reviewed to bring them in line with any plan provisions if it was thought necessary. "Water – our future" puts forward an option of requiring surrender of permits or parts of permits that are in excess of what is reasonably needed.

Permitted takes (Transitional Regional Plan)

Permitted takes are $10m^3$ per day from Kaikoura surface water. Twenty cubic metre per day from groundwater and Canterbury surface water for properties less than 20 ha. Larger properties can take up to 100 m^3/day from groundwater, Waitaki Lakes or the lower reaches of large braided rivers. There are no permitted takes from the Christchurch West Melton groundwater.

The cumulative effects of these takes are unlikely to be of concern unless there is a high density on small tributaries. The position of permitted groundwater takes are recorded from bore records.

Other Methods

- Forestry water yield issues. Under the soil and land use plan (draft due June 2000) trigger levels (% of catchment area) are likely to be used to initiate further investigations in sensitive catchments if it appears that land-use is likely to have a significant effect on water yield.
- Education on irrigation efficiency through Landcare groups
- Promoting leakage prevention on stockwater supply and community reticulation systems

Community Involvement

CRC intends a substantial consultative process following the release of "Water – our future". A series of public and user group meetings are planned, with submissions due by the end of the year. It will be followed by a draft plan and then a proposed plan formally notified under the RMA.

Administration

Duration of consents

Consents are generally issued for 35 years, with review clauses on all consents. Consents issued under previous legislation come up in blocks within a catchment. This places a high demand on staff time but there are advantages in considering consents on a catchment basis.

Funding

Users are charged for direct compliance monitoring of their consents, and any resource monitoring that is only required because of consents. All other monitoring and investigations are funded from the general rates.

Enforcement

Minimum flows are enforceable, but checking/enforcing individual usage is difficult without meters.

Obstacles

- Not knowing actual rate of take or volume used
- Lack of co-operation from some users
- Working within a political framework
- Coping with lack of precision, accuracy and uncertainty in available information
- Time and resources available to provide defensible information and analysis in support of plan

Measures of Success

- State of Environment monitoring
- Plan implementation monitoring (including effectiveness)
- How well the plan is received by the public
- Complaints
- How well does the system work in a drought year

What is Needed Now?

- Guidelines for a water allocation framework – principles, methods, pros and cons of systems and things to think about when designing a system. There has probably been a duplication of effort and thinking on these issues in New Zealand.

- Quality assurance of data upon which plan provisions are based.

- Minimum flows and allocations on tributaries vs mainstem allocation.

- Simple and effective approaches for dealing with takes of dam-released water vs natural flow when an abstractor may be accessing both types of water at the same time, or when there is a mix of takes accessing one or the other type of water at the same time.

- Reasonable use guidelines for all types of uses of water

- Reliability of supply – a method for assessing reliability and criteria on what to take into account (e.g soil, risk)

Total quantity of water allocated per week (direct takes) 49,535,254 m^3
(Equivalent to a flow of 81.9 m^3/s taken continuously)

Weekly allocation for take from storage 4,891,272 m^3
(Take to/from storage dams, or from lakes. Equivalent to a flow of 8.1 m^3/s taken continuously)

Maximum volume that can be taken in a year 1,785,784,536 m^3
(As given in consent database or assuming 30 weeks of irrigation, 52 weeks of domestic take and 50 weeks of industrial takes)

Maximum instantaneous take 91.6 m^3/s
(Take if all consents were used fully and simultaneously)

Water Sources

Direct takes only

Surface Water (direct takes)	**% of total weekly allocation**	**Mean Flow (m3/s)**
Clutha River catchment	58%	572
Taieri River catchment	30%	35.8
Shag River catchment	3%	1.66
Kakanui River catchment	2%	3.19
Waitaki catchment	1%	372
Other surface water (each source <1%)	1%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m3/yr)**
Taieri catchment Groundwater	1%	
Clutha catchment Groundwater	4%	

Notes: 1) Relates to weekly allocation rather than to actual use
2) Does not included permitted abstractions

Sources of water taken to storage – 90% from Clutha catchment, 9% from Taieri

Uses of Allocated Water

Water use (% of total allocation) by type and source – direct takes

	From surface water	From groundwater	All sources
Domestic	3%	2%	5%
Industrial	8%	2%	10%
Irrigation	83%	2%	85%
TOTAL	94%	6%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

Uses of takes to storage is 9% for drinking water, 4% industrial use and 87% for irrigation.

