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Rangitikei Catchment: Surface Water Use and Availability

Report prepared as part of the Rangitikei Strategic Water Assessment project, jointly funded by Rangitikei District Council and the Ministry for Primary Industries (Irrigation Acceleration Fund)

Rangitikei
UNSPOILT...

Ministry for Primary Industries
Manatū Ahu Matua

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1 Introduction

The Rangitikei district is heavily reliant upon the primary sector for its economic and social well-being. This sector is founded upon the district's topography, soils, climate, water resources, and farmer investment and innovation. However, the district's water resource is coming under increasing pressure from irrigators and droughts.

In response to these challenges the Rangitikei District Council and Ministry for Primary Industries (via the Irrigation Acceleration Fund) are jointly funding The Catalyst Group to undertake a strategic water assessment for the district. This project will generate information about the:

- availability and certainty of water supply (surface and groundwater) in the district;
- efficiency of current water use, and opportunities for improvement;
- costs, benefits, on-farm implications, and regulatory and environmental considerations around irrigation, and
- alternative uses for irrigated land.

Such an assessment is a priority for Rangitikei District Council as this project will provide guidance on what additional benefits and opportunities could arise through smart use of the water resource, and identification of the costs of capitalising on these opportunities at a district and individual level.

One of the tasks within the wider Rangitikei Strategic Water Assessment project is an analysis of the availability and allocation of surface water across the catchment. The purpose of this review is to report on the current level of surface water allocation, minimum flow restrictions, actual water use and surety of supply.

This assessment draws upon publically available reports and information, and specifically requested data from Horizons Regional Council. Whilst every effort was made to use the most up-to-date information available, this assessment was still reliant on information sources that were several years old. Where appropriate, the ages of data sources used to inform this assessment are noted.

This assessment should be read in conjunction with the report titled 'Rangitikei catchment: groundwater use and availability'.

2 Background

The Rangitikei River arises in the Southern Kaimanawa Ranges of the central North Island and flows south into the Tasman Sea at Tangimoana. The catchment also takes in drainage from the North-Western Ruahine Ranges. The total area of the catchment is 3,948 km^2.

Land cover in the Rangitikei catchment includes more than 28% indigenous vegetation, most of which lies in the Conservation Estate in the upper catchment. Land on the volcanic plateau to the east of Mt Ruapehu is managed by the New Zealand Defence Force for army training purposes and makes up nearly 9% of the catchment. The majority of the catchment is in agricultural land use with more than 54% of the catchment in sheep and/or beef farming and just over 4% in dairying. Exotic forestry comprises more than 3% of the catchment with small amounts in horticulture and cropping (Clark and Roygard, 2008). River bed, towns and parks make up the remainder.

The Rangitikei River is a gravel bed river, bounded by iconic papa cliffs through the middle reaches. Reaches of braided channel were historically found in the lower river but these have been significantly reduced by river control and flood management works in recent decades. The underlying catchment geology ranges from hard sedimentary in the upper catchment of the mainstem to volcanic geology in the upper Moawhango and Hautapu Rivers with some soft sedimentary rock in the lower Moawhango, Hautapu, Makohine, Porewa and other minor tributaries.

The Moawhango River is a major tributary of the Rangitikei River. The river is utilised as part of the Tongariro Power Development (TPD) scheme. Water from the Southern slopes of Mt Ruapehu is diverted into Lake Moawhango via a tunnel where it is then directed into the Tongariro River. Lake Moawhango was created by the Moawhango Dam, built in 1979. The dam is a significant piece of infrastructure and the TPD is the largest take of water in the Rangitikei catchment, accounting for 16% of the mean annual low flow (MALF) at Mangaweka. Genesis Energy, owner of the TPD scheme, is required to release four flushing flows of 30 cubic metres a second for nine hours between December and March. The operation of the Dam has a significant effect on flows in the middle and lower Rangitikei River.

Water quality in the Rangitikei River is generally good, particularly in the upper river where water clarity is exceptionally high and supports the world class trout fishery.

2.1 Water Conservation Order - Rangitikei River

In February 1993, a Water Conservation Order (WCO) was gazetted for the Rangitikei River to preserve the outstanding wild and scenic characteristics, recreational, fisheries, and wildlife habitat features of the upper river; and the outstanding scenic characteristics, recreational and fisheries features of the middle river. The upper river waters include the mainstem and all tributaries upstream of the Makahikatoa Stream. The waters of the middle river covered by the order include the mainstem from the Makahikatoa Stream to the Mangarere Bridge at Mangaweka, the Whakaurekau River, and all its tributaries, and the Kawhatau River, the Pourangaki River and the Mangakokeke Stream.

The specific protections afforded by the Order include a prohibition on damming in the upper and middle rivers, and prohibition of any damming outside the area of the order that could cause impounding of the upper or middle river upstream of the Hautapu confluence. The Order also requires the quantity and rate of flow of natural water in the upper river to be retained in its natural state; and that the flow in the middle river shall not be less than 95% of the natural flow. The WCO also contains a number of water quality requirements. A copy of the order is included at Annex 1.

2.1.1 Local water conservation notice - Hautapu River

The Hautapu River and its tributaries upstream of the confluence with the Oraukura Stream (adjacent to Taihape) were previously covered by a Local Water Conservation Notice (1990) for the regionally significant brown trout fishery in the upper Hautapu River. Local Conservation Notices were gazetted under the Water and Soil Conservation Act (1967). When this Act was superseded by the Resource Management Act in 1991 the provisions of local notices were migrated into Regional Plans. The surface water quantity aspects of the local notices were originally included within the Land and Water Regional Plan (2003), and have subsequently been superseded by the water allocation framework of the One Plan.

2.2 Surface water management zones and waterbody values

The One Plan[1] identifies a number of water management zones and sub-zones as management units for the Rangitikei catchment (Figure 1) in Schedule AB of the plan (

Table 1). Management of the Region's water resources (both allocation and quality) are implemented on a zone by zone basis.

[1] The One Plan is a combined regional policy statement and regional plan for the Manawatu Whanganui region. This document sets out the objectives, policies, rules and non-regulatory methods Horizons Regional Council will apply to the management of the region's natural resources. The full plan is not operative yet, pending sign-off from the Environment Court and Horizons, but the water quantity provisions are operative.

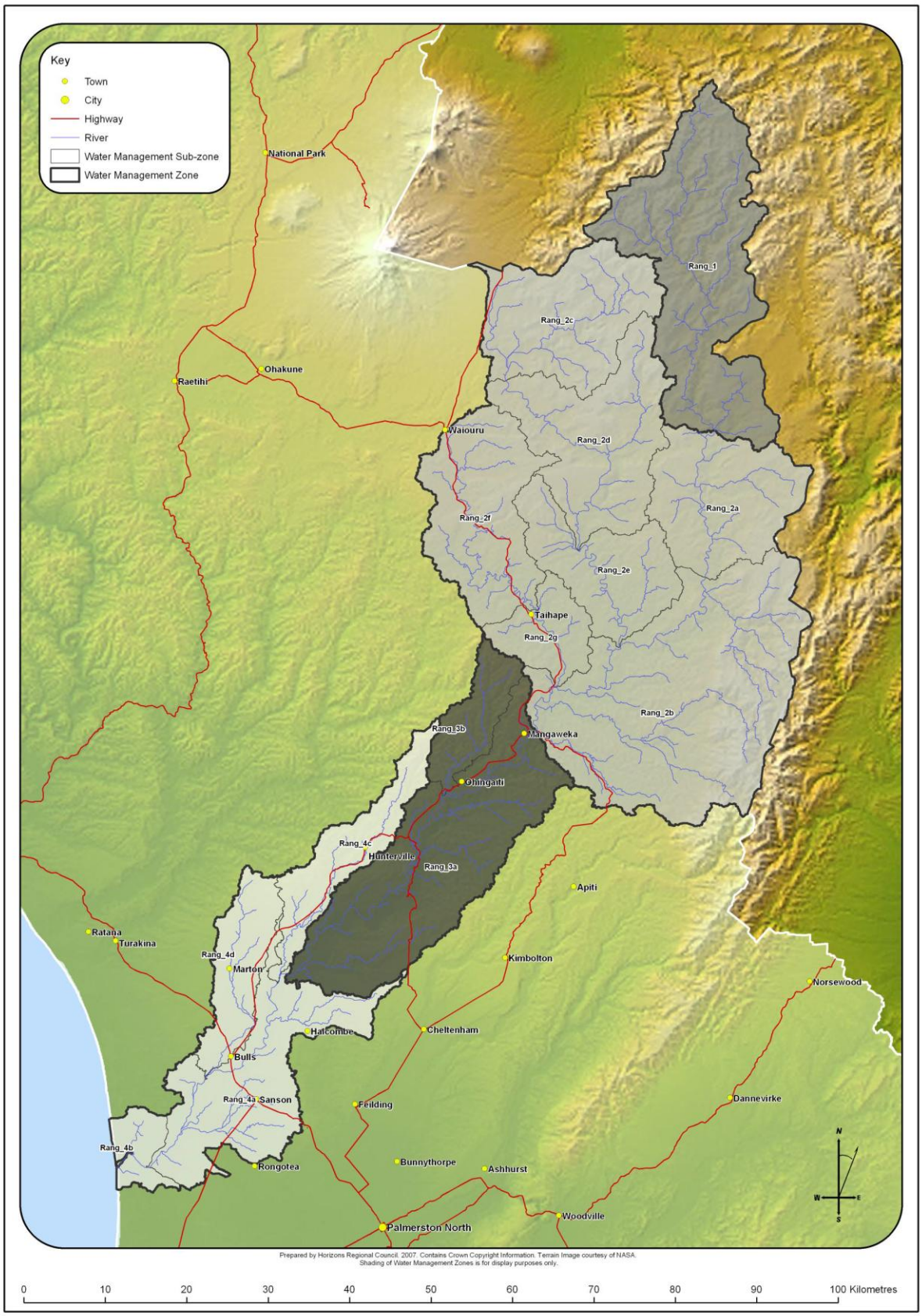

Figure 1: Rangitikei catchment surface water management zones and sub-zones.

Table 1: Surface water management zones and sub-zones of the Rangitikei River catchment.

