Title: Water allocation in the Ruamāhanga whaitua

Purpose: To assist the Ruamāhanga Whaitua Committee to understand the current water allocation regime

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Water allocation in the Ruamāhanga whaitua

Contents

1. Executive summary

- Irrigation – particularly of dairy pasture – is the most dominant use of water in the Ruamāhanga whaitua. Other significant uses for allocated water are stock water races and town water supplies.

- Between 1990 and 2010 water allocation in the Ruamāhanga whaitua increased by around 80%. Nearly 90% of the additional water allocation was for irrigation- more than two thirds of this was for dairy pasture.

- Water allocation for irrigation from Lake Wairarapa increased significantly (nine fold) between 1990 and 2010. There is no allocation limit for the lake in the Regional Freshwater Plan. Interim surface water allocation limits in the 'Working Document For Discussion' refrain from further allocations until the effects of removing water from the lake has been more fully investigated. The process for the plan review: first step is the 'Working Document For Discussion' which is a precursor to a draft regional plan that will be released to the public in September, for comment. It is expected that a final plan will be Proposed in late 2015, after which there will be public hearings and appeals under the Schedule 1 of the RMA.

- The Working Document for Discussion recommends that surface water allocation at median to low flows is limited to 50% and 30% of mean annual low flow for rivers and streams, respectively. For waterways in which allocation already exceeds these limits (e.g., the Waingawa River, Parkvale Stream, Mangatarere Stream, Papawai Stream, Otukura Stream, Stonestead Creek and Tauherenikau River) GWRC is recommending no further allocation be allowed.

- Flow is important but water quality and habitat are also key factors for a healthy waterway. Periods of low flow reduce water depth and velocity, which can result in warmer water temperatures, increased nuisance plant and algae growth and decreased dissolved oxygen levels. High levels of abstraction (water take) can alter flushing patterns within the river systems causing the build-up of sediment.

- Abstractions to supply water races are some of the largest individual takes from many of the rivers/streams in the Ruamāhanga whaitua.. Their primary purpose is to provide water for stock, however, actual use of the water for this purpose is estimated to between 1- 5% of the water abstracted. The rest of the water is required simply to 'drive' the flow through the network and substantial quantities are thought to be lost to groundwater (up to 50%).

- In addition to direct takes from rivers and streams, the abstraction from nearby groundwater systems can result in further stream flow reductions (depletion). . As part of the regional plan review, the allocation status of rivers and streams has been revised to take account of depletion from groundwater takes. Groundwater allocation limits have also been revised to reflect the impact on surface waters.

- Under the proposed groundwater allocation limits, several groundwater management zones in the Ruamāhanga whaitua can be viewed as either fully or over allocated. There are a few groundwater zones that have allocation remaining, although this is typically from deeper confined aquifers or those that are further away from surface water resources.

- The actual amount taken from rivers and aquifers is often significantly less than the consented amount. It is estimated that if the volume of allocated water was actually used the current reliability for water users would be significantly less, and this decline in reliability would have an economic and social impact.

- The existing water allocation regime is predominately based on maintaining ecological values and does not explicitly consider a number of other important values, such as mahinga kai, swimming, and reliability of supply. Further consideration of these other values may lead to alternative allocation regimes, such as higher minimum flows.

2. Water allocation in the Ruamāhanga whaitua

The rivers, streams, lakes, water races and groundwater systems of the Ruamāhanga whaitua (catchment) have significant ecological, cultural and spiritual values. The water resources also provide water for domestic water supply, industry, firefighting and agriculture.

This report is predominately about the existing allocation regime, which is largely based on ecological values and does not provide for a number of values, in particular tangata whenua values and reliability of supply. It is important to note that the statistics presented relate to the amount of water allocated by resource consents, not the amount that is actually abstracted which is often significantly less than the allocated amount. If the total amount of water allocated was actually abstracted, the reliability of the supply of water would be significantly less, and this decline in reliability would have an economic impact.

How do we allocate water and set limits to achieve a flow regime that sustains the in-stream objectives and values?

How do we make sure the processes and values that vary between different rivers and streams are met and sustained?

2.1 How much water is allocated and what is it used for?

The Ruamāhanga River and its tributaries are the most highly used waterways in the region, accounting for 65% of the Wellington region's total allocation, in terms of water abstraction. At the end of 2010, 185.5 million m3/year of surface water and 83.9 million m3/year of groundwater was allocated across the Ruamāhanga whaitua, through approximately 520 water permits.

On an annual basis, the most water is allocated to irrigation (52% of total allocated water), with other significant uses being the stock water races (19%), hydro-electricity[1] (14%), and town water

[1] A large amount of water is allocated for the Kourarau Hydroelectric Power Scheme. However, most of the water allocated for 'use' is returned to the Ruamahanga River catchment; i.e., it is not a consumptive use of water.

supplies (13%). Other minor uses of water are industry and frost protection account for less than 1% of the total annual consented water allocation.

Of the 140 million m3/year of water that is allocated across the Ruamāhanga whaitua for irrigation, nearly three-quarters is for dairy pasture (Figure 1). A significant proportion (18%) of the water allocation for irrigation is for pasture associated with other types of intensive livestock (predominantly beef cattle).