Irrigation Allocation

Irrigation allocation per week — 46.24×10^6 m^3
(Equivalent to 76.5 m^3/s taken continuously)

Allocation from groundwater per week — 0.9×10^6 m^3

Allocation from surface water per week — 41.1×10^6 m^3

Allocation from storage dams per week — 4.2×10^6 m^3

Total irrigated area (excluding schemes) — 53,523 ha

Irrigable area within irrigation schemes — 31,070 ha

Water allocated is equivalent to — 578 m^3 per ha per week
or: — 58 mm per week

Groundwater allocation 25 mm per ha per week
Surface water – non-scheme - 43 mm per ha per week
Schemes 76 mm per ha per week

Percentage of irrigated area by type and source

	Groundwater	Surface water	Storage	Total
Arable	<1%	1%	<1%	1%
Pasture	<1%	7%	<1%	7%
Horticulture	1%	1%	<1%	2%
Wine	<1%	<1%	<1%	1%
Unspecified	3%	43%	3%	52%
Schemes		33%	4%	37%
TOTAL	4%	88%	8%	

Planning Background

Otago Regional Council released a Proposed Regional Water Plan in February 1998. Submissions have been received with decisions expected to be released early next year. The plan covers water quality and quantity, beds and banks of rivers/lakes, wetlands and, groundwater. It contains both region-wide provision and provisions that are specific to a catchment or sub-catchment level. Earlier work on individual catchment plans has been incorporated into these catchment specific provisions provided it was consistent with the overall approach of the plan. The provisions in the Proposed Regional Plan: Water are proposed and matters relating to water allocation may be amended by the decisions of the Council on the submissions received.

The overall rationale taken in the plan is to enable use within precautionary environmental limits. The plan sets out specific management requirements where there is sufficient information regarding resource use and values, and a default water allocation regime for other water resources. The default regimes sets minimum flows, groundwater trigger pressures, and allocation limits. The default regime was chosen based on assessments of the environmental effects and effects on users for a number of regimes, and represent a reasonable balance between instream and out-of-stream values/uses. Taking water within the default allocation regime requires limited assessment of effects and, therefore, greater certainty and reduced costs for consent applicants. Taking outside the default regime is possible provided there is a full assessment of and provision for adverse environmental effects (referred to as "case-by-case").

Mining privileges

Mining privileges began their life as rights to take surface water for gold sluicing and processing. They were granted from about 1860 through to 1940. Most of this water is now used for irrigation including a number of irrigation schemes that were once owned by the government. These rights to take water were not tied to a specific parcel of land and have been extensively transferred and split into smaller amounts. The ORC is notified of these changes. These takes often occur in water-short catchments and buying a mining privilege is often the only source of reliable water. Long running, and therefore reliable takes, are very valuable. Mining privilege water is a fundamental part of the Otago economy and can represent the entire water taken from a resource.

Mining privileges often exceed the amount of water in a river and are only required to leave a small amount in a stream to provide for stock and domestic water. If there is insufficient water for all mining privileges, a detailed priority system based on the age of the privilege comes into operation.

These mining privileges are deemed water permits under the RMA, cannot be reviewed by the consent authority without paying compensation, and expire in 2021. Compensation is payable by the regional council if the take is modified, such as the imposition of a minimum flow. These takes will not be subject to the provisions of the plan. However, ORC wants to educate mining privilege holders about its approach to water allocation, and has indicated that these takes will be subject to the plan once they expire.

Environmental Bottom Lines

Surface water

Minimum flows for the taking of water have been determined for the Kakanui River based upon a comprehensive assessment of in-stream effects and effects on water availability. A minimum flow has been determined for the Shag River based on the need to sustain water supply.