Water Management Zone	Sub-zone name	Sub-zone code
Upper Rangitikei (Rang_1)	Upper Rangitikei	(Rang_1)
Middle Rangitikei (Rang_2)	Middle Rangitikei	(Rang_2a)
	Pukeokahu-Mangaweka	(Rang_2b)
	Upper Moawhango	(Rang_2c)
	Middle Moawhango	(Rang_2d)
	Lower Moawhango	(Rang_2e)
	Upper Hautapu	(Rang_2f)
	Lower Hautapu	(Rang_2g)
Lower Rangitikei (Rang_3)	Lower Rangitikei	(Rang_3a)
	Makohine	(Rang_3b)
Coastal Rangitikei (Rang_4)	Coastal Rangitikei	(Rang_4a)
	Tidal Rangitikei	(Rang_4b)
	Porewa	(Rang_4c)
	Tutaenui	(Rang_4d)

Water related values are defined for each of these water management zones. Values applying across the entire Rangitikei catchment include:

- Life-Supporting Capacity
- Aesthetics
- Contact Recreation
- Mauri
- Industrial Abstraction[2]
- Irrigation[1]
- Stockwater
- Existing Infrastructure
- Capacity to Assimilate Pollution

Values applying across specific reaches of the Rangitikei catchment include:

- Natural State
- Sites of Significance - Aquatic for whio (blue duck), dwarf Galaxias, red fin bully, giant kokopu and brown mudfish
- Sites of Significance - Riparian for dotterels
- Inanga Spawning
- Whitebait Migration
- Trout Fishery (ranging from outstanding to regionally or locally significant depending on location)
- Trout Spawning
- Water Supply (municipal takes of drinking water)
- Flood Control and Drainage

[2] This value is limited to areas where the water allocation framework shows there is water available for abstraction.

2.3 Monitoring of water quantity

The Rangitikei River is monitored by Horizons Regional Council at a number of sites throughout the catchment, and is also part of the National River Water Quality Network (NRWQN) of monitoring sites administered by NIWA. There are two NRWQN sites on the river: the Rangitikei River at Mangaweka, and the Rangitikei River at Kakariki (at the SH54 Bridge). At each site there is a long-term hydrometric recording station.

The Horizons Regional Council water monitoring network is extensive and sophisticated. Data used in this report has largely been sourced from Horizons monitoring networks or information published in regional council reports.

The regional water quantity monitoring programme provides information for a range of purposes including flood management, water allocation and water quality. With end-uses that include emergency management, flood scheme design and automated compliance testing.

Key elements in the Regional Council's surface water quantity programme are:

- Continuous river level and flow monitoring
- Flow gauging
- Water use monitoring
- Rainfall and
- Soil moisture monitoring

2.3.1 River flow monitoring

Continuous river level and flow monitoring information are the core parameters of the water quantity monitoring programme providing both real-time information for immediate decision making needs and accurate long-term records to inform strategic management decisions. Continuous flow and river levels are collected at seven sites in the Rangitikei catchment:

- Rangitikei at Pukeokahu
- Rangitikei at Mangaweka
- Hautapu at Alabasters
- Rangitikei at Onepuhi
- Rangitikei at McKelvies
- Forest Rd Drain at Drop Structure[3]
- Tutaenui at Hammond St

More recent consented takes of water are linked to one of these flow sites for management of water use during low flow conditions, including management measures such as step-down reduction in take volume or cessation of take at minimum flow. Continuous river flow data can be accessed from the Horizons website at: http://www.horizons.govt.nz/managing-environment/resource-management/water/river-heights-and-rainfall/Choose-river-rainfall-chart/ Long-term flow statistics are included for each site on the site selection page (Figure 2). Graphs of river flow over the last seven days, 30 days, or the year to date can be viewed and downloaded from the site (Figure 3).

[3] This site is only used for flood warning and drainage control purposes.

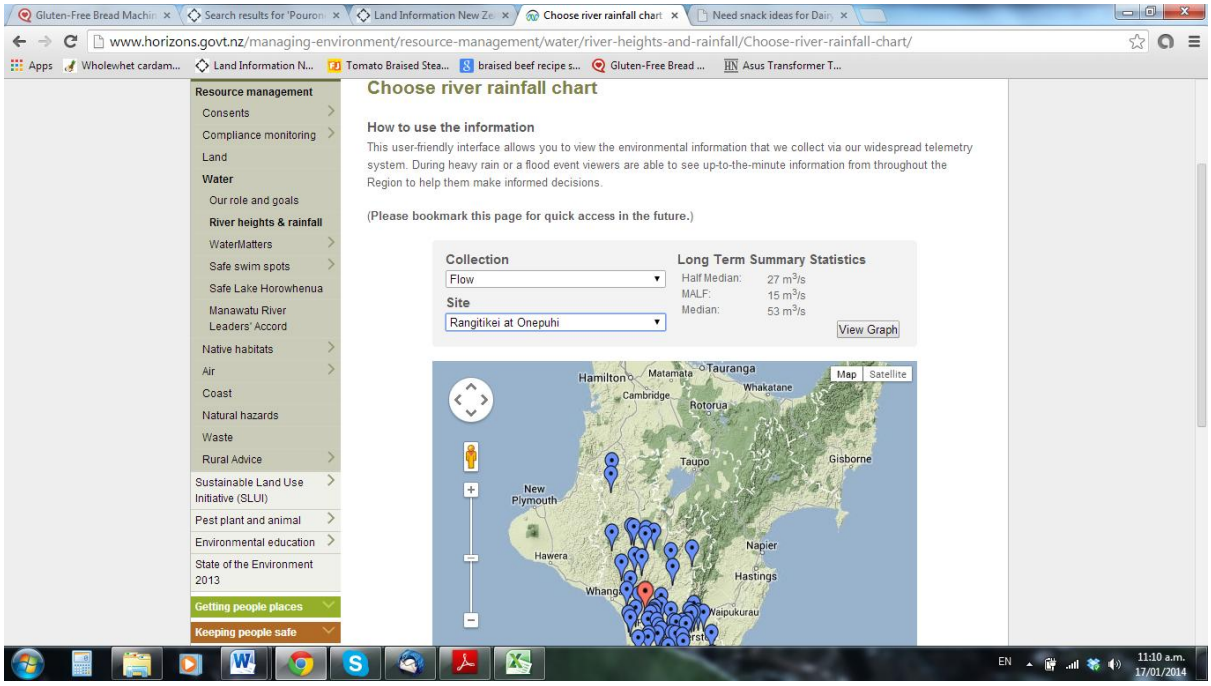

Figure 2: Screenshot of Horizons' Rivers and Rainfall site selection page, including long-term summary flow statistics for the Rangitikei at Onepuhi flow monitoring site.

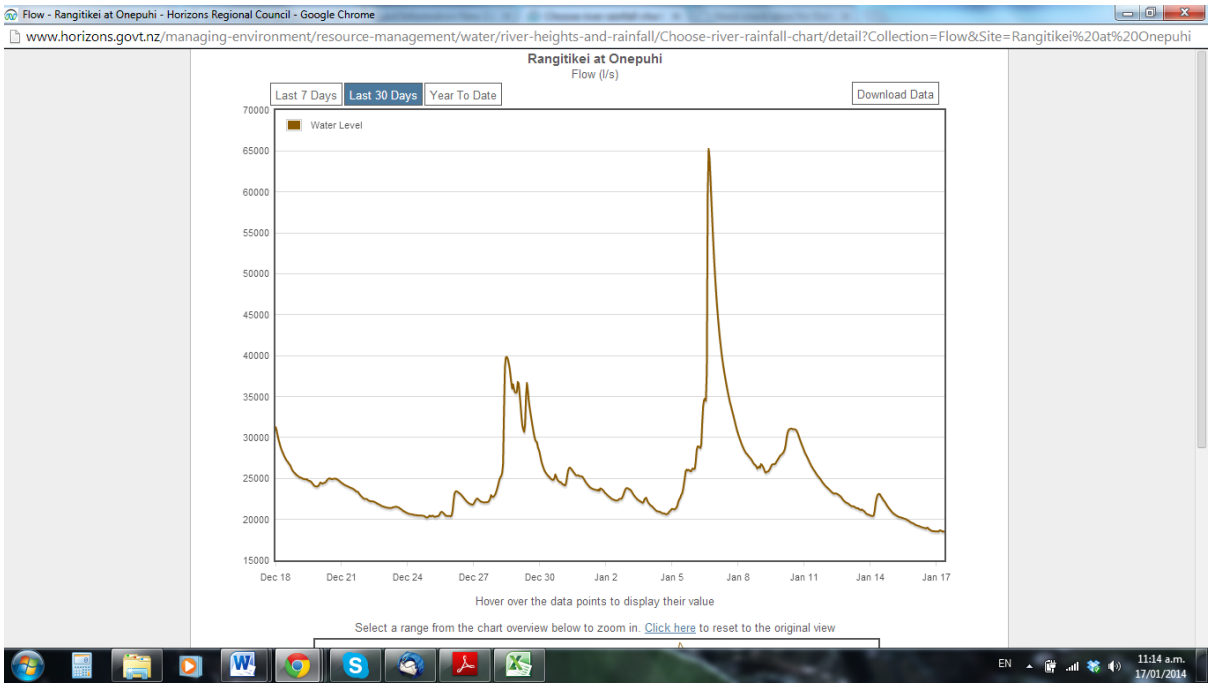

Figure 3: Screenshot of flow in litres per second for the Rangitikei at Onepuhi site for the 30 days prior to January 17 2014 from Horizons' Rivers and Rainfall site.

2.3.2 Flow gauging

Flow gaugings are discrete spot measurements of flow undertaken by hydrology staff. They are often useful for calibrating continuous flow monitoring sites, particularly during high or low flow events, to form relationships between continuous flow sites and other unmonitored sites (often in smaller tributaries) and for compliance monitoring of consented activities.

2.3.3 Water use monitoring

Water use information is automatically collected from a number of sites in the catchment via water meters and telemetered to the regional council. Other (usually smaller) takes are required to keep records via metering and provide these regularly for compliance monitoring purposes. Over 70% of the region's consented surface water volume (excluding hydroelectricity) is now automatically monitored. The One Plan (Policy 15-4) requires all large (greater than 750 cubic metres per day) or significant surface water takes to be metered and telemetered.

Compliance testing and reporting occurs automatically for telemetered takes through the WaterMatters system. Water use information is publicly available via WaterMatters: http://www.horizons.govt.nz/managing-environment/resource-management/water/watermatters/watermatters-overview/

Watermatters can be used to view minimum flow restriction alerts and proportions of consented volume and daily use on a catchment or water management zone basis. Consent holders can also view information on restrictions for individual consents, whether irrigation is allowed that day and recent water use records for their own consents.

