

Part 4: Summary of changes recommended by staff to Chapter 5 Water Quantity

This summary includes all parts of Chapter 5 covered by Officers Report 5 WQN1, as listed under “Matters to be heard” plus other pages throughout NRRP Chapters 4-8 where consequential amendments have been recommended in Officers Report 5 WQN1.

Note: because of the additional text arising from recommendations, page numbers may no longer match the notified versions of NRRP Chapters 4-8.

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This is a true and correct copy of Chapter 5 Water quantity, part of Variation 1 to the Proposed Canterbury Natural Resources Regional Plan prepared by the Canterbury Regional Council.

The Proposed Canterbury Natural Resources Regional Plan is a statutory regional plan prepared by the Canterbury Regional Council in accordance with the requirements of the Resource Management Act 1991.

Variation 1 was adopted at a meeting of the Canterbury Regional Council on 27 May 2004 and publicly notified on 3 July 2004 for submissions.

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5.1 Introduction

Water is a vital resource to all of Canterbury. Rivers and lakes are home to many species of birds and fish, some unique to the region. To Ngāi Tahu water is a taonga, a treasure left by ancestors to provide and sustain life. The region's water resources are used for a wide range of recreational activities, as a source of food, for irrigation, electricity generation,¹ industry and community and stock water supplies. While water is a renewable resource, it is not unlimited. This is because renewable resources can be used in a way that threatens their long-term sustainability, thus risking their eventual exhaustion or permanent changes to their characteristics. This relates both to physical resources, such as the processes that form a braided river, or to the natural environment, such as habitats of plant or animal species.² Managing the competition for water between these different needs and demands is the primary focus of this chapter.

With more water being abstracted from rivers and groundwater, the risks to instream values increase. Environment Canterbury, through the Proposed Canterbury Natural Resources Regional Plan (Proposed NRRP), sets out the regulatory/non-regulatory framework to provide an adequate level of protection ~~to sustain~~ that is effective for sustaining³ the life-supporting capacity of surface and groundwater systems, and sustain Ngāi Tahu and other instream values. At the same time, it enables abstractions, damming or storage by those who wish to use water for economic purposes. This chapter:

- (a) provides certainty that instream values receive an adequate level of protection;
- (b) provides consistency and transparency in decision-making about water management; and
- (c) enables those making business decisions to be better informed about how water management will affect their business.

For administrative ease, the Proposed NRRP has been divided into several chapters dealing with different water issues, for example water quantity and effects of afforestation on low flows, water quality, beds of rivers and lakes, and wetlands. However, it is important to recognise that although environments and ecosystems can be described independently, they are always connected in nature. Promoting sustainable management will require these inter-relationships to be considered in an integrated way when making resource management decisions.

This chapter deals with five major water management topics:

- (i) the strategic protection of some highly valued natural water bodies;
- (ii) setting flow and/or level regimes for the management of rivers, lakes and groundwater to protect instream/intrinsic values;
- (iii) the management of vegetation change to maintain surface flows and instream values;
- (iv) the allocation of water above any set flow or level regime to out-of-stream/consumptive uses, and its efficient use; and
- (v) water storage, augmentation and/or transfer.

¹ WQN1.62

² WQN1.74

³ WQN1.63

5.2 Background

The pressure to use water for economic purposes, particularly irrigation, has increased dramatically over the last 15 years and shows no sign of abating. The area of irrigated land in Canterbury has increased from about 150,000ha in 1985 to about 350,000ha in 1999.

The Canterbury Strategic Water Study⁴ estimates that potentially about one million hectares could be irrigated. A review of river flows showed that there is enough water to do this but not on a run-of-river basis (that is, relying on the natural flow of the rivers). Construction of water storage systems to capture water during higher flows will be necessary to give the reliability of supply that is needed, particularly during periods of low river flow in summer. The Study estimates that of the future potential peak demand, 89% is expected to be for irrigation, 5% for stock water, 3% for municipal supplies, 2% for industrial use, and 1% for plantation forestry demand.⁵ The water study concluded that, with storage, the region has enough water to meet its foreseeable abstractive needs and provide for instream flow requirements.

In addition to irrigation, there is likely to be expansion in processing and other industries that will increase water demand. Population increase will also create further demand for domestic use of water, although this will be small, relative to the growth of irrigation and industry water demand. Statistics New Zealand population growth projections⁶ indicate a medium range growth of 11% for the Canterbury region from 2001 through to 2020. This is more likely to be significant in Christchurch City and surrounding areas.

About 61%⁷ of all the water allocated in New Zealand for other than hydro electricity use comes from Canterbury's rivers and groundwater. Of this, about two-thirds of the abstractions are from surface water, the remaining third are from groundwater. In the absence of irrigation, much of Canterbury's extensive area of productive arable land would be used for dryland farming with a likely substantially lower benefit to the regional economy.

~~A~~ change from short vegetation to tall vegetation, such as an increase in forestry plantings or the spread of gorse or broom,⁸ could affect stream flows, particularly in lower hill country catchments where rainfall is the main source of flow. Increasing the area of tall vegetation in these catchments is likely to reduce surface flows and lead to an increase in the frequency and duration of low flows, reducing the availability and reliability of water for out-of-stream uses.

Water is also used for the generation of hydro electricity, which is an important renewable energy source in New Zealand.⁹ The majority of power generation in Canterbury occurs in the Waitaki River catchment where lakes Tekapo and Pūkaki account for 60% of New Zealand's total controlled hydro storage. The Waitaki scheme generates about 25% of the country's electricity. It stores, diverts water between lakes and uses water at Lake Tekapo and within the canals for power generation in the upper catchment, while the lower dams provide the ability to generate electricity on a run-of-river basis. The entire flow of the Waitaki River is able to be utilised through the dams at Benmore, Aviemore and Waitaki for electricity production. Other hydro electricity generation occurs on the Opuha River in association with augmentation for irrigation and an increase in the minimum flow regime, via the Rangitata

⁴ Morgan M, Bidwell V, Bright J, McIndoe I, 2002. *Canterbury Strategic Water Study* prepared for Environment Canterbury, MAF and MFE by Lincoln Environmental. Report No 4557/1, August 2002

⁵ **WQN1.76**

⁶ Statistics New Zealand, November 2002. *Subnational Population Projections (2001Base – 2021)* www.stats.govt.nz

⁷ Lincoln Environmental, November 1999. *Information on Water Allocation in New Zealand* prepared for Ministry for the Environment (Report No 4375/1)

⁸ **WQN1.79**

⁹ **WQN1.75**

Diversion Race also in association with irrigation, and from Lake Coleridge. The mean increase in electricity consumption over the period 1983 – 2004 in the Canterbury region was 2.9%¹⁰. If this trend continues, the region and the South Island will require additional sources of electricity generation if it is to avoid problems with security of supply.¹¹ There is potential for more development of hydro electricity in association with and/or in competition with other uses such as irrigation. The allocation of water for this purpose would be considered under the Waitaki Catchment Water Allocation Regional Plan.¹²

The effect of climate change is likely to impact on the reliability of supply desired by water users more than on instream low flow requirements. If, with climate change, the same instream values exist then they are still likely to need the same flow regime. If the flow recedes towards this low flow more often, then it is the users of the water above this low flow that will be mostly affected, due to more frequent restrictions and less reliability. If on the other hand, rainfall in alpine and foothill catchments increases due to an increase in westerly condition, as has been projected, then average flows in these catchments are likely to increase.¹³ There is no certainty about the likely effects of climate change. This is something that will have to be monitored and reviewed during the life of the Proposed NRRP and beyond.

5.2.1 Rivers

5.2.1.1 River types

The water bodies of the Canterbury region can be grouped into different ecosystem types that have similar physical and biological characteristics (Appendix WQN1¹⁴). When they are subject to the same human use pressures, they generally exhibit similar types of resource management issues.

Key physical characteristics that can be used to distinguish different types of rivers include water levels, flow source and regime, composition of bed material, the morphology (shape) of their beds, and their interaction with other water bodies. These characteristics dominate in determining the type of plants and animals that are able to spend all or part of their life cycle in the water, the bed, the adjacent riparian margin zone¹⁵ or wetland, or the saturated zone between the bed and the groundwater.

Many organisms are adapted to quite specific physical conditions. Changes in the flow, level and quality of water can have a significant influence on the distribution and life cycles of many plant and animal species.

The major rivers and lakes are shown in Figure WQN1. The river types are shown on Proposed NRRP Map Volumes Part 1 Planning Maps.

5.2.1.2 Life-supporting capacities of rivers and their ecosystems

The hydraulic conditions in a river and the nature of its bed (e.g. sand or boulders), create the physical habitat for aquatic species, and also influence the habitat of the adjacent riparian margin zone¹⁶.

Aquatic communities are sensitive to changes in river flow, for example:

¹⁰ Environment Canterbury, 2006. *Regional energy survey 2004*. Report No R06/28. [WQN1.81]

¹¹ WQN1.81

¹² WQN1.57

¹³ WQN1.82

¹⁴ Snelder, et. al, 2000, *Test of the River Ecosystem Management Framework and River Environment Classification in Planning*. NIWA Consultancy Report CHC00/50 [WQN1.83]

¹⁵ GEN2.14

¹⁶ GEN2.14

- (a) the timing of flow changes can have adverse effects on fish populations. Freshes during spawning can wash away eggs, while a decreased flow can result in less oxygenated water flowing through the gravels, or increased siltation, both of which can cause higher mortality; and
- (b) changes in the flow of smaller or more stable rivers can alter water quality parameters, such as dissolved oxygen, pH, nutrient concentrations, and water temperature, with consequent impacts on aquatic biota. Low flows in combination with elevated temperature and nutrient loadings can promote the growth of algae and periphyton and change the composition of insect fauna. Low flows can also affect the ability of a river to dilute waste, including waste from natural sources such as wading birds and waterfowl.

Several It is not unusual for some of Canterbury's foothill rivers and spring-fed streams to¹⁷ regularly dry up in sections or over their full length, in summer and autumn months. Abstractions from these rivers and linked aquifers will increase the frequency and duration of periods during which the rivers cease to flow, as well as extending the length of dry riverbed. Normal climatic conditions can also cause rivers to go dry after abstractions cease. Areas of dry riverbed are not necessarily devoid of life as some aquatic animals survive by burrowing down into the gravels. When surface flow returns, they re-emerge. With the return of flows, dry areas are also re-colonised by downstream drift of crustacean and aquatic insect larvae, by flying adult insects, and by the movement of fish back into the area. The ability of aquatic ecosystems to recover naturally in this way is affected by the frequency and duration of drying, the length of bed affected, and the quality of the habitat upstream and downstream of the dry area.

As rivers dry up, fish and other biota retreat into pools where they may become stressed because of increased water temperature, and competition for space and food, and may be more vulnerable to predation. As conditions become more extreme some may become stranded and die. For aquatic fauna with short life cycles, populations can rebuild relatively quickly. However, for species that breed only once a year, e.g. fish, the recovery may take several years.

Water diversion and water takes can impact on the life-supporting capacity of rivers by removing fish from the river system. Dams or culverts can provide barriers to fish passage, by disconnecting habitats and affecting migration and breeding patterns.

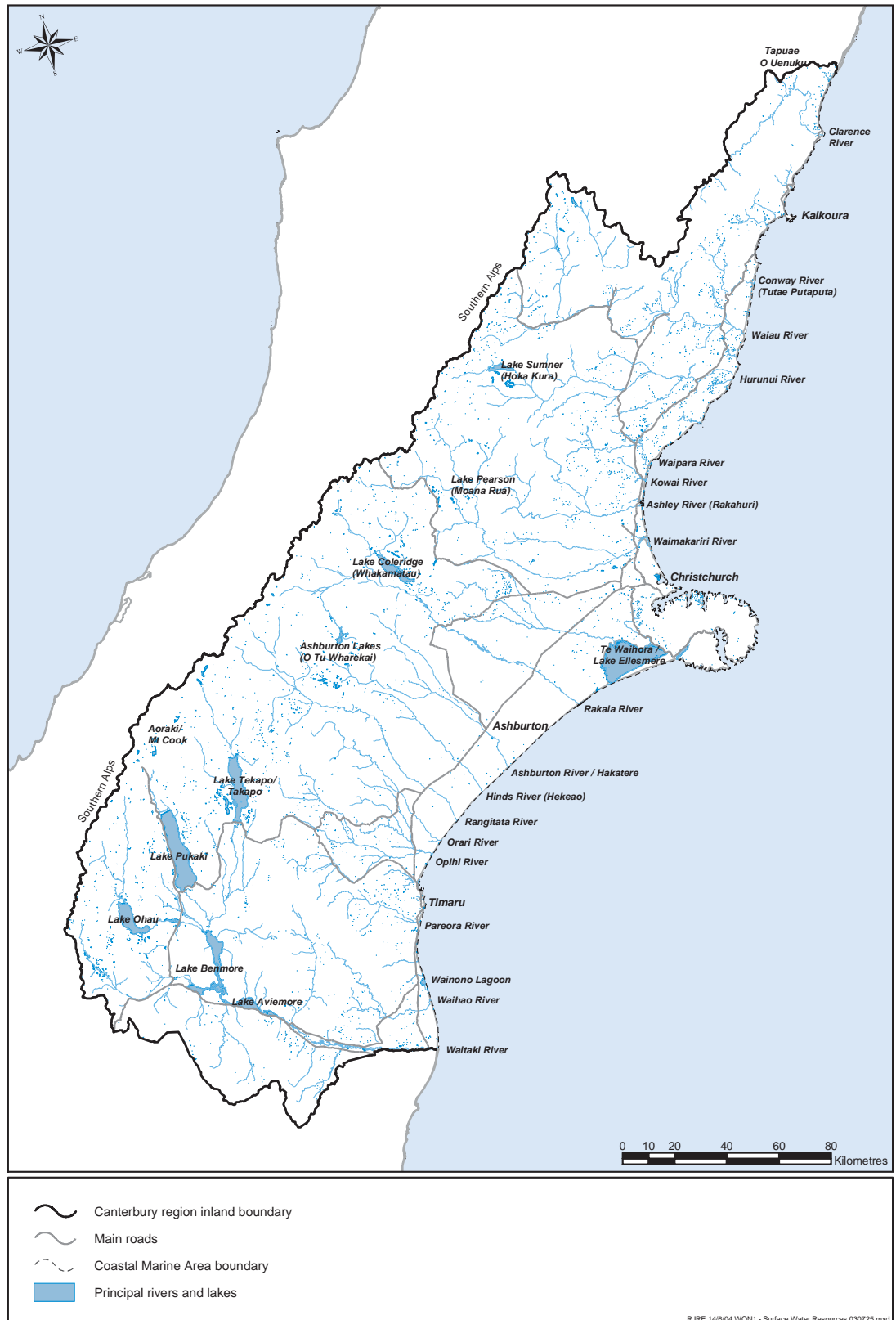
5.2.1.3 Natural character and features in rivers

The natural character of a river describes the physical features, the body of water, and the processes operating within the riverbed. Natural character can be very different across different river types.¹⁸ The elements that contribute to the natural character of a river include:

¹⁷ WQN1.87

¹⁸ WQN1.88

Figure WQN1: Principal rivers and lakes of Canterbury



- (a) the setting – whether the river dominates the landform or is itself dominated;
- (b) the extent to which the landform is a product of the river;
- (c) the surrounding land and riparian and bed vegetation;
- (d) the kinds of aquatic life and other wildlife present;
- (e) the pattern or shape of water movement, e.g. smooth, irregular, random flow;
- (f) velocity and depth of water and the natural variability of these;¹⁹
- (g) the colour, clarity, sound and smell of water;
- (h) texture of the water surface, e.g. still, weed-covered, rippled, white and aerated; and
- (i) the character of the channel, such as outcrops, pools, riffles, rapids, bouldery reaches, runs, meanders, braids, falls and varied bank profiles.