Elsewhere in Otago, a default minimum flow regime is established based on the 7-day 10-year low flow. Subject to this minimum flow, and allocation limits, consents will be granted for takes having regard only to their effect on other takes, or significant wetlands. Allocation may be made outside the default requirements having regard to case by case assessment of effects across the range of potential matters of concern for in-stream or out of stream values.

Schedules in the plan give the default minimum flows for identified waters and cover two general cases:

- Rivers/streams that have established flow recorders that can monitor the effects of abstraction directly; and

- Other water bodies, grouped into minimum flow water management areas. Takes from these areas will be suspended when the flow at a specified surrogate indicator sites for the areas concerned fall below their respective minimum flows.

Provision is made for the management of rationing of takes when minimum flows are being approached, using community based allocation committees.

Groundwater

Groundwater trigger levels or pressures at which abstraction must reduced by 25%, 50% and cease are given in a plan schedule for 5 aquifers. These were set by examining groundwater level records in conjunction with recharge estimates and existing bore depths. Other aquifers are managed to sustainable yield criteria.

Groundwater takes in the Shag and Kakanui catchments are treated the same as surface water takes and required to cease abstraction once the minimum flow is reached.

Rationale

An exhaustive and thorough assessment of options for setting default minimum flows was undertaken. Consultants were asked to assess the effects of various options on natural character, aquatic life and out-of-stream users. The approach had to be flexible enough to cope with catchments where there was lots of information and catchments with no information. The use of a statistical flow and groundwater triggers was seen as reasonable given the time and resources required to do an IFIM or equivalent analysis with appropriate consultation. The default minimum flow represents a flow that the biological communities in Otago's rivers have experienced and coped with in the past. It sets a precautionary limit, which cannot be exceeded in the absence of detailed investigations.

As part of implementing the Plan, ORC will undertake monitoring of rivers/streams during low flow to make an assessment of whether the conditions existing at minimum flows are acceptable.

Values protected

The default minimum flows were set to protect aquatic life and natural character of rivers. Groundwater trigger levels or pressures were set to prevent salt water intrusion and land subsidence, to protect surface water flows and artesian pressure, and to minimise interference effects on existing bores. Plan schedules list significant natural and human use values associated with surface water bodies, and the human use values of aquifers. These values will be considered if revised environmental bottom lines are set on a case-by-case basis.

Implementation

A take which complies with the default minimum flow is a restricted discretionary activity, with consideration of adverse effects limited to effects on other existing lawful users and effects on specific wetlands. An application to take at lower flows that the default minimum flow is a discretionary activity requiring a full assessment of environmental effects. All existing consents, other than mining privileges will be subject to these provisions by 2001. As part of the process of reviewing existing consents, it is expected that there will be a lot of rivers where the minimum flow is set on a case-by-case basis. Council will work closely with the local community to establish alternatives to the default minimum flow regime where required.

A number of submissions on the plan state that the default minimum flow is too high and a similar number submit that it is too low.

The experience of the extreme drought conditions over the 97/98 and 98/99 summers has provided useful information to assist assessment of the appropriateness of the default regime.

Limits on Total Allocation from Resource

Surface water

For surface water, the allocation limit is the greater of the 7-day MALF or the current assessed level of take. Existing users will all be classified as A permits. New users will be classified as A permits if the combined take is less than 50% of the MALF, otherwise they will be B permits,. In the application of restrictions on takes, B permits are suspended before A permits. The wording “assessed actual take” is used to address those users who are known to be taking less than their paper allocation limit.

Similar to the default minimum flow, this allocation limit is a default value that can be varied on a case-by-case basis. Allocation limits are specified in policies rather than rules within the plan. Rules specify that the allocation limit for a resource must be taken into account in resource consent decisions.

Groundwater

Allocation limits are not set for groundwater, with the exception of groundwater takes in the Shag and Kakanui catchment. In these catchments, groundwater and surface water takes are considered together and the allocation limit applies to the combined take.