According to Watermatters almost 77% of the consented surface water volume in the Rangitikei catchment is metered and telemetered (Figure 4). This differs to separate advice provided by Horizons (Annex 4) that states of the 63 surface water takes in the catchment, 33 are telemetered, accounting for 48% of the consented surface water volume.

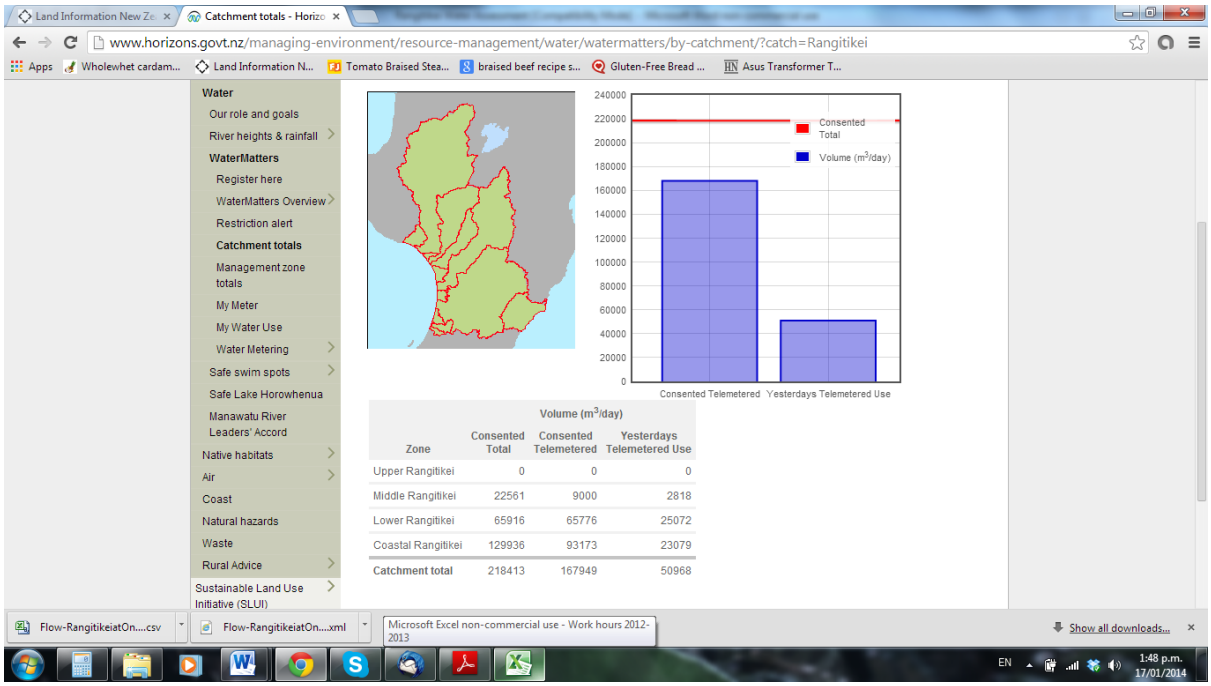

Figure 4: Screenshot from WaterMatters showing the consented and telemetered volumes of water use for the Rangitikei River Catchment.

2.3.4 Rainfall and soil moisture monitoring

Rainfall and soil moisture monitoring are useful for irrigation management of pasture and crops and are also important for flood warnings and flood control design purposes. There are ten continuous rainfall monitoring sites in the Rangitikei catchment, some of which are managed in conjunction with other agencies like NIWA. Currently, there are no continuous soil moisture monitoring sites in the catchment, although several landowners have installed their own soil moisture monitoring systems. All rainfall data is available to view (Figure 5) or download from the Horizons website at:

http://www.horizons.govt.nz/managing-environment/resource-management/water/river-heights-and-rainfall/Choose-river-rainfall-chart/.

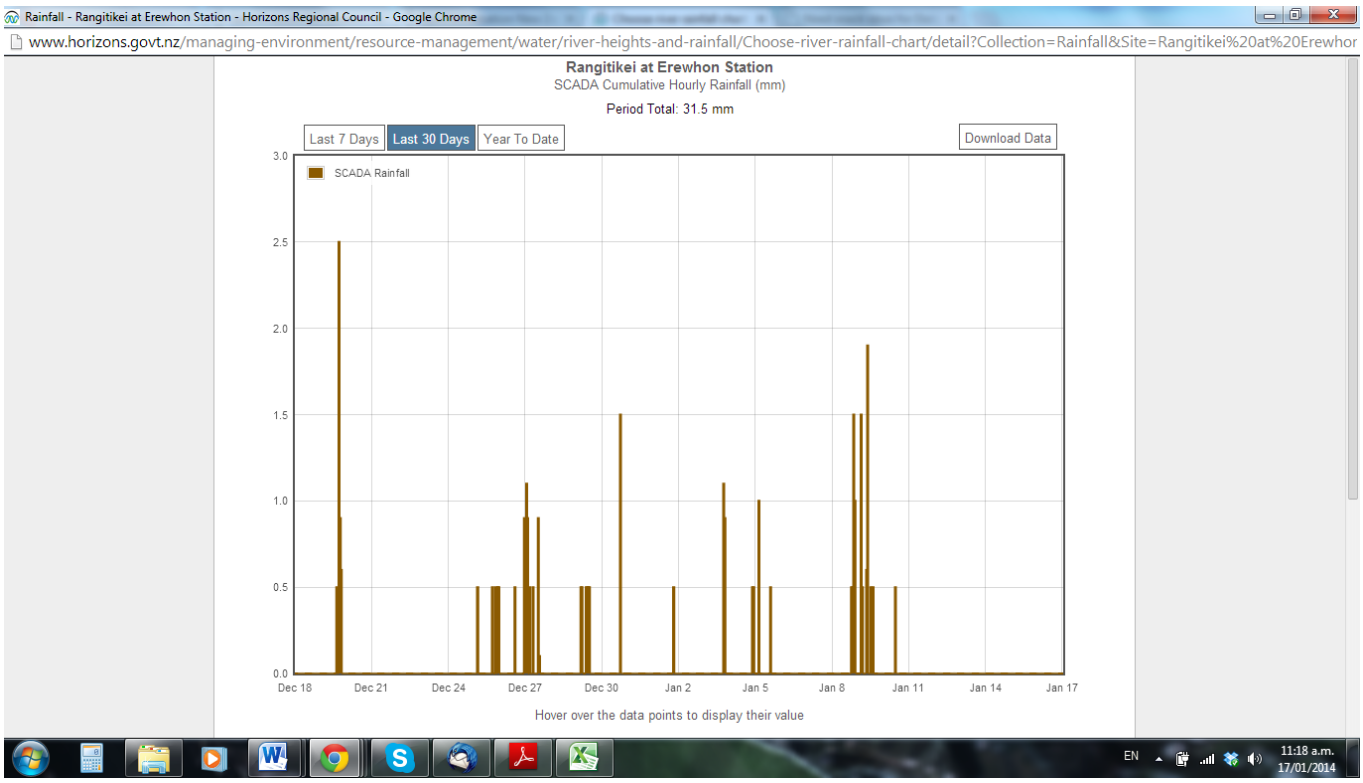

Figure 5: Screenshot of cumulative hourly rainfall for the 30 days prior to January 17 2014 for the Rangitikei at Erewhon rainfall monitoring site taken from Horizons' Rivers and Rainfall website.

3 Water Allocation Framework

Prior to 2000 knowledge of the surface water resource, water use and effects of that use was poor and did not allow for the development of a robust water allocation regime. Since that time, collection and processing of flow data, requirements for water use records, metering of takes and telemetry, the division of the region into surface and groundwater management zones and the definition of water values has allowed for the development of a comprehensive framework for the Rangitikei catchment and the wider Manawatu-Whanganui Region. This is the water allocation framework set out in the One Plan. The framework and its implications for water users in the Rangitikei catchment are described below.

3.1 The Rangitikei surface water allocation framework

Water Allocation Frameworks are used to set minimum flows and core allocation limits that work in combination to provide a balance between instream requirements for ecosystem health, recreation and cultural values and the needs of out-of-stream water users. An instream management objective is recommended by the Flow Guidelines for Instream Values report produced by the Ministry for the Environment (1998) as the most appropriate approach to defining what state of instream values are to be provided for by any water allocation framework. According to Hurndell et al. (2007) the common instream management objective across the water management zones of the Manawatu-Whanganui Region is:

> "*to maintain and enhance aquatic ecosystem biodiversity and productivity over time compared to current levels, using trout, native fish, aquatic invertebrates, periphyton and ecosystem functioning as indicators of overall ecosystem health*."

3.1.1 Surface water allocation limits

The allocation limit for surface water is the amount of water that can be abstracted from a river when the flow is above the minimum flow. In the case of the Rangitikei River it is the consented amount of flow that can be taken in cubic metres per day (m^3/d) in each water management zone and this is known as the cumulative core allocation limit in the One Plan (Schedule B). The core allocation limit is set to ensure the maximum amount of water taken over any day does not exceed the minimum flow or have adverse effects on the hydrological regime of the river. Allocation limits are set to protect specific instream values such as trout fisheries or aquatic biodiversity and to ensure users do not adversely affect each other (see below). On an instantaneous basis the total allowable surface water allocation for the Rangitikei catchment is 3.3 cubic metres per second (excluding hydroelectricity takes).

As allocation volumes for each zone are derived from flow data at their respective monitoring sites, and since flow in upstream reaches and tributaries affects the amount of flow available lower down the catchment (i.e. river flow is cumulative down the catchment) the allocable volumes in the downstream zones include the flows allocable in the upstream zones (i.e. allocable volume is cumulative down the catchment). In this way the cumulative core allocation ensures allocation limits are not exceeded at the point of take, within the management zone or sub-zone

where the take is located, in downstream management zones, or the catchment as a whole. If allocation is available in a tributary sub-zone but taking of that water will mean there is not enough flow for a downstream management zone or for the catchment as a whole to remain within the core allocation limits, the take will not comply with the allocation framework. Minimum flow requirements of downstream management zones help define the management options for each zone. This is particularly relevant in the Rangitikei Catchment where, in the lower catchment, flows into the river from tributaries are small relative to the contribution from the upper catchment.

The surface water cumulative core allocation limits for the Rangitikei River as set out in the One Plan are shown in Table 2.

Table 2: Cumulative core allocation limits for surface water in the Rangitikei catchment management zones.