The natural character of a river is strongly influenced by the scale of its wider surroundings. As already noted, the various elements of natural character, such as terrain, vegetation, water and wildlife, come from nature. Areas where those elements remain largely free of human influence have high naturalness. Where there are significant human influences, naturalness is much lower. Thus, the Avon River/ Ōtakaro, with its garden frontages and willow-lined banks has low naturalness. In contrast, high country rivers flowing through wide-open valleys and bordered by naturally occurring tussock and beech forest have high naturalness.

Human-induced flow modifications may be another factor in reduced naturalness, perhaps altering the natural balance between the areas of open water, rock, gravel or banks, or affecting patterns of vegetation or wildlife either within the river or its surroundings. These can have adverse effects on people's perception and experience of the river's natural character. Factors that can influence the degree of naturalness include:

- (i) the loss or reduction of river flows exposing large areas of empty riverbed;
- (ii) the loss of flow depriving people of the sound, sight and smell of running water;
- (iii) alterations to the shape of the river channel, e.g. reduction in the number of channels in a braided bed which, in an extreme case, could be reduced to a single channel; and
- (iv) changing the size or the natural rise and fall of flows or levels, by altering the seasonal fluctuations in river flow, or by regulating flows so that extreme high or low flows do not occur.

The scale and nature of flow regime changes are important even though it may be difficult to distinguish small human-induced changes from natural variations in the river flow. Changes to flows tend to be more noticeable on smaller rivers, e.g. the Selwyn, Opihi, and Waipara, than on larger ones.

Changing flows may indirectly lead to other changes in the appearance of the river, for example, a decrease in flood peaks can result in vegetation encroaching into river channels.

5.2.1.4 Indigenous riparian vegetation and floodplain habitats

Prior to European settlement, rivers on the plains regularly changed course across their flood plains. The Waimakariri River, for example, at various times flowed as far north as Woodend and as far south as Te Waihora/Lake Ellesmere. Stop banks have since been built along the lower reaches of many rivers to protect urban areas and farmland by preventing small to moderate-sized floods from breaking out of their river channels.

¹⁹ WQN1.88

Floods, and changes in the course of a river, therefore, no longer play such a significant role in maintaining the diversity of pre-European riparian and floodplain vegetation communities. The exceptions are in the high country areas, within managed river beds where there are remaining communities and habitats, and near some river mouths on the coast.

It is likely that many of the remaining wetlands on the lower plains, particularly those that lie outside the stop bank system, will decline and eventually disappear due to their separation from the river bed, and due to farm development pressure, unless active measures are carried out to rejuvenate them. (Refer to Chapter 7 for policies and strategies for managing wetlands.)

5.2.1.5 Mauri, wāhi tapu, wāhi taonga and mahinga kai values of rivers

Ngāi Tahu consider that each water body possesses its own mauri or life force and has its own status or mana that is safeguarded by tribal guardians or kaitiaki. Some of the tangible features that contribute to the mauri of a river are:

- (a) the natural variability of river flows ("the moods of a river"); and
- (b) the ability of a river to "cleanse itself", e.g. to clear debris and remove excess growth of algae and invasive plants.

The essence of this life force can be compromised or lost when the natural characteristics of the river or lake are altered significantly by changing the pattern of flows or levels by damming, by excessive abstraction of water, or by diverting or mixing water between different catchments.

Mahinga kai, including the management and collection of traditional food and other resources, is highly valued by Ngāi Tahu. They have long been concerned about the decline in the quantity and quality of mahinga kai as a result of changes in the flow regime and water quality of rivers. The abstraction of water from some rivers, for example, has reduced flows such that at times there is insufficient water to maintain aquatic habitats and to allow the movement of fish upstream and downstream.

Many wāhi tapu sites are found within, or close to, water bodies. For example, some rivers, springs and lagoons were used as water burial sites. These sites are vulnerable to inundation when dams are built or lake levels raised. Conversely, low river flows can expose sites making them vulnerable to desecration. (See Chapter 2 for further discussion on Ngāi Tahu values and resource management concerns)

5.2.1.6 Recreation and amenity values of rivers

The presence of flowing water has important spiritual, aesthetic and emotional values for many people, and it enriches the quality of the environment for many river-based outdoor activities. These values will be strongly influenced by the width of the riverbed, size and velocity of the flow, clarity and colour of the water, numbers of people present, the availability of public access, and the sounds and smells associated with flowing water.

The capacity of a river to accommodate people undertaking different activities will depend on the size of the flow and the type of river channel. Some activities, e.g. jet boating, generally require long stretches of river, while other types of activities, e.g. individual anglers, require a relatively small area of water. Not all of these activities are compatible with each other. For many people, the level of enjoyment is in part related to the number of people using the same stretch of water. Physical separation along the length and width of a river, as well as the surface area of water is, therefore, important to maintain the level of enjoyment.

For most water-based recreational activities, a range of flows offers a variety of challenges for different levels of experience and satisfaction. A reduction in river flows can restrict the opportunities for some recreational activities and create opportunities for others. For example, a decrease in flow may reduce the number of salmon holes, thereby causing fishermen to congregate at the smaller number of good sites. A reduction in flow may preclude rafting but improve swimming opportunities.

The public perception of a river's health and its suitability for recreation, is strongly influenced by the appearance of water. Prolonged low flows can cause excessive algal growth or a build-up of fine sediments, creating an unappealing waterway, and a slippery riverbed. Algal taints can make fish inedible, e.g. Opihi trout.²⁰

The impoundment of a river by a dam will modify the existing scenic character of a river and the reaches used for some recreational activities (e.g. rafting), while creating a new "natural character" and opportunities for different recreational activities on the newly formed lake (e.g. windsurfing, water skiing, angling). A reduction in flow can have an impact on the feel of a river, e.g. a loss in drama in areas of rapids, or a reduction in the speed of flow through a gorge.

5.2.1.7 Modification of river flows and levels

Rivers comprise a three-dimensional system, made up of the channel, the riparian margin zone²¹ and the floodplain. Often there are hydrological links with an adjacent aquifer. The major processes that link the various parts of a river system are:

- (a) flows ranging from flood flows to low flows which can clear riverbeds of encroaching vegetation, re-shape channels, inundate riparian and floodplain areas and transport sediments;
- (b) flows that keep river mouths open to the sea;
- (c) in-channel flows which provide the instream environment for biological communities;
- (d) leakage through the beds of gravel rivers to recharge aquifers and supply spring-fed streams; and
- (e) sub-surface flows that sustain organisms that live in the riverbed.

Most rivers have seasonal patterns of flow but flooding and low flows can occur at any time of the year.

Variations in the channel shape of a river, which affect the width, depth and velocity of water, create the conditions for a wide range of different habitats. Generally, the more irregular the channel shape, the greater the diversity and number of organisms. High flows are important for creating channel patterns, disturbing the sediments in the riverbed and removing deposits of fine sediments.

Flows can be modified by:

- (i) taking water direct from a river including its tributaries;
- (ii) pumping groundwater from bores ~~adjacent~~ hydraulically connected²² to rivers, causing a decline in river flows. This is a problem in areas where rivers have permeable beds, such as the Canterbury Plains. Significant effects on flows can be caused by an individual groundwater abstraction or by the cumulative effect of many groundwater abstractions;
- (iii) widespread pumping from aquifers, causing a lowering of groundwater levels or pressures, and resulting in a reduction or cessation of spring flows. This is a problem mostly for the lowland, spring-fed streams, e.g. the Avon River/Ōtakaro and Irwell River;
- (iv) dams and the way they operate. For example, dams can reduce the frequency and size of peak flood flows, alter the seasonal pattern of flows, or be used to maintain higher low flows;

²⁰ WQN1.97

²¹ GEN2.14

²² WQN1.98

- (v) diversion of water, including water harvesting and the augmentation of flows in other rivers. For example, augmentation can also be used to alter the seasonal pattern of flows, or maintain higher low flows²³; and
- (vi) changing the vegetation cover of the stream catchment, and, in particular, changing from short to tall vegetation, e.g. changing from grassland to plantation forest or dense tall scrub .

5.2.1.8 River mouth closures

A number of rivers form lagoons behind a narrow barrier beach. The shape and position of the river mouth system is constantly changing in response to the interaction between river flow and coastal processes.

River mouth closure is a natural process but the frequency and duration of closure can be affected by the modification of flows in rivers through damming, diversion and abstraction of water. On some rivers, such as the Ashburton/Hakatere, Waipara and Opihi rivers, the river mouths can close completely at times. This is because river flow is insufficient to keep them open during periods of strong wave action when large volumes of shingle are being moved along the coast. Prolonged closure of river mouths can cause a number of problems including:

- (a) restricting or preventing the passage of fish migrating between the sea and river, thereby disrupting their lifecycle and feeding patterns. Depending on the time of year, this could lead to a decrease in the fish stocks for commercial or recreational fishing and mahinga kai;
- (b) a decline in lagoon water quality, (e.g. elevated pH and water temperatures, reduced dissolved oxygen levels or declining salinity) by preventing the exchange of water between the sea and river, e.g. Opihi River mouth; and
- (c) a build-up in water levels behind the bar, threatening adjacent farmland and holiday settlements, e.g. Opihi River mouth.

At the mouth of the Ashburton River/Hakatere, long periods of low flows can cause the position of the outlet channel to migrate north. When a small or moderate sized fresh occurs, unless a new mouth re-establishes opposite the end of the river channel, erosion of the coastal gravel cliffs may occur. At the Rakaia, this northwards migration can lead to bank erosion in front of the North Rakaia huts.

5.2.1.9 Spread of introduced vegetation in braided riverbeds

Braided riverbeds support important populations of indigenous bird species that are adapted to wide-open shingle habitats, for example, wrybill plover, black-fronted tern and banded dotterel. These birds require large areas of open, bare gravel for nesting. Vegetation invading the riverbeds provides cover from which predators, such as ferrets, weasels, stoats and cats may prey on the nesting birds. Unfortunately, introduced plants such as tree lupin, gorse, broom, and willow have invaded the lowland reaches of all braided rivers, as well as the Tekapo and Ahuriri rivers in the upper Waitaki basin. Once a pioneering plant species gains a foothold in the riverbed, other plants can become established on the same site. For example, tree lupin aggressively colonises open areas of riverbed trapping driftwood and sand to form "islands". Other plant species, such as broom and gorse invade and replace the tree lupin to create dense thickets of vegetation. As a result, the area of open riverbed gradually declines and the increased vegetation cover provides a habitat for introduced predators.

Large floods will wash vegetation away from time to time. Dams and some takes or diversions can reduce this "flushing effect" by removing peak flood flows, thereby allowing plants to encroach further onto the riverbed. Some of these induced adverse effects can be

²³ **WQN1.101**

partially mitigated by the controlled release of “flushing flows”, that can assist in the management of both terrestrial and aquatic plant pests.²⁴

5.2.1.10 Surface water quantity flow and level management issues for instream/intrinsic values

Rivers, lakes and wetlands are ecosystems that provide essential habitat for a variety of indigenous and introduced species. As well they contribute much to people's sense of wellbeing, pleasure and enjoyment. The term "instream values" includes the natural values of a water body, cultural and spiritual values of Tāngata Whenua and the wider community, and amenity and recreation values associated with water bodies. It excludes other forms of instream uses such as hydroelectric generation and waste assimilation. Despite the contribution of instream values to the community's wellbeing and quality of life, the economic value of these is very difficult to determine. Instream values can be adversely affected by the human use of water.

5.2.2 Lakes

5.2.2.1 Lake types

Lakes have been divided into four types;

- (a) unregulated natural high country lakes, tarns and wetlands, for example;
 - (i) large lakes, for example Lake Sumner. These are fed by rainfall, snow-melt and glacial-melt water. Their highest level is in spring and their lowest level is in late summer/autumn. They are deep and cold, and have low nutrient concentrations.
 - (ii) smaller lakes (up to 8km square), for example lakes Taylor, Clearwater and Alexandrina. These are shallow and have higher nutrient concentrations.
- (b) artificially regulated natural high country lakes, for example, lakes Pūkaki and Coleridge. Their flow source is snow-melt and glacial-melt water. Glacial-fed lakes have high turbidity levels. Lake levels are artificially controlled for hydro electricity generation or irrigation. Lake levels are lowest in winter, and highest in summer – autumn. Lake levels vary over a large range.
- (c) artificial lakes, for example, lakes Waitaki, Benmore or Opuha. These have been created by impounding a river and are managed for electricity or irrigation. Depending on the purpose of management, there can be a large range of levels.
- (d) natural coastal lakes, lagoons, estuaries and wetlands, for example, Te Waihora/Lake Ellesmere and Wainono Lagoon. Their flow sources are rainfall, streams, springs, and groundwater. They tend to be wide and shallow with wetland margins. Some are brackish. Some have unstable braided river mouth channels with lagoonal backwaters behind shingle bars. Some mouths close during summer. Most of these have high nutrient concentrations.

5.2.2.2 Life-supporting capacities of lakes and their ecosystems

Under natural conditions, lake level changes are controlled by an interplay of factors such as direct precipitation into a lake, inflows from surrounding catchments, evaporation, and outflows from the lake.