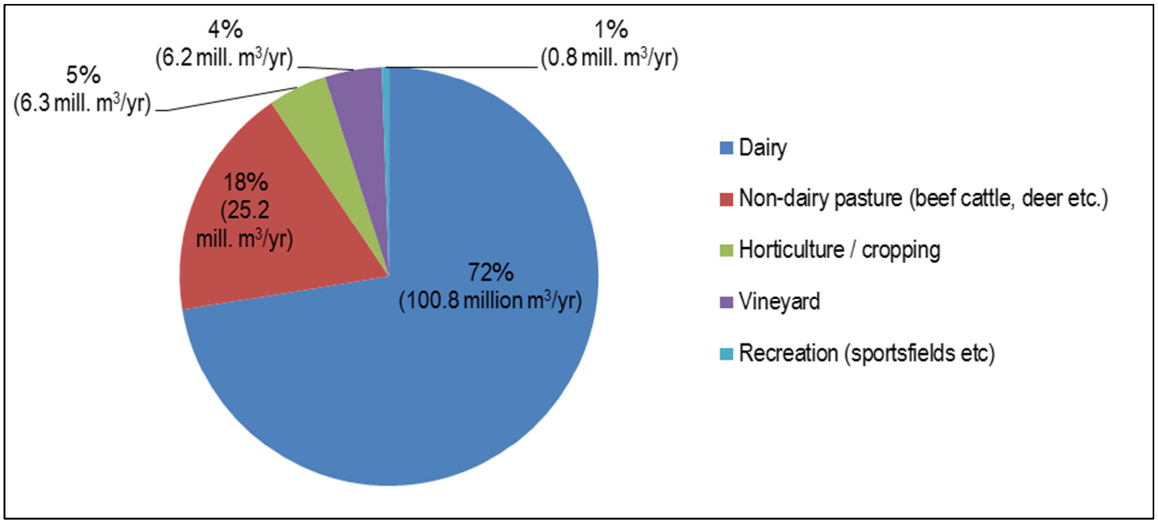


Figure 1. Annual water allocation for irrigation of land use types within the Ruamāhanga whaitua

2.2 Trends in water allocation

Over the twenty year period 1990-2010, water allocation in the Ruamāhanga whaitua has increased by 80%, 150 million m3/year in 1990 to 270 million m3/year at the end of 2010. The most rapid growth in water allocation occurred from the mid-1990s through until about 2004/05. Although surface water resources provide for more allocation than groundwater resources, there is a greater reliance on groundwater then there was in 1990 (Figure 2).

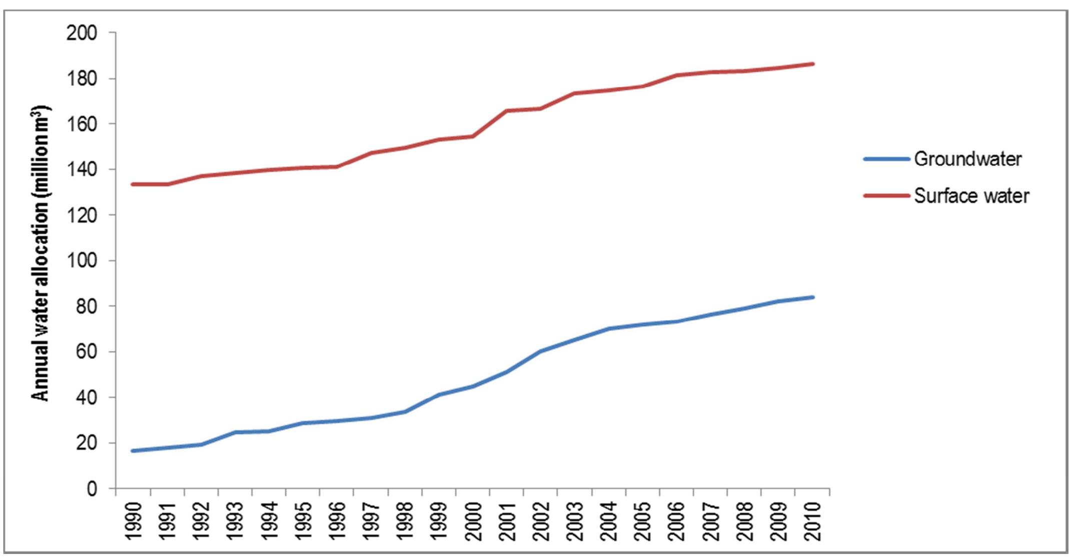


Figure 2. Annual water allocation in the Ruamāhanga whaitua 1990-2010, split into groundwater and surface water sources

The amount of water allocated for public and community water supplies accounted for 10% of total increase over the twenty years. The greatest total increase was that used for dairy pasture irrigation at, 65%. A further 22% of the increase in water allocation was for 'other land uses', which reflects an increase in vineyards and the production of green feed, which is either non-dairy pasture (such as winter crops) or horticulture irrigation.

As well as changes in land-use significant droughts that affected the Wairarapa in 1998 and 2003 are likely to have caused additional demand for water both for irrigation and public water supply.

The largest increase in water allocation were the Ruamāhanga River, Lake Wairarapa, Waingawa River, groundwater systems of the Lower Wairarapa Valley and the shallow groundwater systems associated with the major rivers.

2.3 How much water is allocated from and nearby Lake Wairarapa?

Lake Wairarapa is the only lake in the Wellington region from which significant consented water abstraction occurs. Water allocation from the lake increased nearly 9-fold between 1990 and 2010, and currently totals approximately 8 million m3/year. All of the allocation from the lake is for irrigation (mostly dairy pasture). There is no allocation limit for the lake specified in the Regional Freshwater Plan.

Over the past two years a targeted monitoring programme has been in place to determine a water balance for the lake. The preliminary results indicate the current allocation equates to approximately one third of the estimated lake inflow during mean annual low flow (MALF) conditions. GWRC is refraining from any further allocation until a more robust assessment of the effects of removing water from the lake has been carried out.

2.4 How much river and stream flow do we allocate?

Water allocations from individual waterways within the Ruamāhanga whaitua are listed in Table 1. To give an indication of the significance of water allocation relative to flow, the allocations are compared to the estimated 7-day MALF[2] and a percentage of flow allocated for abstraction (column 3). Column 4 of Table 1 is explained in the section on stream flow depletion.