A hydrologists report on each groundwater consent includes an assessment of water availability. If an aquifer exhibits an ongoing decline in water levels no more consents are issued. This is occurring in at least two aquifers.

Rationale

The default allocation limit was an estimate of the best balance between instream effects and accessibility of water. Setting an allocation limit takes into account the effects of abstraction on the flow regime, provides certainty to users, and guidance for the consent process. The band system used for surface water provides a stated security of supply to users and establishes a progression of accessibility. For surface water the effect of various allocations and bands on natural character, duration of low flow, excessive algal growth and water supply reliability were considered.

Allocation limits which required the claw back of existing takes were not considered. The basis upon which claw back could occur would be problematic. There is no major issue for instream values. Interference between takes is the main issue and any issues of this kind are accepted for existing allocation. It was seen as more appropriate to put the emphasis on bringing existing users in line with minimum flows and aquifer triggers.

Storage

Policies in the plan encourage water harvesting, but is not specifically allowed for.

Fully or Over-Allocated Resources

Because the allocation limit will be set to the greater of existing use and the default value, no resources are considered to be currently over allocated. Applications for consents to take from a fully allocated resource will be assessed on the same case-by-case basis as any other consent that goes outside the default management regime. Catchments with mining privileges could be considered over-allocated based on the size of take, but do not yet come under the provisions of the plan. *("Over-allocation" is a subjective and somewhat emotive concept. Any interference or instream issues could theoretically imply over-allocation. But regard must be had to frequency and duration of effects, and the need to provide for the needs of people and communities. Over-allocation implies claw back is required. We are not presently aware of any particular need for claw back in Otago although cases may become evident as the plan is implemented.)*

A "tradeable water permit" system has been happening with mining privileges for years. The input to this system by council is in keeping the historical records, providing details of the priority system, inspecting where water is taken and recording the transfers in order to keep track of where the water is taken. Permits can be transferred under the RMA, and other than keeping track of where takes are and ensuring there are no adverse effects of the transfer on other users, there is no other role that a council needs to take. Transferability of permits is supported as enabling wider, more beneficial use of scarce resources. The resources do need to be scarce for transfers to occur in preference to new permits.

Setting Aside of Water if Resources are not Fully-Allocated

All consents are treated on a first in first served basis. Existing community water supply takes are recognised as a human use value associated with surface and groundwater resources, and must be protected. Expansion of existing water supply takes would be considered on the same basis as any other water take consent.

Reducing Takes in Water-Short Periods

Surface water

User groups are used to establish rostering of takes when river levels drop close to minimum flows. A consent condition states that the holder will comply with directives from a water allocation committee set up by the regional council. These are local water users groups who decide how cut-backs will be implemented. Council contacts the group when river levels are getting low.

Groundwater

The implementation of the stepped cutbacks for groundwater takes has yet to be finalised. Because it is difficult to restrict individual pumps, the cutbacks can only be implemented collectively so users groups are likely to be established.

Water Use

Measuring method

Actual take is not measured, other than by some users (e.g. irrigation companies) who require flow records for their own purposes. An estimate of actual takes from the Kakanui River was undertaken in a dry summer. All users were asked to turn off and the flow rebound was measured. The estimated usage was only 10% of the volume allocated on paper. Historically a ratio of 3:1 has been used to calculate actual take from the consented volume. In a study undertaken on the Kakanui River, sustained take was approximately 10% of the paper allocation.

Water meters

Water meters have not been considered necessary given the high transaction costs and political issues associated with meters. Water meters are a tool for managing issues among abstractors, and for users optimising their water use rather than for ensuring environmental protection. River flow and groundwater monitoring can be used to assess whether the minimum flow or aquifer trigger is being met. If required, compliance with consent conditions can be checked from pump size and the capacity of delivery channels. Some new consents have requirements for water meters.

Guidelines for reasonable use

- All applicants for water must justify the volumes/flows they apply for, and will be assessed for reasonable use.
- A formula based on land area, crop and climate is used for irrigation (from Grasslands Institute).
- Reasonable use for community water supplies is based on 3000 ℓ/day per house.