Lake margins define an important boundary between land and water. This zone (called the littoral zone) is a region of high biological diversity and an important habitat for the lifecycles of many plants and animals. Typically, lakeshore vegetation communities form a series of distinct zones around natural lakes, reflecting the tolerance of different plant species to inundation, wave action and light intensity. The upper limit of the large submerged aquatic plants (macrophytes) is controlled by turbulence caused by wave action and the lower limit by light intensity. For animal species, the natural fluctuations in water levels help determine

²⁴ **WQN1.104**

feeding opportunities, the timing and success of breeding, and the area of available habitat. Periodic flooding of lake margins can rejuvenate shoreline wetlands and provide additional temporary feeding and spawning areas.

The productivity of the littoral zone comprises a significant proportion of the total biological productivity of lakes, particularly the deep clear lakes found in inland Canterbury. Wetlands, also productive ecosystems, often occur on the margins of lakes.

Waves and currents, by controlling the formation of beaches, sediment sizes, turbulence and water clarity, are the main physical processes affecting the shoreline environment and the distribution of the biological communities. The extent of shoreline affected by wave action depends on the range of lake levels and the maximum wave height. Over a long period, an equilibrium develops between the physical and biological features of the lakeshore, and the changes in lake levels and wave action.

5.2.2.3 Tāngata whenua values in and around lakes

Ngāi Tahu have a strong interest in the region's lakes and their wetland margins. Te Waihora/Lake Ellesmere, Wairewa /Lake Forsyth and Wainono Lagoon are examples of lowland lakes that remain of high importance. Although the quality (and in some cases quantity) of the water in these lakes has diminished, the lakes still retain their importance to Ngāi Tahu. A major grievance has been the decline in the abundance and diversity of mahinga kai, caused in part by the management of the lakes and the disappearance of the surrounding wetlands.

The formation of artificial lakes by damming a river, and the elevation of natural lake levels for hydroelectricity generation, is likely to have submerged a number of sites and areas that were important to the local rūnanga, e.g. old pā sites, and breeding or feeding habitat for mahinga kai. The creation of artificial lakes, however, has led to the formation of new habitats, some of which are suitable for certain types of mahinga kai.

5.2.2.4 Recreational and amenity values of lakes

(a) Shoreline amenity values

Experience with other South Island lakes has shown that altering the natural range of lake levels can have conspicuous or unsightly effects on lake shorelines. For example, the loss or change in the composition of beach sediments from sand to gravel, or the conspicuous numbers of dead trees when forested areas are inundated. Lake levels do vary naturally, especially those fed primarily by rainfall, snow-melt and glacial-melt water, and these variations can have adverse effects on recreational and amenity values (including those arising from dust storms). These effects can be significantly exacerbated under artificial regimes as discussed below.²⁵

Large operating ranges for lakes can also affect the recreation and amenity values along lake shorelines by:

- (i) exposing submerged objects such as stumps, piles, slimy or weed-covered rocks during low levels and creating potential hazards to boats and swimmers;
- (ii) stranding boat launching ramps and jetties; or
- (iii) impeding public access to the water and along the shoreline during periods of higher lake levels.

(b) Dust storms

Artificially lowering water levels in some glacial-fed lakes can increase the frequency and severity of dust storms by exposing a larger surface area of riverbed and shoreline to wind action. In the spring of 1989, unpleasant dust storms affected the settlement of Lake Tekapo

²⁵ **WQN1.107**

and parts of State Highway 8. This combination of events occurs when low winter lake levels persist into spring and coincide with a period of strong northwest winds.

5.2.2.5 Artificial regulation of water levels of natural, modified or artificial lakes

The natural hydrological regimes of a number of lakes have been modified by:

- (a) raising and/or lowering lake levels to provide additional storage for hydroelectricity generation, irrigation and community water supplies; and/or
- (b) reducing the natural range of lake levels by artificially lowering the maximum level to prevent flooding, and to improve the drainage of surrounding land, e.g. Te Waihora/ Lake Ellesmere, Wairewa/Lake Forsyth.

New lakes have been, or may be, established by damming rivers or creating out-of-river storage ponds. These may be affected in similar ways.

An increase or decrease in lake levels beyond the natural or artificial range will lead to changes in the shoreline environment. The impact of these changes will depend on a number of factors including:

- (i) the ability of the biological community to tolerate water level changes;
- (ii) the profile of the lake margins;
- (iii) the geology of the shoreline;
- (iv) the proximity of structures such as roads and boat ramps; and
- (v) the size, timing, rate and duration of lake level changes.

Possible adverse effects of high lake levels include:

- (1) prolonged submergence, which can kill off marginal vegetation and inundate nesting sites (e.g. for crested grebes);
- (2) erosion of the shoreline causing sediment to be redistributed across the littoral zone, changing the texture of the lake bed sediments, covering aquatic plant communities, or causing fine sediment to be suspended in the water column reducing the amount of light reaching aquatic plants.

Possible adverse effects of low lake levels include:

- A. exposing the plants and animals of the littoral zone to the effects of weather, such as freezing and drying out;
- B. damage to aquatic macrophyte communities caused by turbulence and transport of sediment because of greater exposure to wave action;
- C. increased levels of suspended sediment and a corresponding reduction in light penetration causing a decrease in photosynthetic activity and hence biological productivity;
- D. decreased biological productivity of the lake due to a reduction in the total area of the aquatic plant habitat;
- E. nests of birds, such as crested grebes, becoming unusable;
- F. increased potential dust nuisance; and
- G. oxidation of exposed sediment, and growth of terrestrial vegetation that may reduce oxygen levels in the water when it gets submerged and starts to rot.

These effects are of less concern where an artificial lake is created out of, and away from, a river or other natural water body.

5.2.2.6 Inundation of agricultural land and roads adjacent to lakes

During periods of high lake levels, there has been some erosion and flooding of roads and land adjoining the Waitaki hydroelectric lakes.

Water levels in some barrier bar lakes, e.g. Te Waihora/Lake Ellesmere, are managed to prevent flooding of adjacent farmland, while still maintaining the natural habitat, such as the marginal wetlands. The land surrounding most of the coastal lakes is flat, so that relatively small changes in water levels can expose or inundate disproportionately large areas of land.

Wind is also an important factor. Under high lake levels, strong winds can cause water to pile up on the leeward shore and cause localised flooding, or erosion of farmland and roads by wave action.

5.2.2.7 Slumping or erosion of lake shorelines

The creation of a new lake, e.g. Lake Opuha, or the permanent alteration to the levels of an existing lake, can lead to widespread shoreline erosion as wave action creates a new lakeshore profile and beaches.

Water levels in controlled lakes generally vary over a much wider range than in natural lakes. At low lake levels, wave action is concentrated on the near shore zone and may cause sediment to be moved downward into the lake or into suspension. At high levels, wave action can undercut the base of hill slopes, and, in some cases, may initiate mass movement of sediment into the lake.

The rivers and streams draining the high country and the Southern Alps transport large quantities of sediment. Where rivers enter lakes, much of the sediment is deposited to form deltas or localised fans. Raising lake levels will alter the pattern of sedimentation and cause the lower reaches of rivers to aggrade. Conversely, lower lake levels are likely to cause rivers to start cutting downwards and eroding their banks and bed. A substantial drop, or a rapid drawdown in lake levels, can lead to a loss of hydraulic support and may also trigger slumping of unconsolidated delta or shoreline sediments. There is also a possibility that a sudden major slump could generate a tsunami within the lake, although the likelihood of this event occurring is unknown.

5.2.3 Impacts of vegetation change on water yield

Land use activities resulting in vegetation change can have a significant effect on water yield in a catchment particularly at low flows. A catchment with a predominant forest cover will generally have a lower annual runoff than a similar catchment under pasture. This effect is likely to occur throughout the year, and to affect low flows as well as the mean annual flow. This has implications for the management of stream flows as a change in vegetation cover from short to tall vegetation will cause a reduction in surface water flows. This may in turn reduce the amount of groundwater recharge provided by a stream, thereby reducing availability of groundwater to users.

The key issue for Canterbury is the effect of changing vegetation cover on low flows in catchments that are primarily dependent on rainfall for maintaining their surface flows. Such catchments are lower hill country catchments which typically experience large seasonal fluctuations in flow, and often prolonged periods of low flows, generally from December to April, in response to low summer rainfall. They are also likely to experience a peak demand for abstraction for irrigation during this period. A land use change resulting in a change from short to tall vegetation, typically from grassland to plantation forest, will result in a further reduction of the low flows and affect both instream values and the availability of water for out-of-stream uses.

The impacts of vegetation change on flow management raises similar issues to those raised by the impacts of water abstraction – with one important difference – unlike abstractions, water yield reductions from vegetation cannot be stopped once minimum flows are reached. This requires a different management approach to be taken. Whereas abstraction is controlled via water permits, the effects of vegetation change on stream flows can only be

controlled by land use regulations. The concern with a change from short to tall vegetation is solely because of its potential impact on water yield. It is acknowledged that these changes may also influence other issues such as water quality, soil erosion and biodiversity management. While these issues are beyond the scope of this chapter, they are addressed through other chapters of the Proposed NRRP, and through other regional and district planning documents.

Changing land use from grassland to forestry development or other forms of tall vegetation has not been viewed as a major issue for the Canterbury region as a whole. An overview of forestry in Canterbury in 2001²⁶ showed that less than 3% of the region's land area is planted in production forest compared with the national average of 6.5%. Similarly, at the regional scale, the overall impact on water availability in Canterbury from predicted increases in plantation forestry is judged to be relatively small²⁷. However this generalised approach has the potential to mask a potentially significant issue for Canterbury in the management of streams where there are already high and increasing demands for water during the dry summer months. The impacts of land use change on water yield and low flows will be most critical in the water-short, lower hill country catchments.

The nature of the relationship between ground water and surface water resources is currently under investigation, but there is insufficient information to calculate the impact of vegetation change on ground water recharge, or on the supplementing of surface flows by groundwater. For this reason the issue of vegetation change has been confined to its effects on surface water flows at this stage.

The original vegetation of much of the Canterbury hill country and downlands was indigenous forest. Much of that vegetation has been replaced, over the time of human occupation, by indigenous and exotic grasses, to create the current predominantly pastoral environment with a consequential change to stream flows. Yields from the originally forested catchments would probably have been much lower than those currently found under a pastoral system. While stream flows may have changed historically, current management has to deal with existing flows and the existing values and uses of that water when assessing the potential impacts of vegetation change. A change from short grassland vegetation back to tall scrub or forest vegetation is likely to have consequences for stream flows – whether or not it is restoring a similar cover to the original vegetation cover. Management must take into account the effects of the vegetation change, both for land management and for water management.

5.2.4 Groundwater

Most of the region's exploitable groundwater resources underlie the Canterbury Plains. Other significant areas include the Kaikoura plains and the Waimate-Waitaki area. There are a number of river valley and inter-montane basin areas containing alluvial sediments, e.g. Mackenzie basin, and Waiau plains, where all groundwater is likely to eventually discharge into the surface water bodies in the lower part of the basin catchment.²⁸ In these areas, only limited groundwater exploration has been undertaken and has generally indicated poor water-bearing gravel.

5.2.4.1 Aquifer types

The Canterbury Plains can broadly be divided into coastal confined aquifers and unconfined/semi-confined aquifer areas, as shown in Figure WQN2. A confined aquifer comprises a layer of water-bearing permeable sediment that occurs beneath a layer of less permeable sediment. The coastal confined aquifer system underlying Christchurch has at least five confined aquifers, each separated by a confining layer of less permeable sediment.

²⁶ MAF, 2001. *Regional Study: Canterbury*

²⁷ Morgan M, Bidwell V, Bright J, McIndoe I, Robb C. 2002. *Canterbury Strategic Water Study* prepared for MAF, Environment Canterbury and MFE by Lincoln Environmental. Report No 4557/1, August 2002

²⁸ **WQN1.109**

Confined groundwater exists under pressure, which causes the water level in a bore penetrating a confined aquifer to rise above the top of the aquifer. A semi-confined aquifer is an aquifer confined by a layer of moderate permeability sediment (aquitar) that still allows vertical leakage of water into or out of the aquifer.

In confined and semi-confined aquifers, water is released from storage by elastic expansion of the aquifer material. Abstraction will cause an immediate reduction in pressure that could extend several kilometres from the well, the impact decreasing with distance.

An unconfined aquifer has no overlying "sealing" layer of finer sediment. Since the water is not under pressure the water level in a bore tapping an unconfined aquifer will be the same as the water table outside the bore. In unconfined aquifers, water is released from storage by the drainage of the pore spaces within the aquifer. Semi-confined aquifers often occur at depth in many of the unconfined aquifer areas.

Because of the difference in the way water is released from storage, the effects of pumping in a confined aquifer are more widespread than pumping at the same rate from an unconfined aquifer with the same permeability and thickness.

In most areas, rainfall on the plains is the main source of groundwater recharge. However, alpine and foothill rivers lose flow to adjacent aquifers along particular reaches and may gain flow along other reaches. In some areas, seepage from rivers can be the dominant source of groundwater recharge, e.g. Waimakariri River recharge to the Christchurch-West Melton groundwater system.

5.2.4.2 Life-supporting capacity of groundwater and associated river ecosystems

When groundwater is abstracted from an aquifer, there will be a lowering in water levels over the aquifer, with the greatest decline occurring close to the abstraction well(s). In time, the decline ~~will~~ may²⁹ extend to at least one of the aquifer boundaries where groundwater naturally discharges, generally to the sea, streams or springs. The amount of decline in natural discharge will equal the amount of groundwater permanently removed by abstraction.