Column 1 shows that the largest allocations occur from the main stem of the Ruamāhanga River, the Waingawa River and the Waiohine River. The Ministry for the Environment's proposed NES for Environmental Flows recommends that allocation should not exceed 50% of MALF for large rivers and 30% of MALF for smaller streams, in order to avoid adverse effects on the in-stream environment. There are several waterways in the Ruamāhanga whaitua (Waingawa River, Parkvale Stream, Mangatarere Stream, Papawai Stream, Otukura Stream, Stonestead Creek and Tauherenikau River) in which direct surface water takes account for more than 30% or 50% of MALF (column 3). Overall, direct surface water allocation from the Ruamāhanga River and its tributaries is estimated to be 40% of MALF.

[2] MALF is the average of the annual lowest flows for a given river or stream (i.e. the Mean Annual Low Flow). MALF is often used as a reference to set low flow policies, and low flow duration of 7 days is commonly used.

Table 1. Consented surface water allocation compared with mean annual low flow (MALF) for rivers and streams in the Ruamāhanga whaitua

River / stream	Existing allocation (L/s)*	Estimated 7-day MALF at river mouth (L/s)	% MALF allocated (direct surface water takes only)	% of MALF allocated (including groundwater depletion)
	Column 1	**Column 2**	**Column 3**	**Column 4**
Ruamāhanga River – main stem only	2,053	n/a		
Kopuaranga River	125	605	21%	22%
Waipoua River	108	490	21%	32%
Makoura Stream	42	150	28%	41%
Waingawa River	1,091	1,720	63%	70%
Tauweru River – upstream of Kourarau Stream	40	80	50%	50%
Tauweru River – total	110^	500	22%	22%
Parkvale Stream incl. Booths Creek	224	220	102%	110%
Mangatarere Stream	315	220	143%	228%
Waiohine River – total (incl. Mangatarere Stream)	1,040	3,550	29%	43%
Papawai Stream	120	350	34%	76%
Huangarua River	13	360	4%	23%
Other small tributaries	220	n/a		
Ruamāhanga River – incl. all upstream tributaries except those in the Lake Wairarapa catchment	**5,971**	**14,785**	**40%**	**62%**
Otukura Stream	56	100	56%	175%
Stonestead Creek	212	500	42%	67%
Tauherenikau River	212	310	70%	76%
Other Lake Wairarapa tributaries	427	n/a		

* Excludes takes that can only operate during high flow conditions
^Excludes non-consumptive take for Kourarau Hydroelectric Power Scheme

Note that GWRC enforces restrictions on water abstractions during times of low flow, and thus river flows are not necessarily reduced by as much as the percentages shown in column 3. These can be considered to represent the maximum potential impact.

The allocation statistics presented above are for abstractions that are consented to occur during 'normal' (moderate and low) flow conditions. During high flow conditions, additional allocation is permitted to occur for some of the public water supplies, water races and for frost protection of vineyards. However, in general there is a fairly small amount of high flow 'harvesting' in the Ruamāhanga whaitua.

2.5 Water races and how they fit into the allocation regime

Water races were established primarily to supply water for stock, and are still used mostly for this purpose. The water permits for water races are controlled by the district councils. Use of the water within the races is then regulated by the district councils who have granted specific uses for irrigation of dairy farms and a vineyard, frost protection, domestic uses, wetlands, fire-fighting and other minor industrial purposes, including supply to a piggery. The district councils use bylaws to manage these water races, the intent of the bylaws includes the maintenance of flows and to protect and enhance water quality.

Water races vary in length, capacity and areas of land covered (Table 2 shows which rivers in the whaitua contribute flow to water races). Taratahi and Moroa are the largest, with many branches covering a total of approximately 240 km each, while the Te Ore Ore water race is a relatively simple 1-2 channel scheme totalling only a few kilometres in length. The Taratahi water race extends over 10,000 ha and passes through approximately 330 properties.

Research estimates the actual use of the water in the race networks at between 1- 5%. For the Moroa system, this equates to between 11.5 l/s to 25 l/s of a total flow of 450 l/s. Most of the water that is allocated to water races is required to deliver water through the network of channels rather than being consumed. Furthermore, many, if not all, races leak water to groundwater (one report estimates this loss for Taratahi and Carrington as up to 50%).

Many of the water races are connected and merge with streams, and springs. These merged stream/water race networks are often considered to function as a single hydrological system with shared instream values. An example is the Taratahi water race and the Parkvale Stream and Booths Creek. Other water races, such as the Moroa water race, are separate from natural water courses, and do not interact with permanent streams.

The water races have heritage value; the Moroa Water race was hand dug in the 1890's and is the oldest. It is likely that parts of Taratahi water race were hand-dug prior to 1900. These structures built pre-1900 are not currently recognised as an archaeological site, however under Historic Places Act 1993, any modification requires authorisation from Heritage New Zealand[3]. The Carrington water race was likely to be constructed in the 1930's as Depression work and the Te Ore Ore and Opaki water races were constructed in the early 1900s and Longwood water race in the 1920's.