Review of existing consents

When existing consents come up for renewal they will be assessed for reasonable use in the same way as a new consent would be. Most existing consents contain a review clause relating to any minimum flows established under the plan. One option is to implement a formal review of all consents once the plan is operative.

If a consent is taking more than is allocated, but the use is reasonable, the situation may be best addressed by a variation in the consent rather than reducing the take. The decision would depend on the level of effects and whether the consent was within the default water allocation regime.

Illegal takes

These are discovered through complaints or by field officers. There is no active programme to identify illegal takes.

Unused permits

As the plan is based on "assessed actual use", unused takes will be cut-back either at renewal time or under a consent review. The 2 year lapse provisions in the RMA would be used if required.

Permitted takes

All takes for reasonable domestic and stockwater needs are permitted. For other uses, taking up to 25,000 ℓ/day is permitted with the following exceptions: takes up to 1000 m^3/day are permitted from specified large water bodies such as the Clutha River, and; permitted takes from some aquifers is 10,000 ℓ/day. For surface water, the instantaneous take must be less than 0.5 ℓ/s in drier parts of the region and less than 1.0 ℓ/s elsewhere. Groundwater takes must be at less than 1.5 ℓ/s.

These permitted activities reflect current practice and are considered very unlikely to have any significant effects. If monitoring regimes picked up a problem, such as declining groundwater levels, the cumulative effect of permitted takes would be assessed.

Permitted takes from surface water, other than takes for reasonable domestic and stockwater needs, are subject to minimum flow controls. Takes are only permitted if abstraction is not suspended under minimum flow rules.

Other Methods

- Advocacy and promotion of efficient use.
- Water quality recharge zones
- Riparian management can be used in case-by-case situation.

Community Involvement

There has been substantial consultation as part of the plan development. Following the release of the consultative draft, staff attended about 70 meetings to explain and receive comments on the plan. Issues and options documents were also used in some catchments, but did not spark as much discussion as the draft plan. Attention was not really given to the plan until people saw the wording of proposed policies and rules. Once it is approved, plan implementation will involve a lot of community consultation to communicate the impact of the plan and highlight the opportunities it provides.

User group involvement in the management of takes, particularly during water shortages, is a key part of the water allocation system. Established groups are functioning very well and council are often requested to set up such groups. The members of a water allocation committee are appointed by ORC and are all water users.

Administration

Duration of consents

Twenty years unless there is particular issue. Because the limits set by the plan are considered sustainable, there is no reason not to provide long-term security/certainty to users and their investments.

Funding

The only charge to consent holders is an application fee. All monitoring, investigations and planning are funded from the general rate. There is a charge for transfers and land easements for water races.

Enforcement

Throughout the preparation of the plan, a lot of effort went into ensuring that plan provisions are legally defensible. Control measures were required to meet the test of whether they could be justified to an independent authority, equivalent to the Environment Court. Legal opinions were sought on some issues.

Obstacles

- Time required to implement plan effectively and set up information systems needed to manage the plan
- Mining privileges
- Incomplete community understanding of approach used in plan

Measures of success

- State of Environment monitoring of water resources
- How well the system works in a dry year
- Satisfaction of users and of wider community with respect to instream values
- Ability to cater for a variety of situations – flexibility – limit the need for plan variations or changes

Otago wisdom re the value of water

"You can take my partner but don't take my water".

What is Needed Now?

Water management has been going on for a long time, and all councils have developed an approach to managing water takes, even if it is not yet formalised in a plan. For the most part, there are sufficient technical tools available. On a national level, some evaluation of existing or proposed plans would be valuable. There are a number of proposed plans in place which could be used as case studies. What are the key elements of a successful water allocation plan? How well can it be (or is it being) implemented? How do you judge whether a plan is "working"? This type of work is seen as more important than the evaluation of theoretical approaches that have yet to be applied in New Zealand.