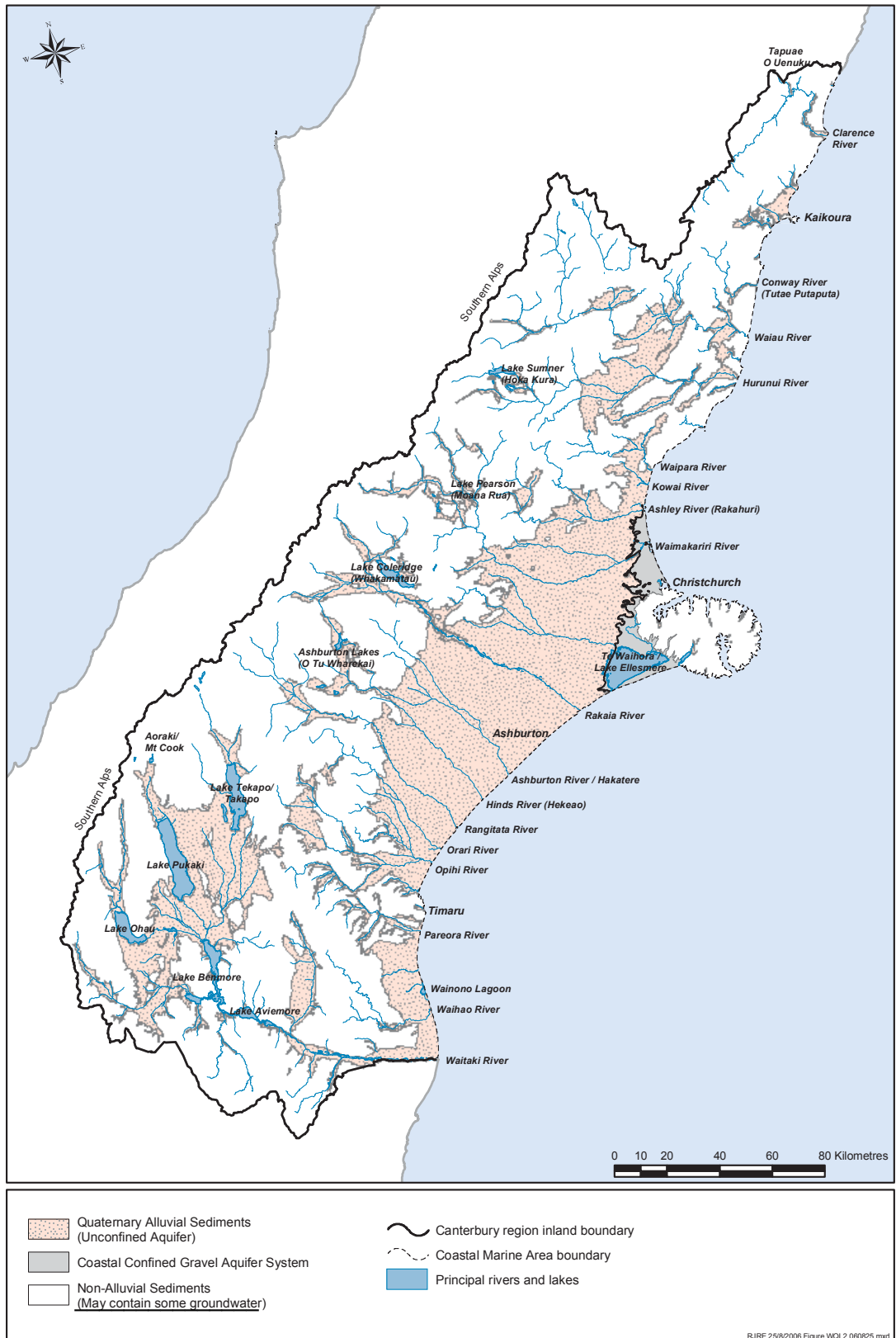
In this way, the flows in many of the smaller rivers and streams on the lower plains are sustained by groundwater discharging as springs and seeps, which is also the case in inter-montane basins where most of the groundwater in the basin will discharge to lower catchment springs that feed the lakes and rivers there³⁰. As discussed in Section 5.2.1.2, abstractions from these rivers or streams, and linked aquifers, will increase the frequency and duration of periods of low flow, as well as the period such rivers and streams may cease to flow, and extending the length of dry riverbed. In this way, groundwater does have an effect on the life-supporting capacity of rivers and streams and the habitat of the adjacent riparian ~~margins~~ zones³¹.

²⁹ WQN1.110

³⁰ WQN1.110

³¹ GEN2.14

Figure WQN2: Groundwater resources of Canterbury



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32 **WQN1.111**

While there is little real knowledge on groundwater ecosystems at this time, it is known that groundwater ecosystems actually contain distinct flora and fauna. Because groundwaters are in permanent darkness, the groundwater ecosystems have a lower diversity of habitat types and have a far more uniform environment (e.g. temperature) than surface waters. Groundwater organisms are generally tolerant of lower dissolved oxygen concentrations, but many are confined to relatively shallow aquifers where chemical conditions are more suitable. Food supply can also be a limitation. Groundwater ecosystems rely on external sources of carbon (e.g. leaching from soils, or recharge from stream and rivers), so that shallow aquifers are usually more productive than deeper ones.

Unfortunately, despite extensive use of groundwaters, our knowledge of these ecosystems lags far behind that of surface waters, terrestrial systems and our surrounding seas. There is some research being undertaken currently in Hawkes Bay and Canterbury that may help in identifying these groundwater ecosystems.

5.2.4.3 Modification of groundwater levels and pressures

Groundwater flows from west to east in the unconfined aquifer and when it meets the confined aquifers a large proportion emerges as spring flow. The headwaters of many groundwater-fed rivers and streams, for example, the Cam, Styx, Avon/Ōtakaro, Heathcote, Halswell and Irwell rivers, emerge as springs and seepages near the western edge of the coastal confined aquifer system. During periods of low rainfall, almost all of the base flow in these rivers comes from groundwater. Higher groundwater levels/pressures lead to higher river flows, and conversely lower groundwater levels/pressures lead to lower river flows.

Many of the coastal confined aquifers are believed to extend beyond the coastline. In the Christchurch area, there is evidence that the uppermost confined aquifer connects to the seabed up to 40 kilometres offshore but it is likely that groundwater discharge to the sea occurs considerably closer to the coast. The interface between freshwater and seawater that exists in the confined aquifers will move in response to changes in groundwater pressure.

Groundwater levels and pressures can be modified by:

- (a) localised pumping effects from an abstraction well or wells causing a lowering of groundwater level or pressure;
- (b) the cumulative effects of groundwater abstractions occurring over the longer term, which could result in long-term decline in groundwater levels or pressures; and
- (c) abstractions from surface water bodies that are hydraulically connected to groundwater. Such abstractions may result in a stream gaining water from inflow of groundwater (that otherwise may have been a losing reach).

Both (a) and (b) ~~create have~~ the potential for contaminants on or in the surface, or within of the ground to move down into the uppermost confined aquifer, or to allow sea water to intrude horizontally into the aquifer.³³

5.3 Statutory framework

5.3.1 Resource Management Act

The Resource Management Act, with its purpose to promote the sustainable management of natural and physical resources, provides the mandate and the initial direction for managing the region's water resources. In the Act, sustainable management means "managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while – (a) Sustaining the potential of natural and physical resources excluding minerals to meet the reasonably foreseeable needs of future

³³ WQN1.112

generations; and (b) Safeguarding the life-supporting capacity of air, water, soil and ecosystems; and (c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment.³⁴

The Act is generally restrictive towards water and relies on resource consents and/or regional plans to enable access to the water resource.

The Resource Management Act sets out the functions and duties of regional councils which, in relation to water quantity, include establishing, implementing and reviewing objectives, policies, and methods to achieve integrated management of the natural and physical resources of the region (s.30(1)(a)). This has been reflected in the preparation and implementation of the Canterbury Regional Policy Statement (CRPS), and in the preparation of this chapter of the Natural Resources Regional Plan³⁵. The functions also include the control of the taking, use, damming, and diversion of water, and the control of the quantity, level or flow in any water body, including: - the setting of any maximum or minimum levels or flows; the control of the range, or rate of change of levels or flows of water; and the control of the taking or use of geothermal water (s.30(1)(e)) and the control of land use to maintain the quantity of water in water bodies (s.30(1)(c)). Environment Canterbury's functions also include the establishment, implementation and review of objectives, policies and methods for maintaining indigenous biological diversity (s.30(1)(ga)).³⁶ In carrying out these functions, Environment Canterbury must also ensure that this is done in accordance with section 5. Section 6 (Matters of national importance), section 7 (Other matters) and section 8 (Principles of the Treaty of Waitangi) further condition these responsibilities.

The RMA defines "water" as follows.

"Water

- (a) Means water in all its physical forms whether flowing or not and whether over or under the ground:*
- (b) Includes fresh water, coastal water, and geothermal water:*
- (c) Does not include water in any form while in any pipe, tank or cistern:"*

Section 14 of the RMA controls the taking, use, damming or diversion of water. Under this section people do not have an automatic right to take, use, dam or divert water unless it is for an individual's reasonable domestic needs, the reasonable needs of an individual's animals for drinking water, or for fire-fighting. Even then, the taking or use of water for an individual's domestic use or for an individual's animals' drinking water can be constrained and/or made subject to a resource consent (through a regional plan) if there is, or could is likely to³⁷ be, an adverse effect on the environment. The taking, using, damming or diversion of water for any other purpose requires a water permit from Environment Canterbury unless there is a rule in a regional plan that allows access to water as a permitted activity.

Section 14 cannot be applied in the case of vegetation intercepting or transpiring water where that, in turn, reduces stream flow. The effects of vegetation change can only be controlled by land use regulation under section 9. To achieve this control, Environment Canterbury must provide policies and rules in a regional plan.

5.3.2 Planning instruments under the RMA

The RMA provides for a hierarchy of planning instruments, with national, regional and district levels, where lower level documents must not be inconsistent with those at higher levels. The RMA provides for national policy statements, but at the current time no national policy

³⁴ WQN1.114

³⁵ WQN1.114

³⁶ WQN1.50

³⁷ WQN1.114

statements have official status. There is an operative Canterbury Regional Policy Statement (CRPS). This has policies that are of direct relevance to this chapter. There are a number of regional plans that were operative or proposed at the time that this chapter was notified as part of the Proposed NRRP. The provisions in this chapter will supersede some of these, while others will continue, and will have to be administered and implemented separately.

5.3.2.1 New Zealand Coastal Policy Statement

The New Zealand Coastal Policy Statement (NZCPS) focus is on the coastal environment and seaward. This coastal environment area can include the mouths of rivers, estuaries and coastal wetlands that may be impacted upon by water management that occurs within these areas or inland of these. There is a need for understanding of these linkages. The Canterbury Regional Coastal Environment Plan has been developed to be consistent with the NZCPS. Management that ensures that the Proposed NRRP and the Canterbury Regional Coastal Environment Plan are compatible and consistently applied should ensure consistency with the NZCPS.

5.3.2.2 Canterbury Regional Policy Statement

The Canterbury Regional Policy Statement (CRPS) Chapter 9 identifies issues that arise from the demand for, and the use of water, and that arise from the use of land that can affect water. It also establishes the framework for managing the region's water resources, both in terms of water quantity and water quality.

In relation to water quantity, the CRPS Chapter 9 Objective 1 is to enable people to use water while protecting the values listed. Objective 2 provides for people to use land where it affects the flows and levels of Canterbury's water bodies while protecting the same values listed in Objective 1. These values are:

- (a) "safeguarding their existing value for efficiently providing sources of drinking water for people;
- (b) safeguarding the life-supporting capacity of the water, including its associated: aquatic ecosystems, significant habitats of indigenous fauna and areas of significant indigenous vegetation;
- (c) safeguarding their existing value for providing mahinga kai for Tāngata Whenua;
- (d) protecting wāhi tapu and other wāhi taonga of value to Tāngata Whenua;
- (e) preserving the natural character of lakes and rivers and protecting them from inappropriate use and development;
- (f) protecting outstanding natural features and landscapes from inappropriate use and development;
- (g) protecting significant habitat of trout and salmon; and
- (h) maintaining, and where appropriate, enhancing amenity values."

The Natural Resources Regional Plan cannot be inconsistent with the objectives and policies of the CRPS.

5.3.2.3 Water conservation orders

Water conservation orders apply to the Rakaia and Ahuriri rivers, and Te Waihora/Lake Ellesmere. At the time of notification of this chapter, an application for a water conservation order on the Rangitata River was being processed.

The Rakaia and Ahuriri River Conservation Orders set flow and allocation regimes which Environment Canterbury must administer. The effect of these Orders is to limit the amount of water that can be taken from these rivers by setting minimum flow rates and allocation limits.

Section 67(2)(a) RMA requires that a regional plan must not be inconsistent with any water conservation order. Section 217(1) RMA provides that no water conservation order shall

affect or restrict any resource consent granted,³⁸ or any lawful use established, in respect of the water body before the order is made. This means that if a water conservation order is established on the Rangitata River that is different to the conditions on consents, the existing resource consents will be able to continue to operate in terms of their conditions of consent until they expire. It is possible for a Regional Plan to establish a different flow regime and have water permits reviewed to give effect to the new regime. Where appropriate, the Proposed NRRP could be used to give effect to a water conservation order.

5.3.2.4 Regional plans

A range of Environment Canterbury planning documents contain provisions relating to water quantity management. These documents are listed below:

³⁸ WQN1.117

Table WQN1: Relationship between existing regional plans and Proposed NRRP Chapter 5

Existing regional plans	Relationship to Proposed NRRP Chapter 5
Canterbury Regional Council Transitional Regional Plan 1991 (excluding the Kaikoura District)	The Canterbury Regional Council Transitional Regional Plan 1991 (excluding the Kaikoura District) includes by-laws and other statutory provisions relating to the taking, using, damming and diverting of surface water and underground water, minimum acceptable flows and permitted activities relating to water. A rule in the Transitional Regional Plan will cease to have effect when a new rule on the same matter in Chapter 5 becomes operative <u>and the relevant part, or the whole, of the Transitional Regional Plan is withdrawn.</u>
Transitional Regional Plan for the Nelson-Marlborough Region as it applies within Kaikoura District (incorporating Changes 1 and 2)	The Transitional Regional Plan for the Nelson-Marlborough Region as it applies within Kaikoura District (incorporating Changes 1 and 2) permits some activities such as minor taking, using, damming and diverting of water, including groundwater and controls over wasteful use of water. A rule in the Transitional Regional Plan will cease to have effect when a new rule on the same matter in Chapter 5 becomes operative <u>and the relevant part, or the whole, of the Transitional Regional Plan is withdrawn.</u>
Regional Coastal Environment Plan	The Regional Coastal Environment Plan manages activities within the Coastal Marine Area. Surface water bodies flowing into the sea or discharging into coastal estuaries can fall at least partly within the coastal marine area (CMA). In that area, the Regional Coastal Environment Plan controls activities, including the taking of fresh water. The Proposed NRRP jurisdiction lies inland of the CMA boundary.
Proposed Waimakariri River Regional Plan	The Proposed Waimakariri River Regional Plan includes rules that apply to the taking, damming, diverting and discharge of surface water and hydraulically connected groundwater, and includes water flow and allocation regimes that apply to the main stem of the river and its tributaries. <u>All policies and rules in the Proposed NRRP Chapter WQN5, other than those addressing surface water flows and the taking, damming, diversion and discharge of surface water and hydraulically connected groundwater, and some types of the use of water, do not apply in this catchment.</u> Other groundwater takes will be managed via the Proposed NRRP. Transitional Regional Plan permitted activities are referenced in the Proposed Waimakariri River Regional Plan. When the Proposed NRRP Chapter 5 is operative a Plan change will be made to replace these Transitional Regional Plan permitted activities with rules on the same matters established in Chapter 5. <u>The relevant part, or the whole, of the Transitional Regional Plan will also be withdrawn at that stage.</u>
Opihi River Regional Plan	The Opihi River Regional Plan includes rules that apply to the taking, damming, diverting and discharge of surface water and hydraulically connected groundwater, and includes water flow and allocation regimes that apply to the Opihi River and its tributaries. <u>All policies and rules in the Proposed NRRP Chapter WQN5, other than those addressing surface water flows and the taking, damming, diversion and discharge of surface water and hydraulically connected groundwater do not apply in this catchment.</u> Other groundwater takes will be managed via the Proposed NRRP. Transitional Regional Plan permitted activities are referenced in the Opihi River Regional Plan. When the Proposed NRRP Chapter 5 is operative a Plan change will be made to replace these Transitional Regional Plan permitted activities with rules on the same matters established in Chapter 5. <u>The relevant part, or the whole, of the Transitional Regional Plan will also be withdrawn at that stage.</u> ³⁹

³⁹ WQN1.55

<p><u>Waitaki Catchment Water Allocation Regional Plan</u></p>	<p><u>The Waitaki Catchment Water Allocation Regional Plan primarily deals with the allocation of water within the Waitaki catchment. The Plan includes objectives, policies and rules that apply to the taking, use, damming and diverting of surface water and hydraulically-connected groundwater, and the transfer of water permits. Policies and rules in the NRRP Chapter 5 addressing the same activities do not apply in this catchment, while those addressing reduction of flows from short to tall vegetation change still apply. There are a number of tables that were in the NRRP that have been incorporated by reference into the Waitaki Catchment Water Allocation Regional Plan and have legal effect as part of the plan in the form that they are incorporated.</u>⁴⁰</p>
<p>Proposed Land and Vegetation Management Regional Plans</p>	<p>The Land and Vegetation Management Regional Plan Parts I and II place controls on the harvesting of plantation forestry in Kaikoura and the Port Hills for soil conservation purposes, but no consideration is included for the impacts of forestry on stream flows. There are no regional plans for Canterbury that address the issue of the impacts of vegetation change, or afforestation, on stream flows.</p>

5.3.2.5 District plans in the region

District councils do not have a statutory mandate to control the taking, use, damming or diversion of water. They do, however, have the ability to control land use activities that may affect water resources, or that may be dependent on water.