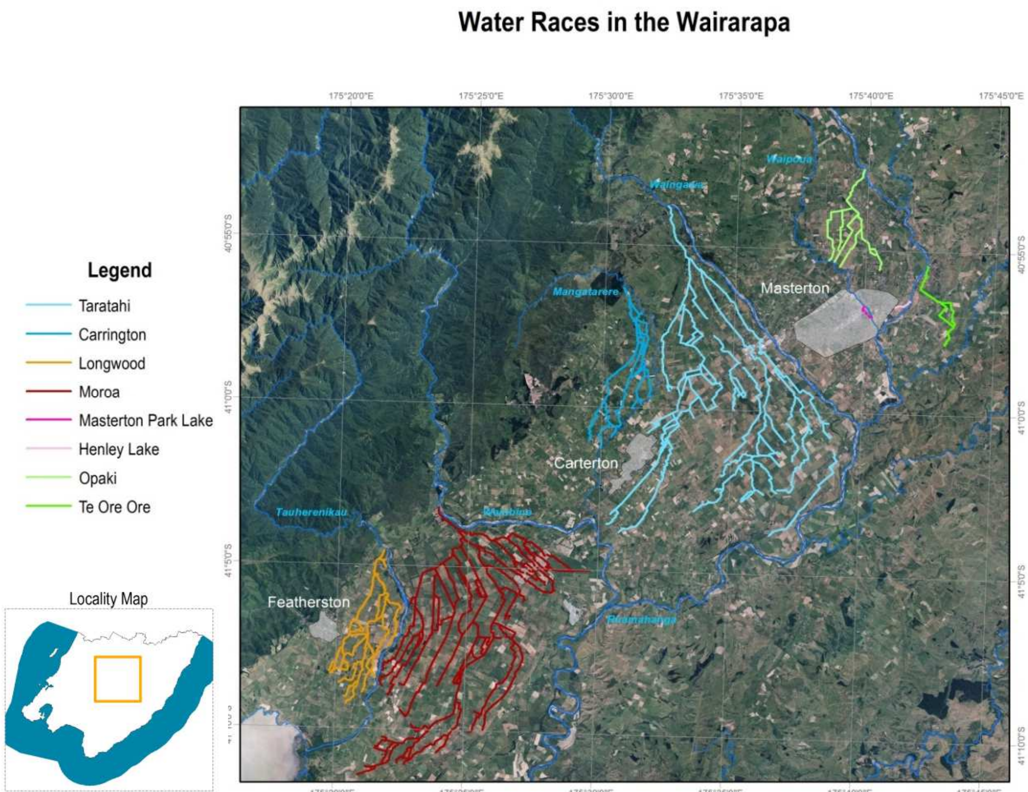
Table 2. Water allocated to the water races in the Ruamāhanga Whaitua

Water race	River from which water is abstracted to feed the race	Maximum consented abstraction
Opaki	Ruamāhanga River	230 l/s
Te Ore Ore	Ruamāhanga River	300 l/s
Taratahi	Waingawa River	481 l/s (*but new consent application seeks a maximum "flushing" flow of up to 800 l/s*)

[3] Heritage New Zealand is the new trading name for New Zealand Historic Places Trust (NZHPT).

Carrington	Mangatarere River	113 l/s *(but new consent application seeks a maximum "flushing" flow of up to 250 l/s)*
Moroa	Waiohine River	500 l/s
Longwood	Tauherenikau River	250 l/s

Map 1. The Water Races in the Wairarapa



Please note: Masterton Park Lake and Henley Lake are water channels that feed water and maintain flow into amenity lakes and are not water races, and thus not under the water race bylaw and considered in the discussion about water races.

3. Ground water and water use

3.1 How does the use of groundwater affect stream flow depletion?

In addition to direct abstraction, river flows can be depleted due to abstraction from hydraulically-connected groundwater systems. Modelling indicates that the stream flow depletion caused by consented groundwater abstraction across the Ruamāhanga whaitua can equal, or be more than, the amount of water directly abstracted from some rivers and streams (shown in column 4 in Table 1). In some waterways, such as the Papawai, Otukura and Mangatarere streams, the percentage of MALF allocated doubles when groundwater depletion effects are also considered. The rivers most at risk from large-scale stream flow depletion are those with productive shallow groundwater aquifers nearby. These are the Ruamāhanga, Waipoua, Waingawa, Waiohine and Tauherenikau rivers and the Parkvale, Mangatarere, Papawai and south Featherston streams.

Under the current management framework, groundwater abstraction that leads to stream flow depletion has generally been counted as part of the groundwater allocation for the relevant aquifer. In some cases restrictions are applied during times of low flow in order to minimise the impacts on the nearby river or stream. It was recommended in the report by Hughes and Gyopari (2011), that groundwater allocation from groundwater systems with a high degree of connection with surface water bodies be classed as 'surface water allocation' from the relevant river or stream.

3.2 How much groundwater do we use/allocate?

The geological nature of the Ruamāhanga whaitua has resulted in a complex groundwater system. Following a study of groundwater modelling of the valley, new groundwater zones and potential allocation limits for each zone are proposed to manage water allocation. These proposals have since been further refined and are summarised, along with the current groundwater allocation statistics, in Table 3 and Figure 1. Note that the existing water allocation from the proposed zones excludes allocation from groundwater systems that have a high degree of connection to surface water; this will be managed as surface water allocation in the future.

Groundwater zones where the existing allocation exceeds the proposed limits are viewed as 'fully allocated', or potentially 'over allocated' in some cases.

Table 3. Consented allocation from groundwater management zones and proposed allocation limits (refined from Hughes & Gyopari 2011).