One technical issue facing Otago that could possibly be helped by national research is a defensible method for assessing habitat requirements that is not as time or resource consuming as IFIM type approaches. The default minimum flow is based on a single rule for the whole of Otago, but it would be preferable to differentiate between streams on an eco-type basis.

Total quantity of water allocated per week 1,451,520 m^3
(Equivalent to a flow of 2.4 m^3/second taken continuously)

Note: As part of preparation for the water plan, SRC are reviewing and updating the consents database.

Water Sources

Direct takes from surface and groundwater

Surface Water	% of total weekly allocation	Mean Flow (m3/s)
Oreti River	58%	43.1
Mataura River	12%	94.8
Waiau River	2%	225.0
Apirama River	1%	24.5
Other surface water	3%	
Groundwater	**% of total weekly allocation**	**Average annual recharge (million m^3/yr)**
Mataura Groundwater	9%	
Waiau Groundwater	4%	
Oreti Groundwater	4%	
Bluff Groundwater	2%	
Makarewa Groundwater	1%	
Mararoa Groundwater	1%	
Other groundwater (each <1% individually)	3%	

Note 1: Relates to weekly allocation rather than to actual use
Note 2 Does not included permitted abstractions

Uses of allocated water (by type and source)

Water use (% of total weekly allocation) by type and source

	From surface water	From groundwater	All sources
Domestic, municipal and stockwater	32%	13%	45%
Industrial	27%	7%	34%
Irrigation	16%	5%	21%
TOTAL	76%	24%	

Notes: 1) Relates to volumes/flow allocated rather than to actual use
2) Does not included permitted abstractions

INTERVIEW SCHEDULE

Information on Water Allocation in New Zealand

Attached is the list of questions that will be used to guide interviews with council staff. The second column contains examples to help illustrate the intent of each question. The examples are definitely not an inclusive list of all options. It is a comprehensive list of questions intended to cover all issues addressed by councils relating to water allocation. Not all questions will be relevant to all councils. Answers to these questions will relate to a mixture of proposed plans, consultative discussion documents and ideas that councils have not yet released formally.

QUESTIONS	EXAMPLES
1. Setting of Environmental Bottom Lines (***minimum flows, groundwater trigger levels or pressures)***	
What method is or will be used to determine these? for rivers with flow records? for rivers/streams with little or no flow records? for groundwater?	IFIM, statistical
What values/aspects are they designed to protect?	Trout habitat, prevent salt water intrusion
How will the bottom lines be implemented? (incl. frequency of review)	Region-wide regional plans, non-statutory methods, resource specific plans
Why did you use this approach?	
2. Determining how much water can be abstracted	
Are there existing or proposed limits on the maximum amount of water (total of all consents) that can be abstracted from a resource?	
What time periods do the allocation limits relate to?	Instantaneous take, daily, weekly or seasonal volumes, summer only
What information is taken into account in setting the maximum allocation?	Potential demand, reliability of supply (risk) to existing users
How are instream uses and values allowed for?	Minimum flow set above environmental bottom line, sharing rules
Is abstraction to storage facilities during time of high flow allowed for?	

QUESTIONS	EXAMPLES
How will the allocation limits be implemented? (incl. frequency of review)	Regional plan, resource consents
Why have you taken this approach?	
3. Reconciling actual allocation with maximum allocation limits	
If, as a result of setting or reviewing the allocation limit, a resource is found to be over-allocated, will the allocated amount be changed and if so how?	Prorata cut back, tendering revise allocations according to actual use, wait until consents get surrendered, actively promote efficiency or alternative source, economic methods
How are new applications and renewals dealt with if a resource is over allocated?	Waiting lists, priority to some uses, tradeable permits
How and why was this approach chosen?	
If a resource is not fully allocated, how do you propose to manage the unallocated amount?	Via consents first-in-first served, volumes tagged for specific uses
How are these measures implemented?	Regional plan
4. Managing water takes in water-short periods	
In water short periods, when environmental bottom lines would be reached if everyone took their allocation, what happens?	Rationing, rostering, priorities assigned to users, water users groups, tradeable water permits
How are these measures implemented?	Formal agreements, s329 measures, regional plans, water users groups, resource consent conditions
Is it enforceable?	
Why and how was this approach taken?	
What input do user groups have (or will have) in deciding the approach?	