Many district plans identify areas of natural value or of landscape significance, and these areas may include water bodies. Land use activities within these areas may be subject to resource consents or may be prohibited. There will be a need to consider related consents whenever activities are proposed within these areas. For example, a proposal to dam a river that is in an area of landscape significance identified by the district plan.

In other situations, land use activities may be dependent on water. For example, a vegetable processing activity in a rural location may require consent under a district plan for the land use and may also require a water permit in order to take water for the processing operation. An alternative example may be where a subdivision proposal, outside a reticulated urban supply area, requires a water permit to demonstrate that the subdivision and development that is proposed will have a sustainable water supply.

In the case of water yield, many district plans have preceded the formulation of the Proposed NRRP, in its identification of the issue of vegetation change on water yield and provision of regional policies and rules. Because the effect of afforestation dealt with in this chapter is a water management matter, it is viewed primarily as a regional council function. Those district plans that have addressed this issue, have done so generally as an assessment matter for consideration where forestry is an activity that requires a resource consent. This has been applied in a variety of different ways, which have not provided any consistency across the region.

It will be necessary to understand these associations and to integrate resource management processes, where appropriate.

5.3.2.6 Other documents and legislation

Provisions in other planning documents and legislation were given regard to because they have a bearing on resource management issues covered by this chapter. These include:

- (a) the Ngāi Tahu Claims Settlement Act (1998) provides for the recognition of areas of Statutory Acknowledgements through regional plans under the RMA. This includes

⁴⁰ WQN1.57, WQN1.113

requiring consent authorities to have regard to any Statutory Acknowledgements when making decisions on consent applications;

- (b) Te Taumutu Runanga Natural Resource Management Plan – this document is an expression of the kaitiakitanga of Te Taumutu Runanga over the natural resources within their rohe.
- (c) Te Whakatau Kaupapa – Resource Management Strategy for the Canterbury Region – this document expresses many of the resource management concerns and aspirations of Ngāi Tahu for the Canterbury Region.⁴¹
- (b) the Department of Conservation Arthurs Pass and Aoraki/Mount Cook National Park Management Plans, and the Canterbury, Otago and Nelson-Marlborough Conservation Management Strategies;
- (c) the plans or strategies of Ngāi Tahu, Fish and Game NZ regions, the regional plans of the adjoining Tasman and Marlborough Unitary Authorities, and the Otago Regional Council; and
- (d) the Biosecurity Act (1993) and Canterbury Regional Pest Management Strategy (CRPMS) place responsibilities on landholders and the regional council for the management or eradication of specified plants and animals that are considered harmful or capable of having significant effects on economic wellbeing, spillover effects on neighbouring properties or significant adverse effects on conservation or other values that are not necessarily shared by land occupiers.

The CRPMS specifies the level of control that must be achieved for pest species such as gorse and broom and wilding conifers in terms of their containment and control of their future spread through the region. Expansion of the area of wildings in some hill country catchments will reduce overall catchment water yield and low flows.

National and international guidance

The **New Zealand Biodiversity Strategy (NZBS)** sets out a strategic framework to conserve and manage New Zealand's biodiversity. One of the goals of the Strategy is to "maintain and restore a full range of remaining natural habitats to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified ecosystems in production and urban environments".

For freshwater ecosystems, these outcomes are to be achieved by using mechanisms under the RMA, such as regional plans, to provide for the protection of freshwater ecosystems and habitats, and to protect freshwater biodiversity from the adverse effects of human activities.

5.3.2.7 Environment Court decisions that have clarified the statutory framework

Environment Court decisions on references to the Tasman District Council's Proposed Regional Policy Statement have clarified the situation in relation to placing controls on land use to maintain the quantity of water in water bodies. The decisions handed down by the Court⁴² included:

- (a) that it is a function of regional councils to control the use of water in all its forms, including rainwater;
- (b) that the artificial establishment of tall vegetation, such as plantation forestry, is a form of land use subject to s.9 of the RMA;
- (c) that an integrated approach to management of the water resource is unachievable if it ignores an activity that has an adverse effect on the resource. To ignore such an activity

⁴¹ **WQN1.119**

⁴² Decision No W7/98, 4th March 1998, Judge Kenderdine – Carter Holt Harvey Forests Ltd v Tasman District Council

(e.g. land use change from short to tall vegetation) would not allow the Council to achieve the provisions of s.5 of the RMA;

- (d) that regional councils need to manage water bodies and stream flows that reflect the current environment, not as they might have been some centuries ago before human occupation; and
- (e) that the allocation of water should provide equal opportunities for all users to access the resource, including forestry, and should include controls on all users of that resource.

5.3.2.8 Legal advice

Legal advice was sought on the interpretation of the functions of regional councils under s.30(1)(c) RMA in relation to the control of the use of land for the purpose of the maintenance of the quantity of water in water bodies. Advice provided indicated;

- (a) that while the artificial establishment or planting of tall vegetation such as plantation forestry is a form of land use subject to s.9 RMA, the passive reversion of tall woody vegetation, including scrub and forest regeneration, does not come within the term “use” and therefore will not be subject to land use controls for the maintenance of the quantity of water in water bodies;.
- (b) that the deliberate afforestation, and associated effects of vegetation change reducing stream flows, can only be controlled by land use regulations. In contrast, normal abstractions are subject to s.14 and require a consent to take or divert water.

5.4 Resource management issues

5.4.1 Rivers, lakes and groundwater

Sections 5.2.1, 5.2.2, 5.2.3 and 5.2.4 above describe the water resources and the issues that can arise from the taking, using, damming or diversion of water and the change in vegetation in sensitive catchments. Sustainable management recognises the need for people and communities to be able to provide for their social, economic and cultural wellbeing and their health and safety through the use, development and protection of resources (and in this case, water), but also requires any resultant adverse effects to be avoided, remedied or mitigated. This very often results in conflicting resource management goals.

5.4.1.1 Natural state and high naturalness water bodies

Taking, using, diverting and/or damming of water can contribute to the degradation of the natural state and the natural values of water bodies.

Water bodies, principally rivers and lakes, within the Canterbury Region range in state from natural to highly modified. Changes have occurred due to land development, vegetation change, drainage, modification of form, flood protection, damming, diversion and abstraction. Some rivers are naturally more resilient than others. It is undesirable that all rivers are modified and there is merit in protecting some of the region’s rivers and lakes in their natural state or in a relatively natural state. To do this it is necessary to identify the rivers and lakes that are, and should be, retained in their natural state or relatively natural state. Furthermore, it is necessary to establish how these should be managed in order that their natural character and value won’t be compromised. In some cases, it may be sufficient to manage these within the flow and allocation regimes that are set for the river generally, in other cases, it may be necessary to impose stricter controls, including the prevention of damming, for example.

5.4.1.2 Flow, level, or pressure regimes

Taking, using, diverting and/or damming of water can contribute to the general degradation of water bodies. If water bodies are not appropriately managed flows, levels or water

pressure may decline or drop to a point that can no longer sustain the life that is present in the water body and that is dependent on the water body.

One of the key instruments for enabling access to and use of water resources, yet sustaining the values of the water body affected, is the setting of flow, level or pressure regimes.

These regimes are intended to set limits on the flow, level or pressure that a water body can be drawn down to due to abstraction. A regime may include:

- (a) a minimum flow (that could vary between months or seasons) at which abstraction ceases, other than that required for essential human or stockwater uses;
- (b) a sharing regime whereby flow above the minimum flow is shared between the river and abstraction;
- (c) retention of an adequate level of flushing flows in a river;
- (d) capping of the total flow or volume that can be abstracted from a water resource;
- (e) a minimum lake or groundwater level or pressure at which abstraction ceases, other than that required for essential human or stockwater uses; and
- (f) rates at which lake levels may be altered, the duration of time that lakes can be held at higher or lower levels, and times of the year when lake levels may be altered.

The combination of either flow, level or pressure regimes, and allocation regimes, leads to overall water management regimes.

The intention is to progressively include in the NRRP, flow, level or pressure regimes for all water bodies where abstraction, for other than small essential domestic or stockwater use, is likely to occur. It is not possible to do this all at once, as it will involve investigations of the water resource and consultation with the affected communities. This chapter includes provisions that set some default options for managing these resources in the interim period.

5.4.2 Impacts of vegetation change on water yield

5.4.2.1 How vegetation affects water yield

Vegetation affects water yield by removing water from the catchment that would otherwise contribute to stream flow. The main features that distinguish different vegetation types from a water yield point of view are the combined characteristics of spatial coverage, interception capacity, rooting depth and aerodynamic roughness⁴³.

Rainfall interception is the portion of the rain that is caught on the vegetation and evaporated back into the atmosphere without falling to the ground. While leaf shape and density have some effect on interception capacity, it is the aerodynamic roughness of the vegetation that dominates the interception loss by promoting the removal of the moisture from the air. Tree-covered catchments have higher aerodynamic roughness than scrub or grass-covered catchments.

Transpiration is also influenced by the aerodynamic roughness of the vegetation together with the available soil moisture and prevailing atmospheric conditions. Given a sufficient period without rain, all vegetation types will exhaust the supply of soil moisture within their root zone. Rooting depth generally increases with the height of the vegetation. Rain reaching the ground during a rainstorm will first fill the soil storage before any runoff can occur. The greater the rooting depth of the vegetation, the greater the loss of soil moisture, and the more rainfall will be needed to replenish the soil moisture store before runoff is generated. Also, because of the higher interception capacity of tall vegetation, less water will be delivered to the soil under trees than under grassland. The combination of interception

⁴³ Duncan M. 2003. *Clarification of the effect of vegetation change on water yield* prepared for Environment Canterbury, unpublished technical report U03/81, October 2003

capacity and rooting depth for trees will result in reduced runoff from areas covered in tall vegetation, particularly where there is a seasonal soil moisture deficit.

5.4.2.1.1 Catchment studies

A comparison of 94 catchment studies world wide, undertaken in 1982, showed that coniferous and eucalyptus forest had the greatest effect on water yield, followed by deciduous hardwoods, scrub and then pasture⁴⁴.

More recently, data from a number of catchment studies undertaken in New Zealand where pasture was replaced with *Pinus radiata* forest, showed a reduction in annual surface water yields in the range of 25-50% with the higher end of the range being observed in the dry South Island sites.⁴⁵ The impact on low flows for dry eastern catchments in the South Island was potentially even more significant, varying from 34% to 80%, with ephemeral streams likely to be drier for longer⁴⁶. Generally the results of experiments carried out in Canterbury are consistent with those from elsewhere in New Zealand⁴⁷.

These catchment studies were carried out on small, paired catchments where there was a complete change of vegetative cover from pasture, or short vegetation, to forest, resulting in a complete canopy closure over the whole catchment. In a larger catchment, however, it is more likely that the area under commercial plantation forest will be at different stages of development, e.g. young trees with open canopy, closed canopy mature forest, forest harvesting and bare land awaiting replanting. In this chapter, this is referred to as an “evenly staged forest development”. Many of these development stages have lower evaporative demands (and so provide more runoff) than closed canopy forest, so the overall effect on water yield will be less than that indicated by the paired catchment experiments⁴⁸.

Assuming an evenly staged forest development, and using planting rates and growth rates typical of Canterbury, the calculated effect on annual water yield of converting a catchment vegetation cover from short grassland to pine forest will be a reduction of about 40% rather than the 50% estimated from the paired catchment experiments. This modified figure has been used as the basis for determining the potential effects of land use change in this chapter.

Other New Zealand studies have measured the effects of a change from scrub to pines, and compared the interception losses from native and exotic tall vegetation cover. Overall they showed that the differences between the various tall vegetation types were minor relative to the more significant differences caused by a change from short to tall vegetation.

5.4.2.1.2 Vegetation changes most likely to affect water yield

A change from short to tall vegetation is likely to occur as a result of:

- (a) the planting of areas of forest over former grazed pasture or grassland;
- (b) the spread of wilding trees from exotic forest plantations;
- (c) the reversion of pasture or short grassland to indigenous scrub and forest; and

⁴⁴ Bosch and Hewlett 1982. *A review of catchment experiments to determine the effect of vegetation on water yield and evapotranspiration* J. Hydrology 56:3-23

⁴⁵ Fahey B.D, and Rowe L.K, 1992. *Land-use impacts in Waters of New Zealand*, Mosley M.P, (ed), NZ Hydrological Society

⁴⁶ Duncan M.J, 1996. *A Methodology for identification of areas vulnerable to flow reductions because of afforestation* NIWA Christchurch Consultancy Report No. CRC60512

⁴⁷ Duncan M. 2000. *Review of the Duncan model for assessing the impacts of afforestation on water yield* Canterbury Regional Council unpublished technical report U00/48

⁴⁸ Duncan M. 2003. *Clarification of the effect of vegetation change on water yield* prepared for Environment Canterbury unpublished technical report U03/81, October 2003

- (d) the spread of exotic woody plants, such as gorse and broom, over areas of pasture or short grassland.