Existing allocation exceeds proposed limits

Existing allocation is approaching proposed limits

	Proposed management zone	Existing groundwater allocation (million m^3/year)	Proposed groundwater allocation limits (million m^3/year)
Upper Valley	Upper Ruamāhanga	0.273	3.550
	Te Ore Ore	0.672	0.480
	Waingawa	0.680	1.900
Middle Valley	Taratahi	0.370	1.140
	Fernhill-Tiffin	0.919	1.200
	Parkvale confined	1.800	1.550
	Parkvale unconfined	0.290	0.340
	Mangatarere	3.450	2.300
Lower Valley	Dry River	0.573	0.630
	Martinborough	1.224	0.790
	Huangarua	0.668	0.640
	Onoke	1.107	2.090
	Lake Basin	6.407	6.750
	Tauherenikau	4.862	6.570

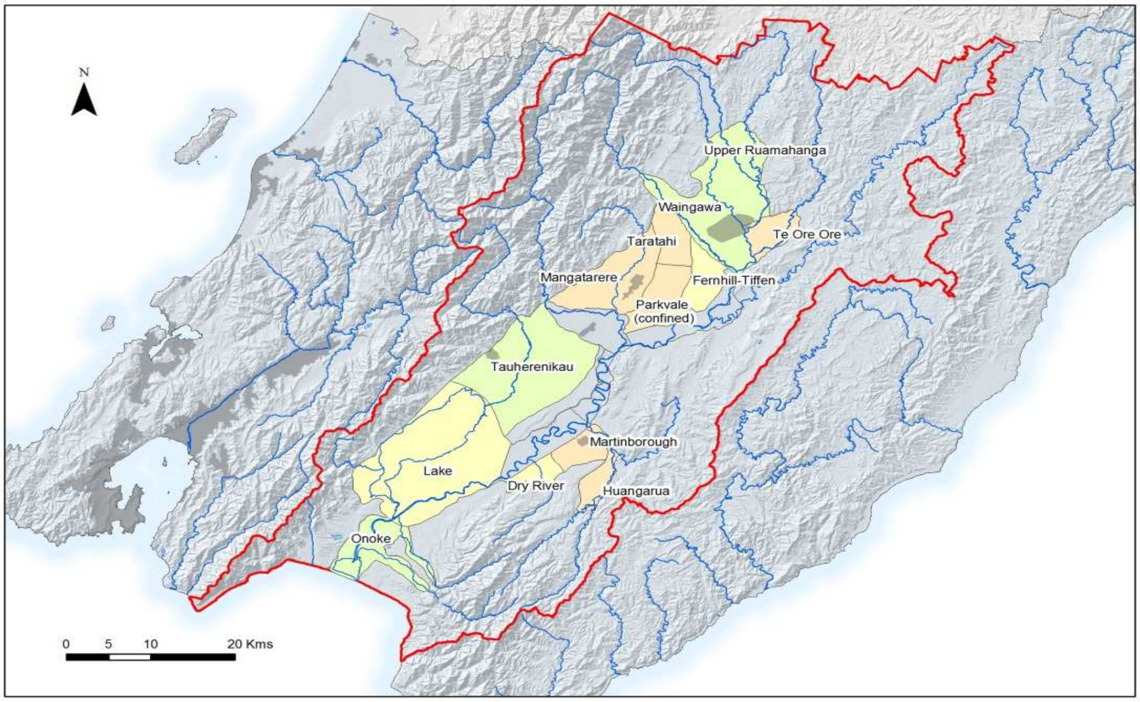


Figure 3. A comparison of consented allocation from groundwater management zones and the proposed allocation limits (refined from Hughes & Gyopari 2011).

existing allocation exceeds proposed limits

existing allocation is approaching proposed limits

significant availability remains within parts of the management zone (typically in the deeper aquifers)

It is important to note that groundwater zone boundaries do not necessarily coincide with surface water catchment boundaries; this is because groundwater aquifers are defined more by underlying geology than the form of the land (i.e. topography).

4. Future water availability

GWRC is putting forward, as part of the current Regional Plan review, interim limits of 50% and 30% of MALF for rivers and streams, respectively. For rivers and streams in which these limits are already exceeded, GWRC is recommending no further allocation be allowed. This means that opportunities for abstraction of 'new' water from rivers, streams and directly-connected groundwater (considered as surface water) will be limited. This will not have significant effects on existing users. As discussed earlier, under the existing Regional Freshwater Plan many rivers and streams are currently already fully allocated. It is expected that limits will remain 'interim' until the whaitua develops numerical catchment-specific limits on the basis of catchment values and levels of acceptable change.

While there is limited availability of surface water at low flows, allocation remains available at higher flows. Historically, there has been little 'harvesting'[4] of higher flows in the Ruamāhanga whaitua. The Wairarapa Water Use Project is an example of investigations into the use of this source of water in the future. A default rule is proposed in the Working Document for Discussion to allow additional abstraction when rivers and streams are running at above median flow. Groundwater is still available for allocation in a few aquifers in the Ruamāhanga whaitua (shown in Table 2 and Figure 1). These are typically the deeper confined aquifers or those that are further away from waters and streams.

5. Water use and the effect on values

5.1 The relationship between water use and river and stream health

When is water flow too low for some species?

What is the duration of low flow, before river/streams values are adversely affected?

If harvesting was to occur in our rivers and streams, what is the threshold level that allows rivers and streams to maintain their processes such as flushing?

How do we set flow guidelines that allows for small streams to maintain their functions and values?

Water abstraction places pressure on rivers and streams by reducing the amount of water available for ecological processes, recreational activities, and other in-stream uses and values. Decreased flows can also lead to deteriorations in water quality and habitat. Abstraction mainly occurs in the west and the centre of the whaitua.

In the eastern hill country within the whaitua, low flow generally reflects a natural low flow with lower groundwater inputs and less frequent rainfall and results in less frequent flushing. Flushing is important to remove accumulation of sediment and periphyton. Whereas, the steep gradients of rivers sourced from Tararua and Aorangi Ranges naturally have a higher flows and higher flushing flow frequencies. There are other water bodies in the whaitua such as Parkvale Stream that are fed by springs/groundwater. These streams are more influenced by groundwater connections and tend to have more stable flows and infrequent flushing.

What are the effects of low water flow?

Low flows occur naturally, but are exacerbated by abstraction. The demand for water is often greatest during dry periods in summer when river and stream flows are at their lowest and temperatures are warm. There are numerous effects of low flow. During low flow there are direct effects on water quality and habitat.