Water Management Zone	Sub-zone name	Cumulative core allocation limit (m^3/day)
Upper Rangitikei (Rang_1)	Upper Rangitikei (Rang_1)	0
Middle Rangitikei (Rang_2)	Middle Rangitikei (Rang_2a)	21,600
	Pukeokahu-Mangaweka (Rang_2b)	52,704
	Cumulative allocable volume (Rang_2a + Rang_2b)	**52,704**
	Upper Moawhango (Rang_2c)	0
	Middle Moawhango (Rang_2d)	0
	Lower Moawhango (Rang_2e)	0
	Upper Hautapu (Rang_2f)	9,936
	Lower Hautapu (Rang_2g)	12,960
	Cumulative allocable volume (Rang_2f + Rang_2g)	**12,960**
Whole Zone (Rang_2)		**52,704**
Lower Rangitikei (Rang_3)	Lower Rangitikei (Rang_3a)	141,696
	Makohine (Rang_3b)	864
Whole Zone (Rang_3)		**141,696**
Coastal Rangitikei (Rang_4)	Coastal Rangitikei (Rang_4a)	213,840
	Tidal Rangitikei (Rang_4b)	285,120
	Porewa (Rang_4c)	0
	Tutaenui (Rang_4d)	6,653
Whole Zone (Rang_4)		**285,120**
Catchment cumulative allocable volume (Rang_1 + Rang_2 + Rang_3 + Rang_4)		**285,120**

3.1.2 Minimum flows

A key aspect of any water allocation framework is the definition of a minimum flow. The minimum flow defines the point at which most abstractions should become restricted in order to protect instream values and aquatic life.

The MALF (Mean Annual Low Flow) statistic is an indicator of the flow at which the average most 'flow stressed' period occurs in any year. Therefore, minimum flows are set with some consideration of the MALF. Understanding the naturalised MALF (what the natural low flow statistics of the river would be without abstraction or discharges) is critical to managing the effects of reduced flows against natural background conditions.

Table 3 describes the minimum flows for each water management zone in the Rangitikei Catchment and the relevant flow monitoring site for determining when the minimum flow is reached. Relationships have been built between the minimum flow in each management sub-zone and the corresponding flow at the monitoring site because flow is measured at a limited number of sites throughout the catchment.

Table 3: Minimum flows and relevant monitoring sites for surface water management in the Rangitikei catchment as set out in the One Plan.

Water Management Zone	Sub-zone name	Flow monitoring site	Minimum flow (m^3/s)
Upper Rangitikei (Rang_1)	Upper Rangitikei (Rang_1)	n/a	n/a
Middle Rangitikei (Rang_2)	Middle Rangitikei (Rang_2a)	Rangitikei at Pukeokahu	5.000
	Pukeokahu-Mangaweka (Rang_2b)	Rangitikei at Mangaweka	12.250
	Upper Moawhango (Rang_2c)	n/a	n/a
	Middle Moawhango (Rang_2d)	n/a	n/a
	Lower Moawhango (Rang_2e)	n/a	n/a
	Upper Hautapu (Rang_2f)	Hautapu at Alabasters	0.640
	Lower Hautapu (Rang_2g)	Hautapu at Alabasters	0.640
Lower Rangitikei (Rang_3)	Lower Rangitikei (Rang_3a)	Rangitikei at Onepuhi	12.100
	Makohine (Rang_3b)	Makohine at Viaduct	0.040
Coastal Rangitikei (Rang_4)	Coastal Rangitikei (Rang_4a)	Rangitikei at McKelvies	10.230
	Tidal Rangitikei (Rang_4b)	Rangitikei at McKelvies	10.230
	Porewa (Rang_4c)	Rangitikei at Onepuhi	12.100
	Tutaenui (Rang_4d)	Rangitikei at McKelvies	10.230

3.1.3 The relationship between minimum flows and allocation limits

Minimum flows are designed specifically to provide a minimum level of protection for instream values (e.g. aquatic life). However, the frequency and duration of minimum flows determines the level of impact. For example, the more water that is taken from the river each day the faster the minimum flow is reached, the more prolonged the minimum flow event is (known as 'flat-lining' the river) and the slower the recovery from low flows. This in turn causes an increase in the number of days water takes are restricted across an irrigation season, reducing the security of supply during critical dry periods. The way to control the amount of water taken from a river each day is to limit the daily allocation or core allocation. In this way both the extreme effects of minimum flows on aquatic life and the security of supply from unfettered minimum flow restrictions can be controlled.

3.1.4 Methods to determine allocation limits and minimum flows in the Rangitikei

There is a range of methods available for determining minimum flows. The selection of method depends on the amount and quality of hydrological data, instream values, demand for water and the provisions of any statutory instruments (i.e. National Water Conservation Orders, National Environmental Standards or Policy Statements).

For many rivers, trout populations are used as an overall indicator of aquatic ecosystem viability over time. Managing flows for trout, which are one of the most flow demanding fish species in New Zealand rivers is seen as a pragmatic approach since there is an expectation that this will also provide adequate habitat and flow for most native fish. In the Rangitikei River using trout as the key species for minimum flow setting is appropriate, given the outstanding trout fishery values identified in the Water Conservation Order and the regionally important trout fishery values in the Hautapu River Local Water Conservation Notice. Table 5 outlines the methods used to determine the minimum flows and allocation limits for the different water management sub-zones of the Rangitikei catchment.

Table 4: Methods used to determine minimum flows and core allocation limits for the surface water management zones of the Rangitikei Catchment. WCO = Water Conservation Order - Rangitikei River; WRA = Water Resources Assessment - Rangitikei River (Roygard and Carlyon, 2004); MALF = Mean Annual Low Flow; IFIM = Instream Flow Incremental Methodology; LWCN = Local Water Conservation Notice - Hautapu River. *Adapted from Hurndell et al. (2007).*

Water Management Sub-zone	Minimum flow and allocation limits derived from:	Minimum flow	Core allocation limit
Upper Rangitikei (Rang_1)	WCO	Natural flow regime as per NWCO	No allocation
Middle Rangitikei (Rang_2a)	WCO	WCO 95% of natural MALF	5% of MALF
Pukeokahu-Mangaweka (Rang_2b)	WCO	Q_{95} flow to maintain minimum flow at Onepuhi	WRA Q_{95} - minimum flow
Upper Moawhango (Rang_2c)	No allocation: One Plan	-	No allocation available after Genesis take
Middle Moawhango (Rang_2d)	No allocation: One Plan	-	No allocation available after Genesis take
Lower Moawhango (Rang_2e)	No allocation: One Plan	-	No allocation available after Genesis take
Upper Hautapu (Rang_2f)	MALF + 15% MALF as core	MALF at Hautapu at Alabasters = 0.64	Allocation reflects LWCN trout fishery value
Lower Hautapu (Rang_2g)	90% of MALF + 20% MALF as core	90% of MALF at Hautapu at Alabasters	Catchment area extrapolation
Cumulative allocable volume (Rang_1 + Rang_2)	Cumulative allocable volume is for the downstream point of Rang_2: no more water may be allocated above this point in the catchment		
Lower Rangitikei (Rang_3a)	WRA	90% adult rainbow trout habitat at MALF at Onepuhi (IFIM)	WRA Q_{95} – minimum flow
Makohine (Rang_3b)	90% of MALF + 20% MALF as core	90% of MALF at Makohine at Viaduct	20% of MALF for Makohine at Viaduct
Cumulative allocable volume (Rang_1 + Rang_2 + Rang_3)	Cumulative allocable volume at the downstream point of Rang_3: includes the cumulative allocable volume at the downstream point of Rang_2 + the volume from Rang_3. No more water may be allocated above this point in the catchment		
Coastal Rangitikei (Rang_4a)	WRA	90% rainbow trout habitat retention at MALF at McKelvies (IFIM)	WRA Maintain Q_{95} at McKelvies
Tidal Rangitikei (Rang_4b)	WRA	90% rainbow trout habitat retention at MALF at McKelvies (IFIM)	WRA: Maintain Q95 at McKelvies flow site
Porewa (Rang_4c)	No allocation	-	No allocation as stream commonly dries up over summer
Tutaenui (Rang_4d)	MALF + 20% of MALF as core	Default method applies due to lack of data	Default method
Catchment cumulative allocable vol. (Rang_1 + Rang_2 + Rang_3 + Rang_4)	Rang_4 cumulative allocable volume includes cumulative volume from Rang_3 + Rang_4. No more water may be allocated above this point in the catchment		

3.2 Consented Activities

3.2.1 Water takes

There are 64 consents for surface water and riparian abstraction in the Rangitikei catchment. Takes of surface water less than 400 litres per hectare per day, up to a maximum of 30 cubic metres per day for animal farming, or 15 cubic metres per day per property for any other use, are permitted activities under Rule 15-1 of the One Plan as long as permitted activity standards are met. All other takes require resource consent.

Surface water abstraction when the river flow is at or below the minimum flow is limited to permitted takes (defined above) and consented takes for:

- reasonable domestic water supply (up to 250 litres per person per day);
- reasonable stock water supply (up to 70 litres per animal per day for drinking water and 70 litres per animal per day for dairyshed washdown); and
- essential takes as identified in the One Plan - Policy 6-19 (Annex 3).

Essential takes are considered to be outside the core allocation limit and include consented takes for hospitals, marae, schools, defence force facilities, industries[4] which if takes were to cease would significantly compromise a community's social, economic or cultural wellbeing (e.g. hygienic production and processing of perishable food), and proportions of public water supply takes. All essential takes are required to reduce their use as much as practicable and in the case of public water supplies the degree of reduction is specified in the Plan.

Groundwater takes have the potential to deplete surface water resources depending on the depth, hydrogeological connectivity, location, amount of take and pumping rate. Groundwater takes with high surface water depletion effects are included within the surface water allocation and are subject to the same minimum flow restrictions as surface takes and are included in the surface water allocation. Takes with medium depletion effects on surface water have their losses included in the surface water allocation but are not subject to restrictions. Groundwater takes with low surface water depletion effects are not considered in the surface water allocation.

3.2.2 Water use

If you exclude takes for hydroelectricity generation, then agricultural irrigation is the greatest surface water use in the Rangitikei catchment by volume (Figure 6). Consent information was not always specific about the type of irrigation use, for example dairying, cropping, commercial vegetable production or a combination of these. From available information it appears that just over 60% of the agricultural irrigation consents relate to dairying operations and pasture irrigation. Industrial water takes are dominated by gravel washing operations, largely in the Coastal Rangitikei area. There are nine consents for stock and washdown water, eight of which were for dairying and one for a piggery. Many of these takes also comprise an amount for domestic use.

[4] Those established at the time of Plan notification in May 2007.