For the purposes of this chapter the following definitions are used to identify the different vegetation covers that affect water yield (Duncan 2003)⁴⁹:

Grassland is the predominant land use in the Canterbury hill country and ranges from pasture established by cultivation, to developed (oversown with pasture grasses) or undeveloped short tussock grassland. The short tussock grassland may include low densities of woody vegetation such as matagouri, manuka/kanuka or bracken fern.

Scrub consists of stands of woody vegetation such as gorse, broom, manuka, kanuka, fern or reverting native forest, but excluding matagouri, which cover at least 80% of the land area to a height of 2 metres or more. Matagouri has a lower ability to intercept and transpire water than other types of woody vegetation. Only those matagouri stands over 2.5 to 3 metres high and covering more than 90% of the land are defined as scrub.

Forest is either native or introduced woody vegetation, greater than three metres in height and with more or less complete ground cover. Plantation forest is any area of planted forest with a density of 150 stems per hectare or more.

Agriculture dominates productive land use on the flat and gently rolling arable soils of Canterbury. Intensive mixed farming occurs on the higher quality soils of the plains and downs, while conversions to dairying are confined to irrigated areas of the plains. Most new forestry development is likely to be established on LUC Class VI land which is mainly steeper hill country unsuited to cultivation⁵⁰.

Pinus radiata accounts for more than 80% of Canterbury's planted forests and is most suited to hill country and downlands areas below 600m altitude. Douglas-fir, the second most commonly grown species, can be grown to 900m and is more appropriate for moist and higher altitude inland areas.

The spread of wilding trees and reversion of pasture to woody scrub species is likely to occur in areas of more extensive pastoral development from the lower hill country up into areas of higher rainfall. Further information is needed to quantify the extent of this vegetation change in the region.

5.4.2.2 Significance of catchment hydrology

While a change from short to tall vegetation will have an effect on low flow in any catchment, the relative size of this effect will vary according to several hydrological characteristics of the catchment.

Catchments with high altitude storage in the form of snow and ice can rely on snow/ice melt as a source of flow during low rainfall periods in summer. Catchments in the lower foothills lack any snow storage, and are dependent on rainfall for their flows.

Many of these catchments experience prolonged periods of low rainfall typically during the months from December to April, and where they have limited soil storage capacity, they are also likely to experience extended periods of low flows. The exception to this is spring-fed streams that are replenished from groundwater sources.

5.4.2.2.1 Determining catchment sensitivity to flow reduction from vegetation change

The catchments most sensitive to flow reduction as a result of a change from short to tall vegetation are likely to have the following physical characteristics:

⁴⁹ Duncan M. 2003: as above

⁵⁰ Ministry of Agriculture and Forestry, 2001. *Regional study: Canterbury*

- (a) the river flow regime is dependent on rainfall as the main source of flow and has limited ability to maintain base flows in the dry summer months (i.e. compared to catchments where flow regimes are dominated by snow, ice, wetlands or springs);
- (b) they are located predominantly within low rainfall areas, within the range of annual rainfall from 600-1200mm, and where summer evaporation exceeds rainfall;
- (c) they lack the geology or terrain which naturally stores water; and
- (d) they experience extremely low flows in summer and autumn compared to their mean flow.

These will include some catchments of the foothills, coastal hill country, the intermontane basins and Banks Peninsula.

The effect of (a) to (c) above is represented in (d) as a simple ratio of the low flow compared to the mean flow. This ratio gives an indication of the sensitivity of catchments to changes in water yield resulting from vegetation change. The lower the ratio of low flow to mean flow, the less able the catchment is to sustain flows during rainless periods. These catchments will be most sensitive to the additional effects of water removed by vegetation.

Catchments most sensitive to the effects of vegetation change on stream flows (i.e. with a low ratio of low flow:mean flow) are referred to in this chapter as “flow-sensitive catchments”. These have been identified as catchments where the ratio of low flow to mean flow is less than 20%.

In areas with annual rainfall less than 500-600mm, much of the rainfall will be lost in evaporative processes regardless of catchment cover. Any further loss of water by trees in these areas will be very small, but may be critical to retaining minimum stream flows.

Much of the LUC Class VI land in Canterbury, favoured for forestry, is found within these flow-sensitive catchments. This may create a significant issue for the management of water resources if there is an uncontrolled expansion of forestry into these catchments in the future.

5.4.2.3 Significance of size and location

Any change from short to tall vegetation is going to cause some reduction in stream flow. Small changes in stream flow associated with small changes in cover, however, may be obscured by natural variations in flow⁵¹. For example, on a total catchment basis, studies show that the replacement of pasture over areas less than 20% of a catchment may not produce a change in flows that can be isolated from other natural variations. This does not mean that the vegetation change is not having some effect.

Not all parts of a catchment contribute equally to stream flow. The areas generating most runoff are areas of highest rainfall and areas of greatest storage. Riparian zones, valley bottoms and hillside depressions, are areas of greatest storage and soil wetness⁵². Trees planted in these areas are likely to have a disproportionate effect on stream flow because they are able to maintain high rates of transpiration for longer. Interception effects will be greatest for trees planted in areas of highest rainfall.

Areas generating runoff have been collectively referred to as “water producing areas” for the catchment. Water producing areas supplying the low flows within each sensitive catchment or sub-catchment are identified from the mapping of the seven-day mean annual low flow (7DMALF) specific discharges (measured in litres per second per square kilometre

⁵¹ Duncan M.J, 1996. *A methodology for the identification of areas in Canterbury vulnerable to surface water yield reductions due to afforestation* NIWA Christchurch Consultancy report No. CRC 60512

⁵² Mosley M.P, 1999. *Identification of areas in Canterbury sensitive to flow reductions due to afforestation* prepared for the Canterbury Regional Council unpublished technical report U99/54, May 1999

[$l/s^2/km^2$]). These will be the critical areas for managing vegetation change for the maintenance of low flows.

While vegetation change outside the low flow water producing area will probably not directly affect the low flows, it may reduce general flows throughout the year, which will consequently impact on low flows by:

- (a) speeding up the onset of low flows; and
- (b) increasing the duration, frequency and severity of those low flows⁵³.

5.4.2.4 Effects of vegetation change on existing users

During times of low flow, conflicts can arise between the needs of existing users for out-of-stream water use, and the flows needed to protect instream values. The supply of water for essential domestic and stock water needs is provided for through Objective WQN1. Abstraction of water for non-essential needs is managed through the use of water permits which allocate volumes of water for abstraction from flows above the set minimum flow. The flows above the minimum flow are therefore important to provide a supply of water for abstractions. The reliability of these flows will be critical to the establishment of any farming or industry operation dependent on irrigation.

Water permits which require abstractors to cease abstracting (“turn off”) once flow is reduced to the minimum flow set to protect instream values. The abstraction effect of vegetation, however, cannot be “turned off” at times of low flows. The result of a change from short to tall vegetation in a sensitive catchment, which naturally experiences low flows during the summer months, will be a reduction in the mean flow levels, and an increase in the frequency, duration and severity of low flows. This will reduce the reliability of supply for out-of-stream users and impact on instream values. This is already an issue for catchments such as the Waipara.

Those parts of the catchment supplying water to low flows and mean flows are identified from mapping the specific discharges for 7DMALF and mean flows. A comparison of the water producing areas for low and mean flows for a number of flow-sensitive catchments has shown that they do not necessarily correspond⁵⁴. Therefore, management of vegetation change within flow-sensitive catchments will need to cover those parts of the catchment providing water to low flows and to mean flows to protect both the reliability of supply of water for abstraction and the instream values.

Appendix WQN4 lists all the flow-sensitive catchments for which there are existing uses or values to be protected from effects of vegetation change on water flows.

5.4.2.5 Protection of instream values

Policy WQN3 sets out a process for setting minimum flows and flow regimes for water bodies to meet the requirements of Objective WQN1.

Where minimum flows/flow regimes have been set in Schedule WQN1, or set via conditions on consents, then in accordance with the Canterbury Regional Policy Statement (CRPS) Chapter 9 Policy 8, land use should not induce stream flows to fall below those set levels.

An inventory of instream values for water bodies in Canterbury has been compiled from existing sources of information. This includes ecological, cultural, landscape, amenity and heritage values for the region’s rivers and lakes⁵⁵. This has been used to identify important

⁵³ Duncan M. 2003. *Clarification of the effect of vegetation change on water yield* prepared for Environment Canterbury unpublished technical report U03/81, October 2003

⁵⁴ Duncan M. and Image K. 2004. *Effects of vegetation change on water yield Phase 1 and Phase 2* (in press)

⁵⁵ Daly A. 2002. *Canterbury Rivers & Lakes – an Inventory of Instream Values* prepared for Environment Canterbury unpublished technical report U02/45, July 2002

instream values for each sensitive catchment where these values are likely to be affected by reduced flows.

Some of the ecological values identified for these streams are likely to occur within small sub-catchments or in the upper part of a catchment where they are not protected by set minimum flows. There is a risk that unmanaged vegetation change in these areas could result in a significant reduction in the stream flow for that sub-catchment and the loss of instream values.

Investigations to identify minimum flows for flow-sensitive catchments will need to be undertaken where consent applications are received to establish forestry plantations.

5.4.2.6 Tools to estimate the impacts of vegetation change on low flows

A number of catchment models have been developed to simulate the effects of land use change on runoff in a catchment. Most of these models reasonably predict the impacts of vegetation change on mean annual flows, but are less reliable at predicting the changes for low flows. Further investigations need to be undertaken to develop models that can accurately predict the small but significant changes to low flow associated with vegetation change.

For the purposes of this plan, the mapping of the 7DMALF isohyds for each sensitive catchment will be used to provide a set of contours of specific discharge of water (runoff) per square kilometre to streams at times of low flow. This mapping identifies the location of water producing areas within a catchment or sub-catchment at times of low flow and can be used to estimate the change in runoff caused by vegetation change over a specific area of the catchment.

Augmenting the amount of runoff lost as a result of a change from short to tall vegetation cover will be one way to mitigate the effects of the vegetation change on low flows. Where the augmentation of flows is a reasonable option for mitigation, the 7DMALF discharge contours will provide an estimate of the volume of water required to replace lost runoff and the rate at which that water should be released back into the stream at times of low flow.

5.4.2.7 Measuring the extent of vegetation change in flow-sensitive catchments

The Land Cover Data Base (LCDB), which uses satellite imagery to identify different types of land cover, can be used to identify the extent of plantation forestry and woody vegetation within catchments sensitive to water yield reduction. Only those forestry plantings older than 3-4 years can be identified using this method. While this underestimates the total cover, the LCDB provides the most up-to-date information on vegetation cover that is available on a region-wide basis.

This information can be used to review changes in the vegetation cover across flow-sensitive catchments over time and in the extent of woody vegetation reversion.

5.4.2.8 Other roles of vegetation in catchment management

5.4.2.8.1 Flood mitigation

Catchment studies in New Zealand have shown that flood peaks can be reduced under forest cover compared with pasture for small to medium floods. The reductions ranged from about 50-80% reduction for small floods and freshes (mainly six to twelve month return period) to a 20-50% reduction for larger floods (one in 50 year floods)⁵⁶. Differences in flood runoff between forest and pasture catchments are primarily attributed to the greater interception by tall vegetation, and the greater soil moisture deficit existing underneath the forest (due to the greater rooting depth and removal of water from a greater depth of soil by trees).

⁵⁶ Duncan M.J., 1996. *A methodology for identification of areas in Canterbury vulnerable to surface water yield reductions due to afforestation* prepared for Canterbury Regional Council NIWA Christchurch Consultancy Report No. CRC60512

During times of very heavy or prolonged rainfall, however, this effect is likely to be lost. Once the leaves become saturated, and soil moisture capacity is reached, the ability of trees to modify runoff will be limited. So for large floods (one hundred year return period and greater) forest cover is unlikely to have any significant reduction effect.

5.4.2.8.2 Erosion control

Many of the foothills and coastal hill country catchments in Canterbury are developed in loess or soft rock and are inherently vulnerable to deep-seated forms of erosion, such as slip, slump, tunnel and tunnel gully erosion. Tree planting may play a key role in stabilising these slopes as the deeper roots provide greater stability than pasture species. Proposed NRRP Chapter 8 Soil Conservation Policy SCN4 promotes the retention or establishment of deep-rooted vegetation on slopes susceptible to these deep-seated forms of erosion. However, in flow-sensitive catchments that are prone to deep-seated erosion, preference should be given to wide spaced tree planting where this will adequately reduce the risk of erosion.

5.4.2.8.3 Water quality

By stabilising banks and slopes adjacent to rivers, trees play a role in reducing erosion and sediment movement into rivers. They can provide shade, habitat and debris important for aquatic organisms. Chapter 4 Water Quality Policy WQL5 promotes the management of the riparian margins zone⁵⁷, including the establishment of appropriate vegetation to maintain and improve water quality and aquatic habitats. A Riparian Strategy will be developed in conjunction with agencies and community groups to provide guidance for managing vegetation within the riparian zone.

5.4.2.8.4 Biodiversity

Biodiversity encompasses the variety and abundance of species together with the communities, ecosystems and landscapes of which they are a part. Of particular importance to New Zealand is the protection of the diversity of indigenous and endemic species that are found nowhere else.

Native forest and shrublands provide important habitat for a range of plants and animals that contribute to New Zealand's indigenous biodiversity. Exotic plantation forest supports less diversity of indigenous species than native forest but, nevertheless, may provide better habitat for these species than pastoral land. The importance of native forest includes the diversity of age classes of trees and the abundance of old age trees. Transitional habitats, such as shrublands and scrub, often support a relatively rich diversity of species.

The Biodiversity Strategy for New Zealand⁵⁸ recognises the current state of decline of New Zealand's indigenous biodiversity, and sets in place a framework to arrest that decline and protect the remaining diversity of species and habitats.

The value of forest and shrublands for enhancing local indigenous biodiversity will be an issue for consideration, along with the potential impacts of that vegetation cover on water yield, when managing vegetation change in a sensitive catchment.