The direct effects of low flow:

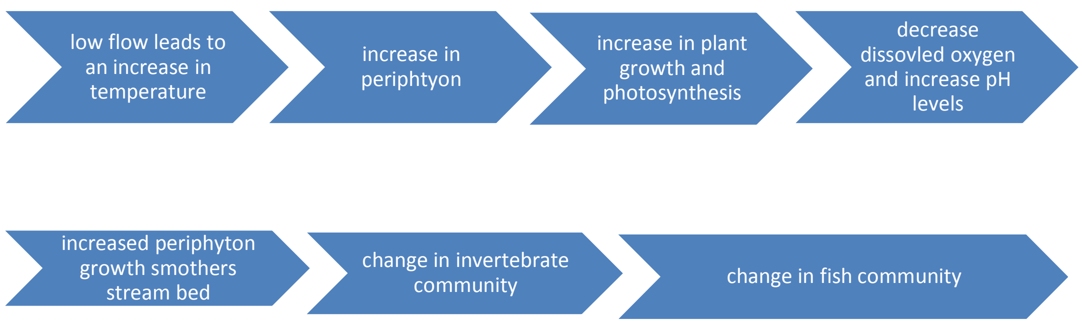
- Reduction in water depth and velocity which can lead to change in hydrological habitats available (many invertebrates and fish have preferred habitats)

[4] This refers to the activity of abstracting water when the river or stream is flowing at a relatively high rate (but not in flood), usually for the purpose of storing in a pond so it can be used later when abstraction is not available at lower flows.

- Increase in water temperature (less water to buffer against summer temperatures and many invertebrates and fish are unable to survive high temperatures)
- Decreases in the area of wetted habitat available, meaning there is less volume of water for the ecosystem.
- Less dilution of contaminants including nutrients (due to less water)
- A decrease in dissolved oxygen concentrations. Fish and other aquatic life require dissolved oxygen to breathe. When dissolved oxygen levels are depleted, aquatic animals can become stressed and die. The oxygen becomes less soluble as water temperature increases.
- A loss in connectivity with riparian vegetation/edge habitat. This is important habitat for foraging and/or reproduction.

There are also indirect changes in processes driven by low water flow. For example, an increase in water temperature and reduced flow velocity can favour increased aquatic plant growth (periphyton and/or macrophytes). An increase in photosynthesis/respiration as a result of this increased plant growth can in turn influence concentrations of dissolved oxygen and pH levels which can in turn affect aquatic fauna. Increased periphyton growth can also smother streambed habitat and is also less favoured by some invertebrate species in terms of habitat and a food source, this can lead to shifts in the invertebrate community that could ultimately result in shifts in the fish community due to changes in food availability.

Flow chart: The potential changes driven by growth of periphyton



Variability of flow is also affected by abstraction. Water harvesting, a process described earlier, affects the magnitude and duration of high flows, and general abstraction reduces the mid-flows and an increase in the frequency of low flows. Variability of water flow is needed to:

- Maintain the physical geomorphological processes such as channel-forming
- Flush/remove periphyton, macrophytes and sediment through the river systems
- recharge groundwater and maintain spring flow and aquifer pressure. This prevents salt-water intrusion or adverse pressure gradients
- To provide cues for migration activity for native fish and in some cases provide opportunities to access suitable habitats amongst riparian vegetation for spawning

How does flow extent and duration influence stream characteristics and species?

Compared with other streams/rivers in the catchment, those associated with the Tararua Ranges are generally steeper, faster, have higher flows and more frequent freshes/floods due to regular rainfall events. As a result periphyton cover/biomass is typically low and invertebrate communities are generally in a good condition with a range of sensitive taxa present. The invertebrate and fish communities in these rivers have all evolved under these conditions and are well adapted to coping with these 'flashy' rivers and/or are quick to recolonize after disturbance (fresh/flood). Introduced species, such as trout, are often more negatively affected by high flows than native species, especially if these coincide during key periods such as around spawning time.

Streams/Rivers with low flows and infrequent floods tend to have higher biomass of periphyton/macrophytes and more tolerant invertebrate and fish communities due to both the natural characteristics of these streams (i.e. naturally more stable with lower flows). They have also been modified through deforestation and abstraction and eutrophication[5] and possibly less effected by abstraction. The Waipoua River has long periods of low flows and generally has high water temperatures. Parkvale Stream, which experiences long periods of low stable flows, is characterised by nuisance periphyton and aquatic plant (macrophyte) growth and tends to have higher pH level in the summer.

A greater flow variation supports a greater diversity of species. In terms of the effects on habitat, small streams are impacted more than big streams and that there is a spectrum of effects across the native and introduced fish species.

5.2 The relationship between water use and the health of wetlands and lakes

Water abstraction also has potential impact on wetlands and lakes. Wetlands are very sensitive to abstraction because the hydrology determines flora and fauna present. If they are dry (or drier than naturally occurs) for long periods of time they are more at risk from invasion of weed species which can reduce overall habitat values of the wetland. Many of the aquatic fauna of wetlands are tolerant of the natural drying regimes wetlands experience. For example, brown mudfish can survive in a dry wetland for several months each year by aestivating (where they burrow/hide under substrate and remain until the water returns). However, the can only survive for a finite time and rely on the water returning in autumn. If abstraction increases the period that a wetland is dry, mudfish, as well as some other aquatic fauna, may not be able to survive.

Water level fluctuations are critical for ecological values and they control the distribution of organisms in most wetlands and the littoral zone in lakes. This is the part of the lake or wetland that is close to the shore, including the intertidal zone. The timing and duration of the connectivity of wetlands to their parent water-body controls the migration of fish and feeding cycles of birds.