QUESTIONS	EXAMPLES
5. Actual use vs allocated amounts	
Do you know how much water is actually used?	Water meters, power consumption, estimates
How do you find out about and deal with permits that are not utilised, permits that take in excess of the allocation or illegal takes?	
How do you deal with existing consents that are allocated more water than is actual or reasonable for the use?	Tradeable water permits or other financial options, revise allocation based on metered use, advocacy and education
Do you provide guidelines for efficient and reasonable amounts? What information are these based on?	Crop type, irrigation method, climate, soil. Industry type, per capita domestic use
How is it decided if water meters are needed for a given resource, and how is metering implemented?	
How are permitted abstractions dealt with and how do you estimate the cumulative permitted take?	
How is your approach implemented?	Information provided to applicants, regional plan, resource specific agreement, resource consent conditions
Why have these approaches been adopted or proposed?	
6. Other water allocation aspects	
What other measures do you undertake that are important to the water allocation issue?	Land-use controls in catchment and recharge areas, gravel extraction, mitigation measures such as riparian management, control of discharges in water short periods
How and why where these methods considered?	
How are they implemented?	
7. Community input	
How have (or will) the community be involved in the establishment of the water allocation system?	Formal submissions on regional plan, working groups, consultative discussion document

QUESTIONS	EXAMPLES
8. Implementation of water allocation system	
What is the duration of consents?	
How are the following funded? water resource investigations water resource monitoring water resource planning consents administration	General rate, annual water permit charge (fixed or variable), consent application fee, other
What are some of the main obstacles to successful implementation at your water allocation system?	
How well can it be enforced?	Legal risks
How easy is it to administer?	
How will you assess whether the allocation system is working?	
9. Where to from here?	
From your perspective, what are some of the key information or research gaps within the water allocation issue?	

"VALUE OF IRRIGATION WATER"
ASSUMPTIONS OF LAND-USE AND GROSS MARGINS

MAF regional offices were sent the irrigated area and irrigation land-use figures obtained from the analysis of consent databases. They were also provided with current Agribase information on land use by area and farm type for all districts within each region.

They were asked to:
- Review the irrigated areas in each land use type.
- Provide estimates of the average gross margin for each irrigated land use
- Estimate the most likely land use if irrigation water was not available
- Provide gross margin figures for each alternative dryland land-use

Current landuse, gross margins and alternative landuse were all best guess MAF estimates, using existing information and judgement.

The following tables give the assumptions used to derive the final results as given in Section 3.6 of the main report.

Irrigated Land Area by Region and assumptions of land-use in the absence of irrigation

Region	Irrigated Area (ha)	Irrigated Land Use	Land Use Without Irrigation
Northland	4000	62% dairying 2% arable 1% glass/plastic houses 33% fruit 3% market gardens	All in lower production dairy or beef
Auckland	6500	13% dairying 1% glass/plastic houses 12% fruit 74% market gardens	All in lower production dairy or beef
Waikato	4500	14% dairying 1% glass/plastic houses 18% fruit 65% market gardens 2.5% viticulture	All in lower production dairy, beef or maize
Bay of Plenty	9435	23% pasture (dairy) 1% plastic/glasshouses 72% fruit 4% market gardens	Dairy (up to 10% less production) Market gardens Fruit Market gardens (up to 20% less production)
Gisborne	5000	8% pasture (dairy) 2% arable crops 5% plastic/glasshouses 10% fruit 5% market gardens 70% vegetables <1% viticulture	Dryland Arable (Maize) Dryland Arable (Maize) Dryland Arable (Maize) Fruit Dryland Arable (Maize) Dryland Vegetables Dryland grapes
Hawkes Bay	23242	8% dairying 8% other pasture 35% arable crops 1% plastic/glasshouses 35% fruit 5% market gardens 8% viticulture	All dryland pastoral except for viticulture Dryland grapes