5.4.2.8.5 Pest control

There is a natural tendency for land in the hill country to revert from grasses to scrub and then to forest. During downturns in the pastoral industry, there is less money available to maintain the more marginal areas in pasture (low inputs of fertilizer, weed control). Unfortunately, the reversion to woody vegetation often includes less desirable, introduced species such as gorse and broom, which are currently classified as plant pests under the Canterbury Regional Pest Management Strategy. Forestry is often regarded as the most

⁵⁷ GEN2.14

⁵⁸ MFE 2000. *New Zealand's Biodiversity Strategy: our chance to turn the tide*

viable use of these areas, and may be used as part of a pest control strategy to control the spread of plant pest species.

In parts of North Canterbury, forestry has also been used to suppress the spread of nasella tussock.

5.4.2.8.6 Climate change and carbon sinks

The loss of forest cover worldwide has contributed to an increase in carbon dioxide levels in the atmosphere which, in turn, may contribute to potentially irreversible changes to the climate system. Rising concentrations of greenhouse gases, including CO₂, are predicted to increase global mean surface temperatures and lead to a rise in the mean sea level⁵⁹.

The Kyoto Protocol includes a number of measures to address the issue of climate change, including the setting of emissions targets and the development of carbon sinks to reduce the level of greenhouse gases. Key to the Protocol is reducing deforestation and encouraging afforestation and reforestation.

Forests act as a carbon sink by removing and storing carbon from the atmosphere during their growing phase. Forests contain more carbon per hectare than shrublands or grassland. The retention of existing forest cover, and the conversion of grassland to forest, both exotic and indigenous, will contribute to the expansion of carbon sinks. Thus there is a tension between afforestation effects relating to global issues of climate change and sea level rise, and the impacts of afforestation at the local level on stream flows, instream values and existing water users.

Because this chapter allows the replanting of forests existing at the date of notification as a proposed plan, this does not affect the government's deforestation liabilities under the Kyoto Protocol. Further, the plan is only regulating plantation forestry in flow-sensitive catchments. There are many areas in Canterbury where afforestation is not regulated for the management of low flows.

5.4.2.8.7 Consideration of the wider benefits of vegetation change

While a change from short to tall vegetation may cause an adverse effect on stream flows for flow-sensitive catchments, it may also play a number of beneficial roles in the protection of soil and water resources and ecosystem management. These include benefits for erosion control, water quality and flood mitigation, and for both instream and terrestrial biodiversity. In terms of achieving integrated management, some of these wider benefits need to be taken into account when assessing the extent of controls needed for managing the impacts of vegetation change on low flows.

For example the value of afforestation for slope stability might override its impact on stream flows where:

- (a) the extent or severity of soil erosion is significant;
- (b) land use practices other than afforestation are not able to solve the soil erosion problem;
- (c) wide-spaced tree planting will not adequately stabilise the slope; and
- (d) soil erosion is affecting instream habitat and water quality.

5.4.3 Groundwater management

5.4.3.1 Effects of artificially lowered groundwater levels on surface water flows

Groundwater development can cause loss in surface water flow either through direct stream depletion effect, or by wide-scale lowering of aquifer water levels/pressures that then deplete spring flows.

⁵⁹ *Third Assessment Report of the Intergovernmental Panel on Climate Change, 2001*

Where an aquifer is hydraulically connected to a river, lake or wetland, there will be interactions between surface and groundwater flow. While groundwater levels (or pressures) are above the bed of the surface water body, a river will gain water from groundwater. Any reduction in groundwater level will reduce gains in surface water flows. Where the groundwater level is below the bed, water will be lost from the river. Where groundwater levels are significantly below a river, losses from the river will be independent of groundwater levels.

This influence of groundwater level change on rivers can occur as a result of pumping from a single bore, or because of the cumulative effect of pumping from many bores causing a widespread decline in groundwater level.

In years when groundwater levels are naturally low through lack of recharge, spring-fed streams will have low base flows. Conversely, where groundwater levels are high, base flow is also high. Other rivers with significant hydraulic connection to groundwater may have low flows, at times of low groundwater level, because this induces more water to be lost from the rivers.

Groundwater abstractions that do not have a significant direct stream depletion effect may still contribute to a cumulative effect that could cause lower flows. Where a minimum flow has been set for a river these cumulative effects may need to be managed so that they do not induce the river to fall below its minimum flow.

The cumulative effects of abstraction may also have to be managed to protect some wetlands.

5.4.3.2 Contamination by saltwater

Groundwater abstraction can induce saltwater contamination.

Where aquifers flow to the sea, freshwater and seawater mix in a zone often referred to as the freshwater/seawater interface. The location of that interface depends on aquifer parameters and flow rates through the aquifer. In unconfined aquifers, the interface extends a short distance inland from the coast, whereas, for the coastal confined aquifer system, the interface is likely to be some distance offshore. Natural and pumping-induced fluctuations in groundwater levels cause the interface to move. Where that movement results in a significant incursion of seawater into the aquifer, with a consequent reduction in freshwater storage, it is referred to as saltwater intrusion.

Intrusion of saltwater into aquifers occurs by:

- (a) downward leakage of water from the sea, an estuary, or a brackish lake like Te Waihora/Lake Ellesmere;
- (b) lateral movement of seawater into an aquifer; or
- (c) up-coning of the freshwater/seawater interface in response to pumping from a bore(s) in a coastal aquifer, where the bore is close to the coast. For every one-metre drawdown that occurs in a bore where the static water level is above sea level, the interface ~~will~~ could rise by up to⁶⁰ approximately 40 metres.

If too much water is pumped from the uppermost confined aquifer, groundwater pressures could fall to the extent that either the freshwater/seawater interface moves inland from the coast or downward leakage occurs, as is the case in the Woolston/Heathcote area. Bores near the coast that pump from the uppermost confined aquifer could then abstract salty water. A similar problem can occur with coastal unconfined aquifers as the freshwater/seawater interface can extend slightly inland from the coast. Pumping from bores close to the coast could cause a localised lowering of the groundwater level and upconing of the freshwater/saltwater interface such as has occurred locally at Makikihi, which has

⁶⁰ WQN1.126

allowed seawater to penetrate further inland. The risk of this occurring would be greater in years when groundwater levels are naturally low.

The position of an interface is difficult to monitor directly if it is offshore, and it has to be inferred from knowledge of the aquifers and onshore water level/pressure data. Up-coning would be detected by raised salinity in bores at the coast. However, detection would mean that there is already a problem.

The issue of lateral seawater intrusion has not been extensively researched in Canterbury, largely because until recently the confined aquifer freshwater/seawater interface was thought to have been 30-40 kilometres offshore, and because there has been no evidence to suggest lateral intrusion is a problem. However, recent investigations have led to the conclusion that the freshwater/seawater interface in the first aquifer near Christchurch lies only three to four kilometres offshore of New Brighton Spit.

For the Christchurch-West Melton groundwater system, if groundwater levels in the aquifer system are maintained high enough to sustain adequate minimum flows in the Avon/Ōtakaro and Heathcote rivers, then widespread pressure reversal and associated lateral saltwater intrusion, are unlikely to arise. However, there is still a risk of localised downward contamination by seawater as a result of excessive pumping in areas adjacent to the coast.

It is reasonable to apply this thinking for the coastal confined aquifer system that extends from the Ashley River/Rakahuri in the north to the Rakaia River in the south. Because of the potential threat of seawater intrusion, coastal monitoring bores have been installed by Environment Canterbury at the coast on the Ashley-Waimakariri and Ashburton-Rakaia Plains, New Brighton Spit, and Kaitorete Spit.

5.4.3.3 *Downward contamination associated with localised pressure reversal groundwater abstraction*

Groundwater abstraction results in changes in flow direction which may result in downward contamination.

When water is pumped from a bore in an unconfined aquifer, this induces a localised change in flow direction toward the bore that can draw contaminants into the groundwater that is being abstracted.

When water is pumped from a bore in a confined aquifer⁶¹, the pressure around the bore is reduced and it can reverse the upward pressure gradient around the bore. This creates potential for downward movement into the aquifer of any adjacent contaminants on or in the ground (e.g. from old rubbish dumps or contaminated sites, or saltwater if the bore was near the coast/estuary).

Many confined aquifers contain water at a higher pressure than the aquifer above. The resulting upward pressure gradient creates potential for slow upward movement of water from deep to shallow aquifers and helps to limit the downward movement of contaminants. This needs to be maintained to avoid such contamination occurring.

5.4.3.4 *Land subsidence*

There is some potential for localised subsidence to occur due to construction site dewatering or other activities where dewatering occurs.

In confined aquifers, the pressure of water in the pore spaces supports some of the weight of the overlying sediments. A significant loss of aquifer pressure can cause overlying sediments (e.g. silt, clay, or peat) to settle and compact, ~~reducing aquifer water storage capacity and~~⁶² causing the ground surface to subside.

⁶¹ WQN1.127

⁶² WQN1.127

While wide-scale land subsidence can occur in confined aquifers as a result of over-pumping, this is not considered to be an issue in Canterbury. This is because the majority of aquifers in Canterbury are gravel-based and, therefore, less susceptible to subsidence. In addition, the aquifers are linked to spring-fed streams that have significant instream values. To maintain flows that are sufficient to protect these values will require groundwater pressures to be maintained at levels well above those that could lead to wide-scale subsidence.

5.4.4 Allocation of water within water management regimes

There is a limit to how much water can be abstracted without compromising both instream values and the reliability of the water supply to users. The issue of the effect on instream values is addressed in 5.4.1.2. The issues relating to allocation of the resource, once flow, level or pressure regimes are set, are discussed here.

Issues that arise include: the competition between users for the resource; including for domestic and stockwater,⁶³ who or what type of use should be given access to the resource; what priority they should have over newcomers or different uses; and what is the risk of diminishing reliability of supply if limits are not established.

In this plan, allocation relates to how water above any flow or level regime is made available to out-of-stream uses, or other uses that may occur within a river such as hydro-electricity generation. Where a flow, level or pressure regime has been set for a water body to protect instream or other values, then some of the water above that flow, level or pressure regime will be available for allocation for human use. It is anticipated that flow/level pressure regimes will be considered at the same time as allocation regimes and that for each water body a comprehensive water management regime will be established.

In many areas of Canterbury, there is strong competition for available water, particularly surface water. This is highlighted during periods of water restriction when there is insufficient water to meet all demands. As more water is taken from groundwater, this resource will also come under increasing pressure.

Irrigation, hydro electricity and other water-dependent activities can have many millions of dollars invested in equipment and development, and need dependable supplies of water to justify and sustain these investments. However, many parts of the region do not have enough water to meet current and potential demands, and a reliable supply may only be achieved by setting a limit on the amount of water that can be used or taken from the water body.

By setting allocation limits, conflict between abstractors/users may be reduced but this may mean that fewer people can access the resource, leading to a separate conflict between those who have access to reliable water and those who may only be able to access less reliable supplies.

Water is available for human use with varying degrees of reliability from surface and groundwater sources. Reliability of supply from the source water body, in simple terms, can be thought of as the block of water, which on average, over many years, is available for a certain percentage of the time. As the percentage reliability of supply increases, the size of the block decreases. Thus, if irrigators want access to a block of water that has a reliability of 90%, that block will be much smaller than the block where a reliability of supply of 80% was acceptable. As a consequence, fewer people are able to get the water they want at 90% reliability than at 80%. Allowing too many people to access a block will mean that nobody gets enough. Such competition for water can lead to improvements in efficiency, but if competition is too intense then inadequate water availability can adversely affect the long-term economic viability of users. Allocation regimes are one tool for dealing with this potential problem.

⁶³ WQN1.131

Setting allocation limits will rely on a judgement about equitable distribution of water resources. Individuals will want all the water they believe necessary to maximise their social and economic wellbeing, yet this will not necessarily mean the water is being used to maximise the social and economic wellbeing of the wider community, as is required by Chapter 9 Policy 2 of the CRPS.

Irrigation, and the reliability of supply that is required for this, is used to guide the setting of allocation limits because irrigation is one of the major types of water use in Canterbury and this is where the greatest demand for additional water is coming from. The other major water use is hydro electricity generation. Use of water for hydro electricity production can improve supply reliability for other uses, such as irrigation, by providing storage, using and then releasing the water for down stream use. But, it can also conflict with other uses, e.g. where water is diverted into canals for use. Abstraction that affects the amount of water in storage or able to be used for power generation will affect the hydroelectric generation activity reliability.

The implementation of allocation regimes will require accurate monitoring of the amounts of water that can be taken. Allocation of the water resource will be most effective where the amount of water allocated closely matches the amount of water needed for the activity. If water is allocated but not utilised, there may be an opportunity cost to other potential abstractive users and to the community.

Existing investment in water-dependent infrastructure is a relevant resource management consideration and there may be justification in giving preference to existing water permit holders when setting and maintaining allocation regimes. If this approach is taken, it is vital that only the amount of water that is needed for the activity to efficiently achieve realistic target production levels is allocated. Yet, there is an expectation that water will be available to anyone who wants it.

5.4.5 Reasonable and efficient use of water

Water that is taken is not always conveyed or used in an efficient manner. If the water “cake” is to be distributed widely, there is a need for the “slices” that individuals get to be sufficient but not excessive.

The CRPS recognises two aspects of efficiency, technical and allocative efficiency. Technical efficiency focuses on the avoidance of waste and allocative efficiency looks to using water where it has greatest value and gives the greatest benefit to the regional economy.

Taking water from a resource can deny others the opportunity of taking what they need from that same resource. This effect occurs regardless of whether the water is used efficiently, or inefficiently, but if it is used inefficiently, the adverse effect on other users is avoidable.

With irrigation there will always be some inefficiency, but farmers should know how much water needs to be applied, and how much is being applied. Ideally, water application should not exceed the available soil water-holding capacity. Irrigation systems should also give a high uniformity of application, with application rates that match soil infiltration rates.

There is also the issue of allocative/economic efficiency to consider. The net benefit of water allocation may differ between the individual and the community depending on the approach taken. The CRPS looks at managing water allocation to enable the community as a whole to maximise its wellbeing. This could override an individual water user's endeavour to maximise their wellbeing, which will be focused on the best return to them, given economic costs and benefits of a chosen irrigation method. Generally, newcomers are adopting irrigation systems that are 80% efficient or better. ~~A common view is that it may not be~~ Some people have questioned whether it is⁶⁴ worthwhile economically for an existing water user to change from a less efficient system to a more efficient system. There will be a redevelopment cost and

⁶⁴ WQN1.132

most likely a greater operating cost where water is pumped and sprayed onto land in place of a gravity-run border irrigation system, for example. This is understood, yet there will be potential for increased coverage, more uniform application, more versatile land uses, increased productivity and less water and nutrient losses, with improvements in water use efficiency. Similar gains have been identified by Bloomer and Daveron⁶⁵. There is the opportunity for increased benefits to the region as a whole. Where changes in allocation are introduced as a consequence of this plan, there will be a need to consider how to manage any transition from less efficient systems to more efficient systems.