5.3 Manawhenua values

The use of cultural values and indicators in water allocation regimes is supported by the National Policy Statement for Freshwater Management 2011 (NPSFM). The NPSFM requires councils to work with iwi and hapū to identify tangata whenua values and interest in freshwater and reflect these values in freshwater management. Treaty settlement specifies a legislative response that requires Councils to have regard for manawhenua[6] values and relationship with land and water and form

[5] Eutrophication is the depletion of oxygen in water: the process by which a body of water becomes rich in dissolved nutrients from fertilizers or sewage, thereby encouraging the growth and decomposition of oxygen-depleting plant life and resulting in harm to other organisms

[6] The word 'Manawhenua' is used in this report as this is the term referred to in the NPS FM, and means the authority over an area of land, and is a good term to use when referring to a larger area of land such as a catchment. Tangata whenua means people of the land.

collaborative arrangements that give effect to this. GWRC in partnership with Ministry for Primary Industries (MPI)[7] and local iwi commissioned a cultural report on instream flows and cultural values and indicators (Royal 2011). The goal of the report was to provide an approach to considering and incorporating Māori values in the setting of flow limits for a number of Ruamāhanga waterways.

The approach taken by Royal (2011) was, in consultation with local iwi, to identify the major themes across the whaitua relating to cultural values (see Table 4), then determine whether historical activities associated with these themes for specific waterways could be accommodated by the same waterways in their current state. Royal (2011) states “this approach is fundamental in recognising and providing for the relationship Māori have with their waterways”. The customary values inform the tangata whenua values.

Table 4. Tangata whenua customary values

THEME	ACTIVITIES
Wairua (spiritual)	Tohi rites, removal of tapu associated with war/death, baptisms and blessings of people and items.
Tinana (physical body)	Washing after child birth or menstration, water for cleaning and cooking, collection of food and weaving resources, preserving and storing food.
Hinengaro (mental wellbeing)	Collection of rongoa (healing plants), drinking water (mental clarity), teaching and learning (education), meditation.
Whanau	Transportation (waka), recreation, gathering of building resources, positioning of Pa, manaaki (sharing) the bountiful resources

The customary values outlined in the table above inform the values held by tangata whenua. Some of the tangata whenua values:

- Mahinga Kai[8]- water body that sustains tuna (eel) and other native fish populations
- Recreation values - water flow is needed to maintain deep swimming holes
- Ecological values - water flow needed for native fish travel to upstream reaches of the river and to the sea. Flow is needed to maintain range of indigenous species.
- Aesthetic values - threatened by poor water clarity, and are also reduced by channel modification.
- Waahi Tapu - scared sites
- Riparian Fencing - water body protected from stock
- Human health - water has a great impact on human health and there is a report ‘Healthy water- Healthy people’ that looks into this value in more detail.

Royal’s (2011) report culminated in recommendations for alternative minimum flows for some rivers and streams. These are compared with GWRC recommendations in Table 5 for a selection of waterways. They should be considered a starting point for a conversation on the effects of flow on tangata whenua values. Royal’s (2011) recommendations are generally higher than those of GWRC. One of the reasons is that the minimum flows proposed by Royal are seen as serving a ‘restorative’

[7] Ministry for Primary Industries (MPI) is formed from the merger of the Ministry of Agriculture and Forestry, the Ministry of Fisheries and the New Zealand Food Safety Authority.
[8] Mahinga kai generally means indigenous freshwater species that have traditionally been used as food, tools, or other resources. See the glossary for a more extensive meaning.

function, restoring past and present customary values rather than being focused on maintaining present day values.

In arriving at his minimum flow recommendations, Royal (2011) emphasised that the quality of water is often more important for the nourishment of Māori values than quantity of flow; he stated that "it is more valuable to have a small flowing stream of excellent water quality than a large river of extremely poor water quality". This is a very important point in the context of balancing values, finding common ground between alternative viewpoints and determining final water quantity and quality limits.

Table 5: Comparison of minimum flow recommendations for selected Ruamāhanga whaitua waterways based on ecological values (GWRC) and Māori cultural values (Royal 2011).

Waterway	GWRC minimum flow recommendation	Suggested minimum flow to support Māori values
Ruamāhanga River	NA- depends on the tributaries below	10,000L/s (Wardells)
Waipoua River	250L/s (Mikimiki)	500L/s (Mikimiki)
Kopuaranga River	270 L/s (Palmers Bridge)	600L/s (Palmers Bridge)
Waingawa River	1100 L/s (Kaituna)	2500 L/s (Kaituna)
Waiohine River	2300L/s (gorge)	3570 L/s (gorge)
Tauherenikau River	1100L/s (Donalds Rd)	1350L/s (gorge)

5.4 Social values

A report commissioned by WWUP on social values of people in the Wairarapa (Winstanley et al. 2009) states that people are aware that water is a valuable resource and there is a high awareness of droughts and impacts on different groups. Urban water restrictions are common and in South Wairarapa District Council (SWDC) they are constant and people are receptive to restricting water use. However, while people are seen as being receptive, The Winstanley (et al. 2009) report states there is a perception of 'wastage', an inefficient use of water by dairy farmers and people on town supply. In addition, people expressed values about fairness and equity of water allocation and sustainability of water resources, land use and farm practices.

There are both social benefits and costs of water use. Benefits for farmers include reliability of water, reduced variability of income, and decreased stress. Social costs include a changing community, as intensification brings an influx of new people with different values and perspectives and cultures. An increase in property values and this has is both a negative and positive. Also, there is an increased potential of off farm ownership, which can change social dynamics and led to farms and management decisions becoming more production focused, where owners are not seeing and experiencing first hand any social and ecological effects of farming operation that could occur.

How do we best communicate water flow guidelines and policies so they are well understood by the users?