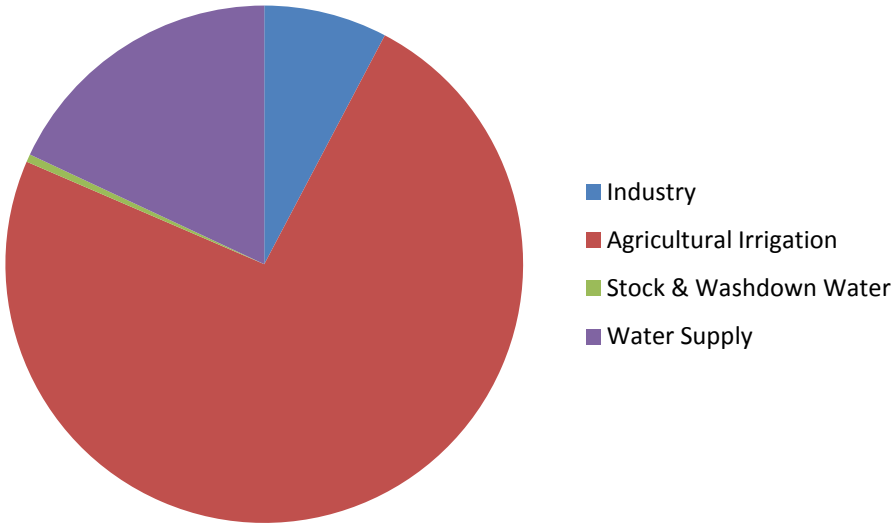

Figure 6: Proportion of surface water volume by use in the Rangitikei catchment.

3.2.3 Other consents

There are 97 consents for groundwater in the Rangitikei zone, including 37 takes for the purposes of stockwater and dairyshed washdown. Agricultural irrigation is the greatest groundwater use in the Rangitikei zone by volume. At least 75% or more of the agricultural irrigation consents relate to dairying operations and dairy pasture irrigation. Industrial water takes are dominated by Canterbury Meat Packers, Riverlands Meat Processing and Malteurop malting plant, with golf clubs making up most of the remaining industrial take volume. Two per cent of the groundwater take volume (spread across 37 separate consents) is used for stock drinking and dairyshed washdown.

In 2007 there were ten significant discharges[5] to water in the Rangitikei catchment most of which were town sewage discharges (Table 5). Knowing the daily discharge volumes is important for calculating naturalised stream flows.

Table 5: Significant discharges to surface water in the Rangitikei catchment. *Source: McArthur and Clark (2007).*

Source	Discharge type	Receiving water
Taihape sewage	Municipal sewage effluent	Hautapu River
Mangaweka sewage	Municipal sewage effluent	Rangitikei River
Hunterville sewage	Municipal sewage effluent	Porewa Stream
Marton sewage	Municipal sewage effluent	Tutaenui stream
Bulls sewage	Municipal sewage effluent	Rangitikei River
Riverlands	Meat processing waste	Rangitikei River
Bullocks	Gravel wash discharge	Rangitikei River
Ohakea sewage	Defence force sewage effluent	Drain adjacent to Rangitikei River
Sanson sewage	Municipal sewage effluent	Makowhai Stream tributary
Flock House	Domestic sewage effluent	Parewanui Drain No. 2

[5] Significant discharges to water are considered to be those containing industrial waste or domestic sewage effluent - they do not include individual dairyshed effluent or septic tanks discharges.

3.3 Current surface water allocation status

Demand for surface water across the Manawatu-Whanganui Region has been steadily increasing in recent years. Consented daily abstraction volumes (excluding hydroelectricity) for the Region increased by 108% from 1997 to 2004 (Hurndell et al, 2007). The areas where water demand is concentrated include the lower Rangitikei River, the Makotuku River, the Manawatu River and several of its tributaries.

Consented surface water use in the Rangitikei Catchment more than doubled from 2000 to 2004 and has increased by a further 33% in the last ten years. Currently more than 2 cubic metres a second is consented to be taken directly from the river across the whole catchment (excluding hydroelectricity generation takes). Much of the increase in water use has been driven by agricultural irrigation needs.

Based upon consented volumes, approximately 39% of the Rangitikei catchment surface water allocation remains available on a cumulative basis, while on a water management sub-zone basis the proportion of available allocation ranges from 2 to 76 per cent (Table 6). The Tutaenui Stream sub-zone is currently over-allocated.

The relationship between maximum consented allocation and actual water use varies greatly. Not all allocated water is used by consent holders at any one time. In stressed and highly allocated catchments, this can mean that water is potentially 'locked-up' in consents and unavailable for other users.

Table 6: Current surface water allocation in the Rangitikei catchment.

Zone code	Sub-zone	Core allocation limit m^3/day	Allocation in sub-zone only m^3/day	Cumulative current allocation m^3/day	Available Allocation m^3/day	Percent allocated %
Rang_1	Upper Rangitikei	0	0	0	0	
Rang_2a	Middle Rangitikei	21,600	5,100	5,100	16,500	24
Rang_2b	Pukeokahu-Mangaweka	52,704	7770	12,870	39834	24
	Cumulative 2a & 2b	52,704	12,870	12,870	39,834	24
Rang_2c	Upper Moawhango	0	0	0	0	
Rang_2d	Middle Moawhango	0	0	0	0	
Rang_2e	Lower Moawhango	0	0	0	0	
Rang_2f	Upper Hautapu	9,936	9,691	9,691	245	98
Rang_2g	Lower Hautapu	12,960	0	9,691	3,269	75
	Cumulative 2f & 2g	12,960	9,691	9,691	3,269	75
Cumulative 2a through 2g		**52,704**	**22,561**	**22,561**	**23,901**	**43**
Rang_1 + Rang_2	**Catchment cumulative**	**52,704**	**22,561**	**22,561**	**23,901**	**43**
Rang_3a	Lower Rangitikei	141,696	65,916	65,916	75,780	47
Rang_3b	Makohine	864	0		864	
Cumulative 3a & 3b		**141,696**	**65,916**	**65,916**	**75,780**	**47**
Rang_1 + Rang_2 + Rang_3	**Catchment cumulative**	**141,696**	**88,477**	**88,477**	**53,219**	**62**
Rang_4a	Coastal Rangitikei	213,840	79,867	79,867	133,973	37
Rang_4b	Tidal Rangitikei	285,120	0	79,867	205,253	28
Rang_4c	Porewa	0	0	0	0	
Rang_4d	Tutaenui	6,653	6,956	6,956	-303	105
Cumulative 4a through 4d		**285,120**	**86,823**	**86,823**	**198,297**	**30**
Rang_1 + Rang_2 + Rang_3 + Rang_4	**Cumulative catchment**	**285,120**	**175,300**	**175,300**	**109,820**	**61**

3.3.1 Fully and over-allocated zones

- In the Upper Rangitikei zone the WCO allows for zero allocation of water
- All water in the Moawhango sub-zones is allocated to the TPD scheme
- Low flow volumes in the Porewa sub-zone over summer do not provide for any allocation
- The Tutaenui sub-zone is over-allocated and also has naturally low flow volumes in summer
- The Upper Hautapu is almost fully allocated

3.3.2 Middle Rangitikei water availability

- 57% of the Middle Rangitikei core allocation remains unallocated
- 76% of the allocation upstream of Pukeokahu (River Valley Lodge) remains unallocated
- 75% of the allocation in the lower Hautapu remains unallocated

3.3.3 Lower Rangitikei water availability

- 38% of the core allocation at Onepuhi remains unallocated
- A small volume remains unallocated in the Makohine

3.3.4 Coastal Rangitikei water availability

- Across the coastal and tidal Rangitikei sub-zones 70% of the allocation remains available if no further water is allocated from the zones located upstream
- Currently, only the coastal and Tutaenui sub-zones are being utilised for water abstraction purposes
- Further allocation in the lower river will be restricted to the mainstem Rangitikei River within the coastal and tidal sub-zones
- The possibility of saline intrusion near the coast as the river becomes fully allocated is something that will need to be closely monitored and managed

3.3.5 Whole catchment cumulative water availability

On a cumulative, full-catchment basis the Rangitikei River is 61% allocated with only the Tutaenui sub-zone over-allocated as a result of actual abstraction (rather than just having zero water for allocation through the One Plan policy framework). There are four key issues that need to be taken into account when considering how much water is still available for use in the Rangitikei catchment:

1. Additional water use via permitted takes/essential uses,
2. The proportion of actual water use versus the allocated (consented) use,
3. Potential stream depletion effects from connected groundwater and riparian takes, and
4. The effects of actual or increased water use on the security of supply.

3.3.6 Water use outside the minimum flow or allocation framework

Because permitted water takes are not subject to resource consent, there is no information on the amount of water use in the Rangitikei catchment activities for domestic use or fire-fighting. Essential takes for dairyshed washdown and stockwater are consented activities and although they are considered within the cumulative core allocation limit they are not subject to minimum flow restrictions. There are nine consents for essential takes of surface water specifically for dairyshed washdown and stockwater supply, totalling approximately 850 cubic metres per day across the catchment.

Portions of a number of water supply takes also qualify for essential water use status under the One Plan, meaning they can continue to take water albeit at reduced volumes below minimum flows. On a catchment wide basis essential takes are likely to have only minor effects on low flows in the mainstem and larger tributaries. In small tributaries and over-allocated sub-zones such as the Tutaenui, essential and stockwater takes may have significant effects, particularly over the summer months, causing non-essential takes to be restricted more frequently and exacerbating effects on aquatic life.

Almost one third of the surface water consents do not currently have cease take or step down at minimum flow requirements. Of these consents, half are water supply takes, and 25% each are industry and irrigation takes. The industry and irrigation consents without minimum flow provisions are all due to expire prior to 2020 and will have minimum flow restrictions included on any renewed water permits, reducing the influence of these takes on flows during dry summers.

Holders of these consents will need to plan for a reduction in their surety of supply when their current resource consents get renewed with minimum flow restrictions included.

4 Volumetric Water Use

On an annual average basis the actual volume of water abstracted is usually considerably less than consented water use because water for irrigation purposes is not taken at a constant rate year-round and few consent holders abstract their maximum daily volume all irrigation season. Additionally, minimum flow restrictions mean that water users must cease their takes over low flow periods. The effect on actual water use due to minimum flow restrictions varies from year to year based on the frequency and duration of low flow events.

Actual water use measured over the July 2012 to June 2013 period (Annex 4) showed telemetered use ranged between 4.3% of consented use in April 2013 and 65.1% in February 2013. The highest three months of water use were in February 2013, January 2013 and December 2012, typical months for irrigation pressure and greatest soil moisture deficit. The severity of the 2012-2013 drought is reflected in the number of days of minimum flow restrictions over those months (Table 7).