Irrigated Land Area by Region and assumptions of land-use in the absence of irrigation - continued

Region	Irrigated Area (ha)	Irrigated Land Use	Land Use Without Irrigation
Taranaki	2000	88% dairying 12% market gardens	Lower production dairy Dryland arable
Manawatu-Wanganui	8000	70% dairying 8% other pasture 20% arable crops 2% market gardens	Dryland dairy Dryland pastoral Dryland arable Dryland pastoral
Wellington	9273	60% dairying 10% other pasture 10% arable crops 4% fruit 10% market gardens 6% viticulture	Dryland dairy Dryland pastoral Dryland pastoral Dryland pastoral Dryland pastoral Dryland grapes
Tasman	8000	5% dairying 3% other pasture 5% arable crops <1% plastic/glasshouses 73% fruit 5% market gardens 6% other horticulture (hops) 3% viticulture	Dryland dairying Dryland pasture Dryland arable/pasture Housing Dryland fruit/ arable/pasture Dryland fruit/ arable/pasture Dryland fruit/ arable/pasture Dryland grapes
Marlborough	12087	7% dairying 2% other pasture 29% arable crops 29% fruit 4% market gardens 29% viticulture	Dryland dairying Dryland pasture Dryland arable/pasture Dryland fruit/ arable/pasture Dryland fruit/ arable/pasture Dryland grapes
Canterbury	350000	34% dairying 36% other pasture 27% arable crops <1% plastic/glasshouses <1% fruit 2% market gardens <1% other horticulture <1% viticulture	59% dryland pastoral, 31% dryland arable, 10% dairy (low production) Dryland pastoral 67% dryland arable, 33% dryland pasture Lifestyle blocks 33% lifestyle, 67% dryland arable As for fruit 50% lifestyle, 50% sheep Dryland grapes
Otago	66260	24% dairying 67% other pasture 2% arable crops 5% fruit <1% market gardens 1% viticulture	Dryland Sheep Dryland Sheep Dryland Cropping Dryland Sheep/Deer Market gardens Dryland Sheep
Southland	1500	70% dairying 20% arable 10% fruit	Lower production dairy Dryland arable Dryland arable
TOTAL	509797		

Irrigated Gross Margins by land-use ($/ha)

	Dairy	Other Pasture	Arable	Glass/Greenhouses	Fruit	Market Gardens	Other	Viticulture
Northland	1200		1100	129000	20000	3000		
Auckland	2200			129000	24000	3500		
Waikato	2100			129000	24000	2900		
Bay of Plenty	2100			?	24000	2900		
Gisborne	3000		2000	20000	8000	2000		5000
Hawkes Bay	1800	600	1500	100000	5500	8000	3000	8000
Taranaki	Used Waikato figures							
Manawatu-Wanganui	1200	600	4000					
Wellington	1200	600	1000		8000	8000		8000
Tasman	2000	400	700	20000	10800	8000	10000	8000
Marlborough	2000	500	700		9000	8000		8000
Canterbury	1980	610	990	100000	10000	8000	10000	8000
Otago	2000	520	500		23000			8000
Southland	Used Otago Figures except for fruit				10000			

Dryland Gross Margins by land-use ($/ha)

	Dairy	**Other Pasture**	**Arable**	**Glass/Greenhouses**	**Fruit**	**Market Gardens**	**Other**	**Viticulture**
Northland	1066	350						
Auckland	1950	600						
Waikato	1950	600	1200					
Bay of Plenty	1950				24000	2320		
Gisborne			1500		7000		1500	4500
Hawkes Bay		350						4000
Taranaki	Used Waikato figures							
Manawatu-Wanganui	1500	350	700					
Wellington	1500	350						4000
Tasman	1800	300	450	200	4000	600	600	4000
Marlborough	1600	300	350		1000	1000		4000
Canterbury	1540	350	460					4000
Otago		200/240	250					
Southland	1500		250					