5.5 Economic values

Land use options and productivity in the Wairarapa Valley are limited by summer dry seasonal patterns and the risk of drought. An increased year-round reliability of water would increase the range of land use options and productivity in the region and result in significant economic benefits but not if the economic costs of environmental sustainability are factored in.

An increase in water availability would affect existing land uses in different ways. Increase availability of water in form of irrigation scheme for intensification of sheep & beef irrigation is found to not be viable in feasibility studies undertaken by WWUP.

For viticulture, the availability of reliable water for irrigation or frost protection on viticulture properties greatly enhances the security of the grape crop (frost fighting) and productivity of the vineyard.

For arable and cropping land use, the returns from water use are significant.

For dairy farming, an increase in water use increases marginal returns. Water use brings reliability and irrigation schemes are identified as most reliable source of water and are currently being investigated by the Wairarapa Water Use Project (WWUP). The cost of water will dictate the attractiveness of irrigation. Significant increases in production can be achieved by irrigation or by substantial use of bought-in feed (palm kernel or grain), and decision is made on cost, the cost of water versus the cost of purchased feed.

Irrigation allows for reliable summer growth and stocking rates cane increase between 0.8 and 1.5 cows per hectare. Irrigation also increases milk production by 30-65% dependant on soil type. Having reliable water generally leads to increase in land prices. The value of dairy farms relates to the production of milk solids, the more kilograms of milk solids produced, the more valuable the farm.

6. Knowledge gaps

- Whether temporal trends in low flows at the bottom of the catchment differs from natural flows in the upper catchment. With the substantial increase in surface and groundwater allocation, the duration of low flows at the bottom of some catchments may have increased.
- Understanding the reasons for declines in groundwater levels and associated environmental consequences.

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Report prepared by	**Report approved by**
Tessa Bunny **Date**	***Alastair Smaill*** **Date**

For more information

Royal, C. (2011). Cultural Values for Wairarapa Waterways Report. Produced by Ohau Plants ltd for Greater Wellington Regional Council

Keenan, L., Thompson, M., Mzila, D. (2012). Freshwater allocation and availability in the Wellington region: State and trends. Greater Wellington Regional Council, Publication No. GW/EMI-T-12/141, Wellington.

Glossary

Abstraction/water take- withdrawal of water from a rivers, streams, lakes and groundwater systems by a consent holder

Core allocation- total amount of water in a catchment authorised for abstraction. This is the surface water allocation below the median river flow.

Ecological flows are the flows and water levels required in a water body to provide for the ecological integrity of the flora and fauna present within water bodies and their margins.

Environmental flows are the flows and water levels required in a water body to provide for a given set of values which are established through a regional plan or other statutory process. In the NPS FM Environmental Flows is a type of limit that describes the amount of water in a body of fresh water (except ponds and naturally ephemeral waterbodies) which is required to meet freshwater objectives. Environmental flows for rivers and streams must include an allocation limit and a minimum flow. Environmental levels for other bodies of water must include an allocation limit and a minimum water level.

Flow - volume of water given in cumecs. One cumec equals one cubic metre of water flowing past a point in one second. One cubic metre of water equals one thousand litres and weighs one tonne.

Groundwater- all water that is below the surface of the earth. These are often referred to as our 'underground rivers'.

Harvesting- activity of abstracting water when the river or stream is flowing at a relatively high rate (but not in flood), usually for the purpose of storing in a pond so it can be used later when abstraction is not available at lower flows.

Kaupapa Māori worldview is the foundation of cultural normalities.

Macrophyte is an aquatic plant that grows in or near water and is emergent, submergent, or floating.

Mahinga kai- The customary gathering of food and natural materials, the food and resources themselves and the places where those resources are gathered.

Manawhenua- people who have local tribal or sub-tribal authority over a particular area.

Mean Annual Low Flow (MALF) - the average of the annual lowest flows for a given river or stream. MALF is often used as a reference to set low flow policies, and low flow duration of 7 days is commonly used.

Minimum flow- A point where all abstractions must cease and this threshold is specified in a regional plan. Minimum flows are commonly set as a proportion of a low flow statistic, such as a mean annual flow.

Naturalised Annual Low Flow (NALF) - information gathered from unimpacted river flow. NALF is useful reference point to assess predicted habitat availability in water depth under various river flow. There is no information of NALF in the Ruamāhanga whaitua.

Over allocation is a situation where the resource has either been allocated to users beyond a limit, or is being used to a point where a freshwater objective is no longer being met.

Periphyton- a slimy material attached to the surfaces of rocks and other bottom substrate in rivers and streams. It comprises of algae, diatoms, bacteria and fungi and plays a role in aquatic food webs because it is the main source of food for benthic invertebrates, which in turn are an important food source for fish. However, it reduces ecological, aesthetic and recreation values of rivers and streams.

Riffle a shallow part of river or stream where water flows and is more turbulent.

River- means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal).

Riparian - river margins

Supplementary allocation- water authorised for abstraction at times in time of high flow, when flow exceeds threshold. This is the surface water allocation above the median river flow.

Surface water- as defined in the RMA: all waterbodies above the land such as streams, rivers and lakes. Please note; The Working Document For Discussion has a different definition including water races and artificial dams.

Tangata whenua- people of the land, referring to indigenous people.

Temporal - relating to time.

Trophic cascade -when something in the food web suppresses the abundance and/or alters traits (behaviour) of their prey.

Water availability- amount of water that may be taken out of our rivers, streams, lakes and groundwater systems without compromising the life supporting capacity and other identified critical values associated with individual water bodies.

Water body - means fresh water or geothermal water in a river, lake, stream, pond, wetland, or aquifer, or any part thereof, that is not located within the coastal marine area. A river means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal).

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