Table 7: Monthly proportion of consented daily water use and days of minimum flow restriction at Onepuhi in the Rangitikei catchment for the 2012/2013 water year.

Month	Percentage of maximum daily use (telemetered)	Days of Minimum Flow restriction
Jul-12	5.1%	0
Aug-12	10.5%	0
Sep-12	8.2%	0
Oct-12	8.4%	0
Nov-12	32.1%	0
Dec-12	56.9%	0
Jan-13	64.7%	0.9
Feb-13	65.1%	15.9
Mar-13	30.2%	25.5
Apr-13	4.3%	16.8
May-13	6.5%	0
Jun-13	5.8%	0

Water supply takes and other essential use takes for stockwater and dairyshed washdown are not required to cease at minimum flow, although larger water supplies are often required to 'step-down' or reduce take. Many irrigation consents granted prior to 2010 or takes from bores with riparian connection are also required to 'step-down' when flow restrictions apply rather than to cease altogether. This means there are current inequities in the conditions of use for the same purpose.

While flow restrictions were in place for long periods throughout the 2012/2013 summer, some irrigators were able to continue to use water either at a reduced rate or entirely unrestricted while others were required to cease taking for many days on end. All of the older irrigation consents not currently required to cease taking water at minimum flow will expire by 2020. Once consents are renewed these takes will also be required to cease at minimum flow and all irrigators in the catchment will need to consider strategic management of water requirements during prolonged dry periods and minimum flow restrictions.

5 Surety of supply

Surety or security of supply is the calculation of the average probability of restriction of take as a result of minimum flows in the river, based on historic flow records. The greatest number of days of minimum flow restriction recorded occurred during the 2012/2013 water year. As more water is allocated from the river, the probability of a greater number of days of minimum flow increases because of the relationship between increased allocation size and the frequency, duration and severity of minimum flow events. Recovery from minimum flows is also hampered by larger allocation volumes especially if users begin to take water as soon as flows rise above the minimum. In highly allocated catchments this commonly causes a 'yo-yo' effect in the hydrograph of the river throughout dry summer periods.

Horizons Regional Council provided summary information on the number of days when flows were below the minimum for the entire flow record for the Mangaweka, Onepuhi and McKelvies sites (Annex 5). Calculation of average days of flow restrictions is significantly influenced by the length and quality of the flow record. Mangaweka has the longest flow record in the Rangitikei catchment, dating back to 1978. Records for Onepuhi and McKelvies were eleven and seven years long respectively. A flow record of ten years is usually considered the minimum to determine robust security of supply statistics.

Water allocation has increased significantly over the last ten years and this increases the probability of minimum flow restrictions. Infrequent but severe climatic events (i.e. droughts) also significantly influence the average days of restriction. Taking into account the very dry 2012/2013 water year in combination with increased allocation of water from the catchment, the probability of minimum flow restriction is increasing, reducing the surety or security of supply to irrigators with minimum flow restrictions. However, the significant increase in standard deviation indicates the reliability of the average including the 2012/2013 water year has reduced (Table 8).

Table 8: Comparison of average (and standard deviation) number of days where flows are less than the minimum for three sites on the Rangitikei River.

Site	*n*	Average excl. 2012/13 year	SD	Average incl. 2012/13 year	SD
Mangaweka	35	5.1	±9.4	6.2	±14.1
Onepuhi	11	3.5	±7.6	8.1	±18.4
McKelvies	7	0	±0	3	±8

On an average basis, irrigators will need to plan for restricted use for between three and eight days per year. Though in reality these days of restriction will only occur in some years, so restrictions will often be significantly longer than the average.

Existing users will need to investigate off-line storage or alternative water sources to continue irrigating when flows are less than the minimum, which could be as many as 24 to 59 days per year at least once every ten years, particularly if more water is allocated from the catchment in future. So although water is available for allocation throughout most of the Rangitikei catchment, increases in allocation will incrementally increase negative effects on the surety of supply during dry periods. The influence of climate change on the frequency and duration of dry periods/droughts and the impacts of this on the surety of supply of water in the Rangitikei district remains uncertain at this time.

6 Conclusion

The Rangitikei River catchment drains approximately 4,000 square kilometres with land cover ranging from relatively pristine Conservation Estate in the upper reaches to intensive dairying and agricultural land use in the lower catchment. A National Water Conservation Order protects the outstanding fisheries and wild and scenic values of the upper and middle river. Flow in the river is significantly affected by the Genesis hydroelectricity generation take from the Moawhango Dam. Inflows from tributaries in the middle and lower catchments provide minimal volume to supplement flows in the mainstem. Because of these unique influences, the Rangitikei River is both a high value and a high pressure system. Maintaining values, providing for hydroelectricity generation and allowing for additional water use across the catchment requires careful management of the water resource.

The core allocation limits and minimum flows for the water management zones of the Rangitikei catchment are set out in Schedule B of the One Plan. These limits were based on a water resource assessment in 2004 and subsequent studies.

Consented surface water use in the Rangitikei Catchment more than doubled from 2000 to 2004 and has further increased by more than 30% over the last ten years. The largest growth area in water use has been in agriculture, compared with water supply and industrial uses which have remained relatively stable over time.

Current allocation from the Rangitikei River shows that while most water management sub-zones in the middle Rangitikei have water available for allocation, tributaries are under water stress. The Tutaenui sub-zone is currently over-allocated. Consideration of the effects of high allocation on the surety of supply in tributaries and the continuation of essential and stockwater takes below minimum flow is needed.

Water use records suggest that actual water use is generally much less than consented water use, therefore consented allocation is a 'worst-case-scenario'. Metering and telemetry of water use data has significantly improved over the last ten years. However, many takes in the catchment are classed as 'essential', including takes for domestic water supply. They continue to take water (sometimes on a volume restricted basis) when the river is below the minimum flow. Some older irrigation consents also operate unhampered by minimum flow restrictions, although these consents will require renewal before 2020. The continuation of takes below minimum flow and further allocation of water within the catchment, reduce the security of supply of water for irrigators during dry periods.

Climate change predictions and increasing allocation pressure may reduce the surety of supply for existing users in the future, particularly in tributaries. On-line storage such as the damming of tributary inflows is not a viable option for the Rangitikei catchment due to the protection afforded by the WCO in the upper and middle catchment and by the low water yielding nature of the tributaries in the lower catchment. However, the supplementary flow provisions in the One Plan are designed to encourage and enable water harvest and storage. Investigations into investment in off-line infrastructure may be a useful strategy for the development of secure future water resources in the catchment.

Irrigators need to consider planning for changes in farming practice, off-line storage, harvesting of water or alternative water sources to provide adequate irrigation supply for as many as 24 to 59 days per year at least once in every ten years. On average irrigators will need to plan for restricted use during the summer months of between three and eight days per year.

7 Summary

The key findings from this assessment into the use and availability of surface water in the Rangitikei catchment are:

- Surface water abstraction in the Rangitikei catchment has significantly increased (>100%) over the last fifteen years.
- Irrigation is the largest water use in the district (excluding hydroelectricity takes) and has undergone the greatest increase in recent years.
- Minimum flows and allocation limits have been set in the One Plan for all surface waters in the Rangitikei catchment to manage allocation between users and minimise adverse effects on instream values.
- Water use records suggest actual water use is generally much less than consented water allocated.
- Only one zone/sub-zone is currently over-allocated (Tutaenui), although several other zones/sub-zones have zero volumes available for allocation due to the Rangitikei Water Conservation Order, allocation for hydroelectricity generation, or because the waterways dry up in summer.
- Across the entire Rangitikei catchment, 39% (c. 110,000m^3/day) of the cumulative flow remains available for allocation, although the availability of this water is location dependent.
- Almost a third of current surface water consents in the catchment do not have minimum flow restriction conditions. That is, they are not required to reduce/cease their take once waterways fall below minimum flows. These consents will all expire prior before 2020. Minimum flow restrictions will be included on any new and renewed consents.
- On average, minimum flow restrictions occur between 3 and 8 days per annum. However, every 10 years, flow restrictions may be in place for 29-50 days during drier summers. The impacts of climate change on the frequency and duration of dry summers is uncertain at this stage.
- Surety of supply is reduced as the allocated volume increases, because the frequency and duration of minimum flows increases and water users are restricted more often.
- Instream or on-line storage (damming) is not a viable option through much of the Rangitikei catchment due to prohibitions on damming on named waterways in the Rangitikei Water Conservation Order.
- Options to increase summer surety of supply include improved irrigation efficiency, and off-line or winter water harvesting.

8 References

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Annex 1: Water Conservation Order, Rangitikei River

Reprint
as at 19 February 1993

Water Conservation (Rangitikei River) Order 1993

(SR 1993/15)

Catherine A Tizard, Governor-General

Order in Council

At Wellington this 15th day of February 1993

Present:
The Right Hon D C McKinnon presiding in Council

Pursuant to section 214 of the Resource Management Act 1991, Her Excellency the Governor-General, acting by and with the advice and consent of the Executive Council, hereby makes the following order.

Order

1 Title and commencement

(1) This order may be cited as the Water Conservation (Rangitikei River) Order 1993.

(2) This order shall come into force on the 28th day after the date of its notification in the *Gazette*.

2 Interpretation

In this order, unless the context otherwise requires,—

Act means the Resource Management Act 1991

Middle River means—

(a) the Rangitikei River itself from its confluence with the Makahikatoa Stream (approximate map reference Infomap 260 U21/725 888) to the Mangarere Bridge (approximate map reference Infomap 260 T22/483 496); and
(b) the Whakaurekau River plus all its tributaries and the Kawhatau River plus its following tributaries, namely, the Pouranaki River and the Mangakokeke Stream:

river flow means for any given point on the Middle River and Upper River—
(a) the mean daily flow occurring at that point; plus
(b) the sum of abstractions from the Upper and Middle River upstream of that given point expressed as a daily mean, but not including any abstraction from the Moawhango River at the Moawhango Dam (approximate map reference Infomap 260 T20/471 962) for hydroelectric power generation purposes

Upper River means—
(a) the Rangitikei River itself from its source (approximate map reference Infomap 260 U19/723 313) to its confluence with the Makahikatoa Stream (approximate map reference Infomap 260 U21/725 888); and
(b) all rivers and streams contributing water to the Rangitikei River upstream of that confluence.

3 Outstanding characteristics and features

(1) It is hereby declared that the Upper River includes and provides for—
  (a) outstanding wild and scenic characteristics; and
  (b) outstanding recreational, fisheries, and wildlife habitat features.

(2) It is hereby declared that the Middle River includes and provides for—
  (a) outstanding scenic characteristics; and
  (b) outstanding recreational and fisheries features.

4 Waters to be protected

Because of the outstanding characteristics and features specified in clause 3, the waters of the Upper River and Middle River are, subject to clause 5, to be protected as follows:

(a) the quantity and rate of flow of natural water in the Upper River shall be retained in its natural state:
(b) the rate of flow of the natural waters at any point in the Middle River shall not be less than 95% of the river flow at that point:
(c) resource consents under the Act shall not be granted to dam the Upper River or the Middle River:
(d) resource consents under the Act shall not be granted to construct any dam downstream of the Middle River, which has the effect of impounding water in the Middle River upstream of the confluence with the Hautapu River:

(e) in granting any resource consents under the Act or making a rule in a regional plan, in respect of the Upper River or the Middle River, the regional council shall ensure that, after allowing for reasonable mixing of the discharge with the receiving water,—

(i) the natural water temperature shall not be changed by more than 3 degrees Celsius; and

(ii) the acidity or alkalinity of the water as measured by the pH shall be within the range of 6.0 to 9.0; and within that range the natural pH of the water shall not be changed by more than 1.0 unit; and

(iii) the concentration of dissolved oxygen shall be not less than 80% of saturation concentration; and

(iv) there shall be no undesirable biological growths attributable to contaminants.

5 Scope of order

(1) Nothing in this order shall be construed as limiting any right to the use of water for domestic needs, for the needs of animals, and for or in connection with fire-fighting purposes.

(2) Nothing in this order shall prevent the renewal of any general authorisation granted under section 22 of the Water and Soil Conservation Act 1967 and deemed to be a provision of a regional plan under section 368 of the Act, or any resource consent under the Act which is current on the commencement of this order, or the granting of resource consents under the Act in substitution for existing use rights which are current on the commencement of this order.

(3) Nothing in this order shall prevent the granting of resource consents under the Act, or the making of rules in regional plans, in respect of the Upper River or the Middle River, for the purposes of—

(a) research into, and enhancement of, fisheries and wildlife habitats; or

(b) maintenance and protection of roads, bridges, and other necessary public utilities; or

(c) soil conservation, rivers control, or other activities undertaken pursuant to the Soil Conservation and Rivers Control Act 1941.

(4) Nothing in this order shall prevent the granting of resource consents under the Act for the construction of any dam downstream from the Middle River which has the effect of impounding water in the Middle River as far upstream as the confluence with the Hautapu River.

Marie Shroff
Clerk of the Executive Council

Annex 2: One Plan Policies Regarding Water Quantity and Allocation

Policies applying to both Surface Water and Groundwater

Policy 6-12: Reasonable and justifiable need for water

The amount of water taken by resource users shall be reasonable and justifiable for the intended use. In addition, the following specific measures for ensuring reasonable and justifiable use of water shall be taken into account when considering consent applications to take water for irrigation, public water supply or industrial use, and during reviews of consent conditions for these activities.

(a) For irrigation, resource consent applications shall be required to meet a reasonable use test in relation to the maximum daily rate of abstraction, the irrigation return period and the seasonal or annual volume of the proposed take. When making decisions on the reasonableness of the rate and volume of take sought, the Regional Council will:

(i) consider land use, crop water-use requirements, on-site physical factors such as soil water-holding capacity, and climatic factors such as rainfall variability and potential evapo-transpiration

(ii) assess applications either on the basis of an irrigation application efficiency of 80% (even if the actual system being used has a lower application efficiency), or on the basis of a higher efficiency where an application is for an irrigation system with a higher efficiency

(iii) link actual irrigation use to soil moisture measurements in consent conditions.

(b) For industrial uses, water allocation shall be calculated where possible in accordance with best management practices for water efficiency for that particular industry.

(c) For public water supplies, the following shall be considered to be reasonable:

(i) an allocation of 300 litres per person per day for domestic needs, plus

(ii) an allocation for commercial use equal to 20% of the totalallocation for domestic needs, plus

(iii) an allocation for industrial use calculated, where possible, inaccordance with best management practices for water efficiencyfor that particular industry, plus

(iv) any allocation necessary to cater for the reasonable needs oflivestock or agricultural practices that are connected to the publicwater supply system, plus

(v) an allocation necessary to cater for growth, where urban growth ofthe municipality is zoned and is reasonably forecast, plus

(vi) an allocation for leakage equal to 15% of the total of subsections(i) to (v) above.

Where the existing allocation for a public water supply exceeds the allocation calculated in accordance with subsections (i) to (vi) above, the Regional Council will establish, in consultation with the relevant Territorial Authority, a timeframe by which the existing allocation shall be reduced to the calculated amount.

Policy 6-13: Efficient use of water

Water shall be used efficiently, including by the following measures:

(a) requiring water audits and water budgets to check for leakages and water-use efficiency

(b) requiring the use of, or progressive upgrade to, infrastructure for water distribution that minimises use and loss of water

(c) enabling the transfer of water permits

(d) raising awareness about water efficiency issues and techniques

(e) installing water metering and telemetry to monitor water use.

Policy 6-14: Consideration of alternative water sources

When making decisions on consent applications to take surface water, the opportunity to utilise alternative sources such as groundwater or water storage shall be considered.

Policies for Surface Water

Policy 6-15: Overall approach for surface water allocation

(a) The requirements of water conservation orders shall be given effect under this Plan.
(b) The provisions of this plan will not be inconsistent with the intent of local water conservation notices.
(c) Core allocations of surface water from rivers shall be determined in accordance with Policies 6-16 and 6-17. Takes that comply with the relevant core allocation, when assessed in combination with all other takes, shall be allowed.
(d) Supplementary allocations of surface water from rivers shall be determined in accordance with Policy 6-18.
(e) Takes from rivers shall be apportioned, restricted or suspended in times of low flows in accordance with the provisions of Policy 6-19.
(f) Takes of water from lakes shall comply with Policy 6-20.

Policy 6-16: Core water allocation and minimum flows

(a) The taking of surface water shall be managed in accordance with the minimum flows and core allocations set out for each water management zone in Schedule B.
(b) The minimum flows and core allocations set out in Schedule B shall be assessed after any takes for hydro electricity generation have been taken. The only exception to this will be the hydro-electricity takes from Zone Whau_3c.

Policy 6-17: Approach to setting minimum flows and core allocations

(a) Where good hydrological information, such as a specific water resource study or a long-term flow record, is available it shall be used to set minimum flows and core allocations in Schedule B.
(b) Where information described in (a) above is not available, the minimum flows and core allocations set out in Schedule B shall generally be a minimum flow equal to the estimated or calculated one-day mean annual low flow, and a core allocation equal to a percentage of the minimum as specified Schedule B.

Policy 6-18: Supplementary water allocation

In addition to the core allocations set out in Policy 6-16, a supplementary allocation from rivers may be provided:

(a) in circumstances where water is only taken when the river flow is greater than the median flow, and the total amount of water taken by way of a supplementary allocation does not exceed 10% of the natural flow in the river at the time of abstraction
(b) in circumstances where it can be shown that the supplementary allocation will not:
    (i) increase the frequency or duration of low flows
    (ii) cause any adverse effects on the values of the waterbody as set out in Schedule D
    (iii) limit the ability of anyone to take water under a core allocation.

Policy 6-19: Apportioning, restricting and suspending takes in times of low flow

During times of low flow, takes from rivers shall be managed in the following manner:

(a) **Permitted takes** – Takes that are permitted by this Plan (surface water and groundwater takes) or are for fire-fighting purposes shall be allowed to continue regardless of river flow.

(b) **Essential takes** – The following core water allocation takes shall be deemed essential and shall be managed in the manner described.

(i) takes greater than permitted by this Plan (and therefore subject to resource consent) that are required to meet an individual's reasonable domestic needs or the reasonable needs of an individual's animals for drinking water shall be allowed to continue regardless of river flow

(ii) takes required to meet the reasonable needs of hospitals, other facilities providing medical treatment, marae, schools or other education facilities, or correction facilities shall be allowed to continue regardless of river flow

(iii) takes required for the operation of industries which, if their take were to cease, would significantly compromise a community's ability to provide for its social, economic or cultural well-being or for its health or safety shall be allowed to continue regardless of river flow, but shall be required to minimise the amount of water taken to the extent reasonable

(iv) public water supply takes shall be restricted to a total public water consumption calculated as follows:

(A) an allocation of 250 litres per person per day for domestic needs, plus

(B) an allocation for commercial use equal to 20% of the total allocation for domestic needs, plus

(C) an allocation which meets the reasonable needs of those facilities and industries listed under subsections (b)(ii) and (b)(iii) where such facilities and industries are connected to the public water supply system, plus

(D) any allocation necessary to cater for the reasonable needs of livestock that are connected to the public water supply system, plus

(E) an allocation for leakage equal to 15% of the total of subsections (A) to (D) above.

(c) **Non-essential takes** – Other core water allocation takes, including irrigation takes but excluding the essential takes described under subsection (b), shall be managed in the following manner:

(i) water takes shall be required to cease when the river drops below its minimum flow, as set out in Policy 6-16

(ii) water takes shall be allowed to recommence once the river flow has risen above its minimum flow.

(d) **Meaning of 'core water allocation take'** – For the purposes of this policy, a core water allocation take means a take that has been granted consent in accordance with a core water allocation made under Policy 6-16, or in accordance with a previous core water allocation regime.

Annex 3: Current surface water allocation within the Rangitikei Water Management Zones (Horizons Regional Council)

Table 1 Current water allocation within the Rangitikei WMZ's Rang 1 – Rang 4

WMZ	Sub-zone	Sub-zone name	Core allocation limit	Allocation in sub-zone only	Cumulative current allocation within WMZ	Available allocation	Status
			m^3/day	m^3/day	m^3/day	m^3/day	
Rang 1	Rang_1a	Upper Rangitikei	*0*	0	0	*0*	fully allocated
Rang 2	Rang_2a	Middle Rangitikei	*21,600*	5,100	5,100	*16,500*	okay
	Rang_2b	Pukeokahu-Mangaweka	*52,704*	10,891	25,682	*27,022*	okay
Cumulative Rang 2a + Rang 2b			*52,704*	**15,991**	**25,682**	*27,022*	**okay**
	Rang_2c	Upper Moawhango	*0*	0	0	*0*	fully allocated
	Rang_2d	Middle Moawhango	*0*	0	0	*0*	fully allocated
	Rang_2e	Lower Moawhango	*0*	0	0	*0*	fully allocated
	Rang_2f	Upper Hautapu	*9,936*	9,691	9,691	*245*	okay
	Rang_2g	Lower Hautapu	*12,960*	0	9,691	*3,269*	okay
Cumulative Rang 2f + Rang 2g			*12,960*	**9,691**	**9,691**	*3,269*	**okay**
Whole zone cumulative Rang 2a + Rang 2b + Rang 2c + Rang 2d + Rang 2e + Rang 2f + Rang 2g			*52,704*	**25,682**	**25,682**	*27,022*	**okay**
Catchment cumulative Rang 1 + Rang 2			*52,704*	**25,682**	**25,682**	*27,022*	**okay**
Rang 3	Rang_3a	Lower Rangitikei	*141,696*	65,916	65,916	*75,780*	okay
	Rang_3b	Makohine	*864*	0	0	*864*	okay
Whole zone cumulative Rang 3a + Rang 3b			*141,696*	**65,916**	**65,916**	*75,780*	**okay**
Catchment cumulative Rang 1 + Rang 2 + Rang 3			*141,696*	**91,598**	**91,598**	*50,098*	**okay**
Rang 4	Rang_4a	Coastal Rangitikei	*213,840*	79,867	79,867	*133,973*	okay
	Rang_4b	Tidal Rangitikei	*285,120*	0	79,867	*205,253*	okay
	Rang_4c	Porewa	*0*	0	0	*0*	fully allocated
	Rang_4d	Tutaenui	*6,653*	6,956	6,956	*-303*	over allocated
Whole zone cumulative Rang 4a + Rang 4b + Rang 4c + Rang 4d			*285,120*	**86,823**	**86,823**	*198,297*	**okay**
Catchment cumulative Rang 1 + Rang 2 + Rang 3 + Rang 4			*285,120*	**178,421**	**178,421**	*106,699*	**okay**

Annex 4: Summary of water use data from Rangitikei Catchment from July 2012 – June 2013 (Binsted and Roygard, Horizons Regional Council)

Summary of water use data from Rangitikei Catchment from July 2012 – June 2013
Prepared by Stacey Binsted and Jon Roygard, Horizons Regional Council January 2014

This document provides a preliminary assessment of the water use in the Rangitikei Catchment during the period July 2012 to June 2013. This information is currently being audited for a report that is being prepared by Horizons Regional Council.

In the Rangitikei Catchment there are a total of 63 consents for water takes (excluding those related to hydroelectricity generation). These 63 consents have a total allocation of 261,760m3 of water per day. Of these 63 consents there are 33 telemetered consents which automatically supply water information to Horizons. These 33 consents are recording the water use of an allocated 125,523 m3/day. All telemetered data used for these summaries is raw data with only the noticeable spikes removed. There is further water currently available for allocation in several of the water management zones in the Rangitikei Catchment.

The actual daily water use in the Rangitikei catchment by the telemetered consents is shown in Figure 1. This is the summation of the daily totals returned for each of the 33 telemetered consents. Table 1 shows water use per month as a percentage of the total consented volume for the telemetered consents. These will likely be an underestimation of the actual water use due to missing data from some of the telemetered takes. The extent of the missing data points is presented in Table 2.

Figure 1: Estimated actual water use in the Rangitikei Catchment for 33 telemetered takes in 2012 / 2013 compared to the maximum consent volume for these consents and all of the consents (excluding hydroelectricity consents). Note, no adjustments have been made to maximum consented volumes to account for minimum flow restrictions.

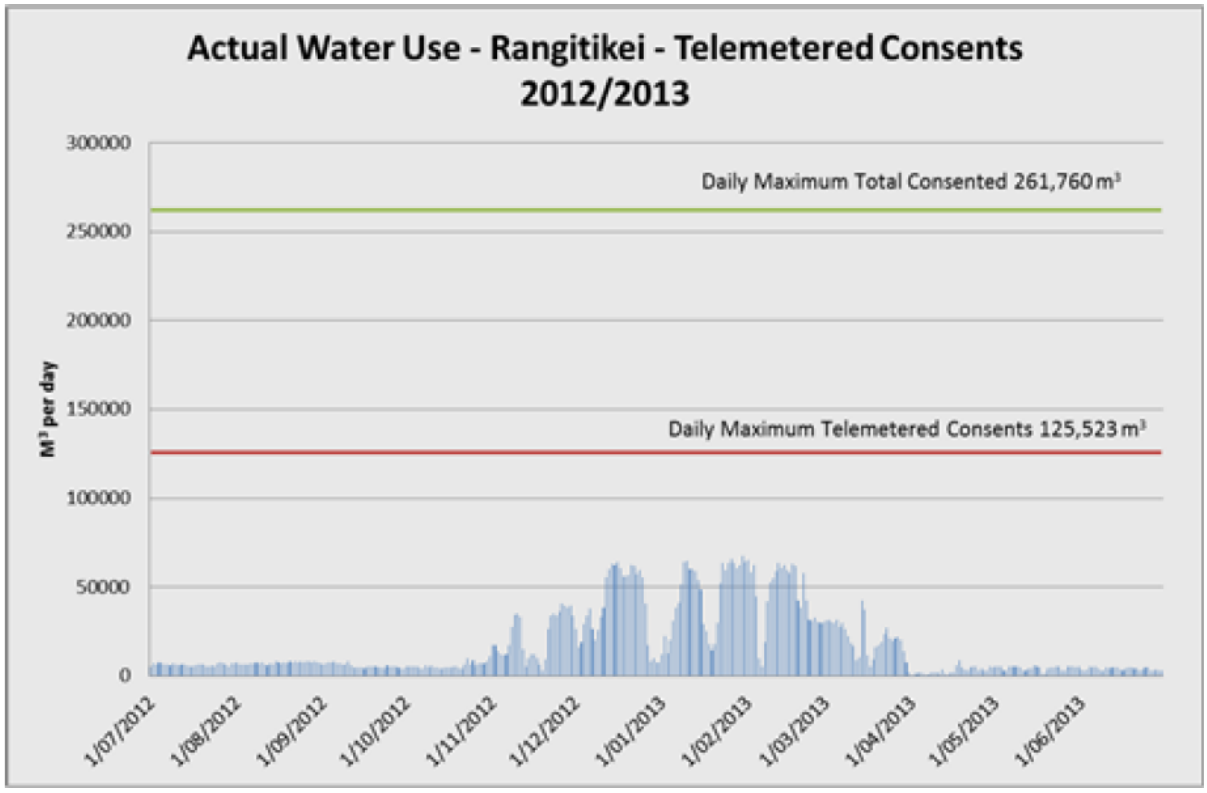

Table 1: Estimated actual water use as a percentage of the telemetered volume. Note, no adjustments have been made to maximum consented volumes to account for minimum flow restrictions. These numbers are calculated by summing the total water use from each of the 33 consents for each day of the month and dividing by the number of days in the month i.e. they are an average percentage of maximum daily consented use for the month.

Monthly Totals	Percentage of maximum consented daily water use for the Telemetered Consents
Jul-12	5.1%
Aug-12	10.5%
Sep-12	8.2%
Oct-12	8.4%
Nov-12	32.1%
Dec-12	56.9%
Jan-13	64.7%
Feb-13	65.1%
Mar-13	30.2%
Apr-13	4.3%
May-13	6.5%
Jun-13	5.8%

Table 2: Summary of missing data

Rangitikei Water Use 2012 / 2013 (raw data)	Number of Missing Days	Percent of Missing Days
Total	1834	15.2%

Annex 5: Surety of supply tables- Rangitikei River (Source: Horizons Regional Council)

Flow monitoring site	One Plan Minimum Flow (m^3/s)	Flow record start	Flow record end	Days of Restriction recorded				
				Max	90th percentile	Average	Median	Min
Rangitikei at Onepuhi	12.100	1/07/2002	1/08/2013	59.0	24.2	8.1	0.0	0.0
Rangitikei at Mangaweka	12.250	1/07/1978	1/08/2013	67.0	17.4	6.2	0.0	0.0
Rangitikei at McKelvies	10.230	1/07/2006	1/08/2013	21.1	8.4	3.0	0.0	0.0

Table 1: Number of days the One Plan minimum flow (12.100 m3/s) occurs at the Rangitikei at Onepuhi flow monitoring site

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.9
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6	8.6	5.0	0.0	0.0	24.2
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.0	5.4
2009	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2011	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2012	0.0	0.0	0.0	0.0	0.0	0.0	0.9	15.9	25.5	16.8	0.0	0.0	59.0
Maximum	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.9**	**15.9**	**25.5**	**16.8**	**0.0**	**0.0**	**59.0**
90th Percentile	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**10.6**	**8.6**	**5.0**	**0.0**	**0.0**	**24.2**
Average	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**2.9**	**3.2**	**2.0**	**0.0**	**0.0**	**8.1**
Median	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Minimum	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Table 2: Number of days the One Plan minimum flow (12.250 m3/s) occurs at the Rangitikei at Mangaweka flow

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	6.6
1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0	0.0	0.0	15.0
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	0.0	0.3	3.6	0.0	0.0	0.0	0.0	3.9
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0	0.0	0.0	0.0	6.8
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	21.0	3.9	0.0	0.0	30.5
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.3	4.4	3.2	0.0	18.9
2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	8.2	0.0	0.0	0.0	11.5
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4	19.2	11.4	0.0	0.0	40.0
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	9.6	0.0	0.0	15.2
2009	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2011	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2012	0.0	0.0	0.0	0.0	0.0	0.0	3.4	19.3	27.5	16.8	0.0	0.0	67.0
Maximum	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**6.8**	**19.3**	**27.5**	**16.8**	**3.2**	**0.0**	**67.0**
90th Percentile	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**5.7**	**13.1**	**4.2**	**0.0**	**0.0**	**17.4**
Average	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**1.6**	**2.9**	**1.3**	**0.1**	**0.0**	**6.2**
Median	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Minimum	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Table 3: Number of days the One Plan minimum flow (12.250 m3/s) occurs at the Rangitikei at McKelvies flow monitoring site.

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2009	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2011	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	17.7	3.3	0.0	0.0	21.1
Maximum	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**17.7**	**3.3**	**0.0**	**0.0**	**21.1**
90th Percentile	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**7.1**	**1.3**	**0.0**	**0.0**	**8.4**
Average	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.5**	**0.5**	**0.0**	**0.0**	**3.0**
Median	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Minimum	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**