Irrigation and open stockwater races are known to have significant leakage losses to groundwater. Stockwater races, in particular, have to take a large volume of water to enable a small portion to be delivered to the stock. Significant savings could be achieved by piping these systems.

The RMA does not provide for regional councils to “pick winners” or decide which uses should get access to water in preference to other uses based on economic returns for example. The money returns for particular products are highly variable and it is beyond the scope of the Proposed NRRP to deal with these. However, there is a requirement to test any proposed use against a test of efficiency, and ensure that no more water than is necessary is granted or applied on the ground.

The RMA s136 does, however, provide for the transfer of water permits under certain circumstances and subject to certain requirements, including expressly allowing for it by a regional plan. Where a water resource is close to or fully allocated, transfer mechanisms can promote the efficient use of water resources, especially where potential demand may exceed availability of water for utilisation.⁶⁶

5.4.6 Water restrictions

Once minimum flows and levels have been established to protect the environmental values associated with water bodies, and available water is allocated, there is the issue remaining of how to restrict the taking of water at times of low flows. Priority must be given to domestic, stockwater and fire-fighting uses.⁶⁷

Such restrictions⁶⁸ will need to be fair and equitable amongst the water users, and will need to be certain so that users can maximise their potential benefits from the water. From an administrative point of view, restrictions will need to be relatively easy to implement and administer, otherwise it will be difficult to enforce compliance.

A number of different approaches to restrictions are possible, such as having no restrictions above the minimum flow and cessation of abstraction once the minimum flow is reached, to incorporating stepped or pro rata reductions. Consideration will need to be given to ensuring all restrictions are at all times equitable, particularly in terms of the relative effect of the abstractions on the resource.

5.4.7 Interference effects between bores – well interference

The installation and operation of wells can affect the quality and availability of groundwater for other well owners.

Pumping from a well lowers the water level in a cone-shaped depression around the well. Where two or more wells are close together, their respective cones of depression may intersect. If this happens, the wells start to interfere with each other and water yields decrease. Setting appropriate well spacing and managing abstraction rates are an important

⁶⁵ *New Zealand Irrigation Association Newsletter* – April 2004

⁶⁶ WQN1.120

⁶⁷ WQN1.134

⁶⁸ WQN1.135

management tool for controlling the extent of the effect of interference in terms of loss in yield.

Pumping from a confined aquifer will reduce pressure in that aquifer. The effect will be most pronounced in the vicinity of the well and diminish with increasing distance from the well. A significant pressure drop from pumping wells in a confined aquifer can cause wells that flow freely at the ground surface (artesian wells) to decline or stop flowing altogether. As the pressure drops further and the water level in the wells sink below ground level, pumps may need to be installed, increasing the cost of abstraction.

If there are a significant number of wells drawing from the same unconfined aquifer their cumulative effect may be to lower groundwater levels over a much larger area. Where there are older, shallower wells, the water level may be drawn down to a level below which these wells can reliably abstract. The depth to which wells penetrate an aquifer is, therefore, an important factor affecting well interference and response to declining groundwater levels.

The effects of interference or widespread drawdown on well water yield can be exacerbated if the well is poorly constructed, developed or maintained.

5.4.8 Augmentation

The damming, storage and/or transfer of water between catchments can have significant effects on the water bodies affected and on existing and potential water takes and uses within the source and receiving catchments.

Augmentation of water resources provides improved supplies of water for abstraction, may provide opportunities for use for hydro electricity generation, and may also be used to improve flows to better protect instream values. Augmentation may involve damming or diversion, and the managed release of flows into rivers or possibly to groundwater. There will be effects on both the source water bodies and the receiving water bodies that will need to be considered. A number of issues can arise relating to the effects on instream values through to the redistribution of the water.

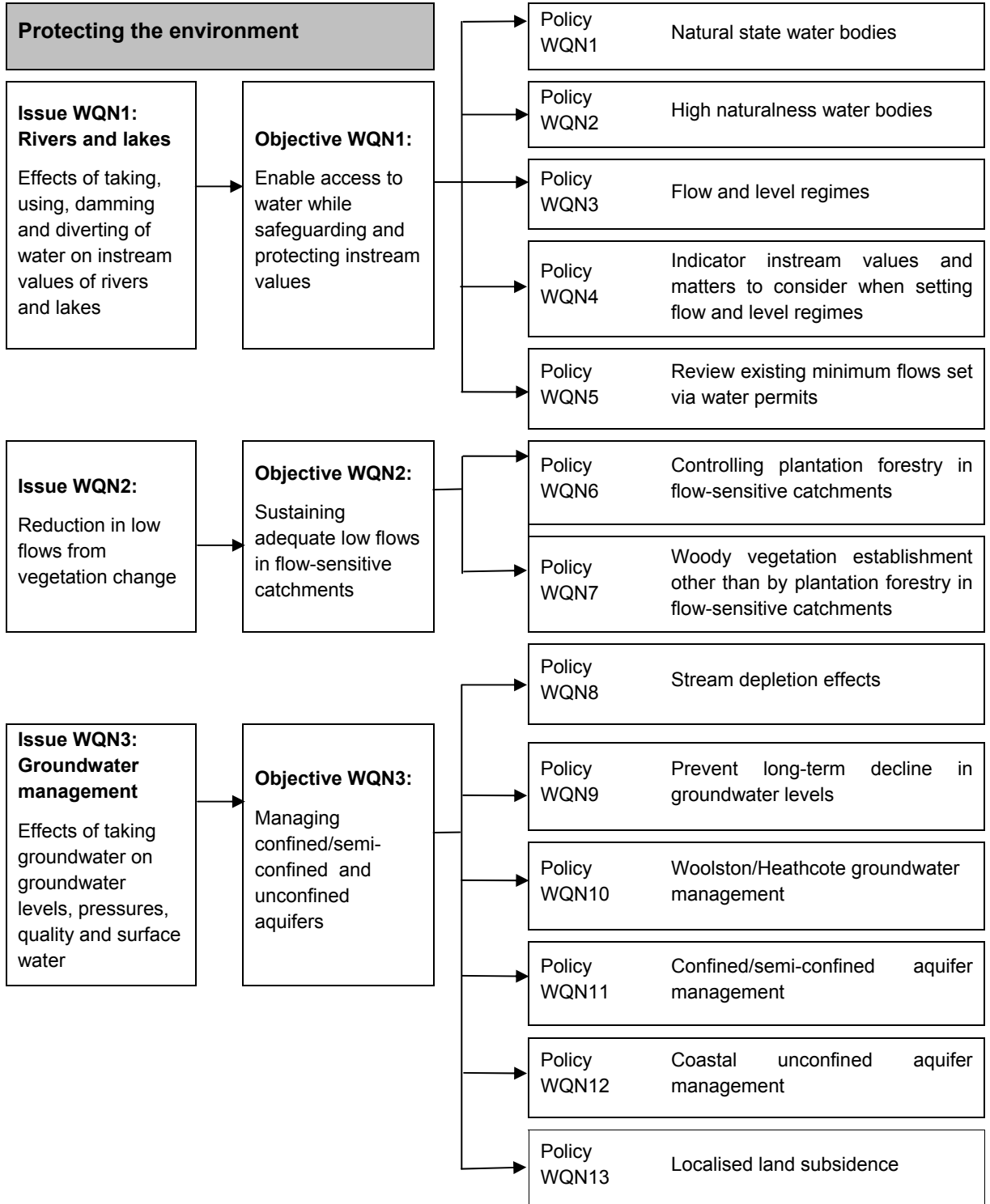
The Canterbury Strategic Water Study (2002) has identified opportunities for augmentation across the region. Many of these would require augmentation of water supplies through storage and/or transfer of water between catchments.

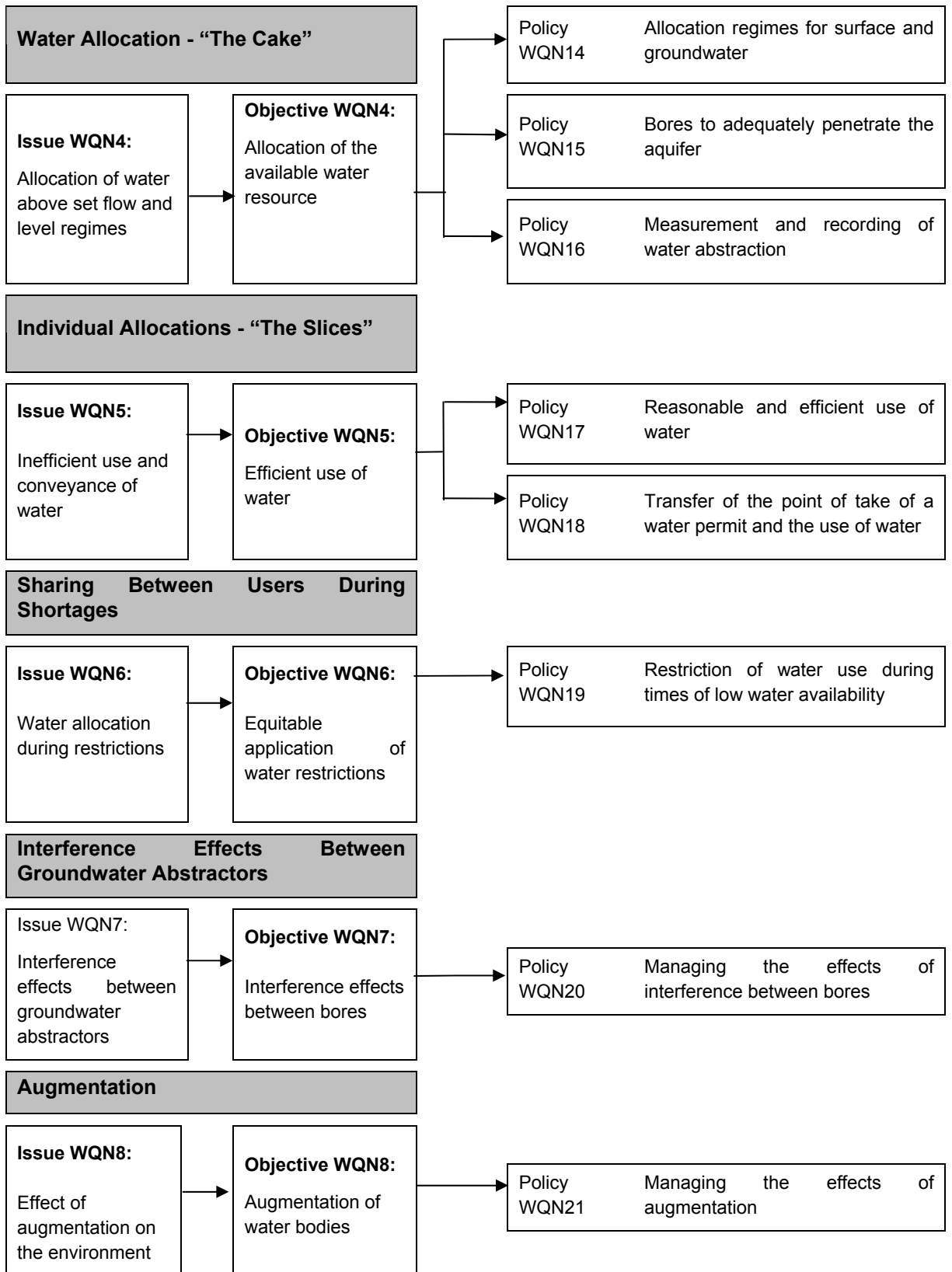
5.5 Issue Resolution

5.5.1 Issue resolution summary

Figure WQN3: Issue resolution summary

(This is a summary only. The text that follows contains the actual council policy).





precise locations and values may need to be filtered to protect sensitive sites from desecration;

- (b) develop and maintain a database of important instream/intrinsic values for all natural state rivers and lakes and make this available publicly;
- (c) prepare and disseminate information on the important instream/intrinsic values of these natural state areas; and
- (d) work with community groups, or encourage their formation, where this can assist in the protection of these water bodies, e.g. resource care groups.

Method WQN1(c) Regional rules

Environment Canterbury will apply regional rules WQN1-WQN3, WQN6-WQN11, WQN20-WQN23, WQN30, WQN34-WQN36, WQN39-WQN42 and WQN44.

Method WQN1(d) Resource consents

Resource consents for the taking, using, damming or diverting of water within these water bodies shall only be granted where they are in accordance with Policy WQN1.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.⁷³

Method WQN1(e) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

Policy WQN2 High naturalness water bodies

- (1) **Outside the areas covered by Policy WQN1, the following water bodies are classified as high naturalness water bodies:**
 - (a) **the mainstem of the Rangitata River;**
 - (b) **tributaries of the Rangitata River upstream of and including the gorge;**
 - (c) **the mainstem of the Hurunui River to Lake Sumner;**
 - (d) **tributaries of the Hurunui River upstream of the confluence with, but not including, the Mandamus River;**
 - (e) **the mainstem of the Hope, Boyle and Waiau rivers;**
 - (f) **tributaries of the Hope and Boyle rivers, and tributaries of the Waiau River upstream of the confluence with the Hope River;**
 - (g) **the mainstem of the South Branch of the Ashburton River/Hakatere**

⁷³ GEN1.102, WQN1.7, WQN1.16, WQN1.140

- upstream of the contour that is 601.5m above mean sea level (near Hakatere Station); and
- (h) tributaries of the South Branch of the Ashburton River/Hakatere upstream of the contour that is 601.5m above mean sea level (near Hakatere Station).
- (2) Maintain the high naturalness of these water bodies by:
- (a) preventing damming of the mainstems of the Rangitata, Hurunui, Waiau, Hope and Boyle rivers, and of the mainstem of the South Branch of the Ashburton River/Hakatere upstream of the contour that is 601.5m above mean sea level (near Hakatere Station);
- (b) preventing the damming of any of the water bodies defined in (1) (b), (d), (f), and (h) above where this would significantly impact on the values in the area to be dammed or on the flow regime needed to maintain instream values downstream. In particular, the flows needed to:
- (i) clear gravel river beds of invading exotic vegetation;
- (ii) remove excessive periphyton from the substrate;
- (iii) mobilise the beds of gravel rivers so as to remove any build up of fine sediment;
- (iv) maintain the mauri and mahinga kai values of the river;
- (v) protect wāhi tapu sites or areas, and wāhi taonga;
- (vi) maintain the natural character of the river;
- (vii) maintain habitats for indigenous birds and fish;
- (viii) maintain spawning areas for trout and salmon;
- (also refer to Policy WQN4(3))
- (c) ensuring any taking or diverting within the water bodies above, reduces and ceases in accordance with the flow regime set for the mainstem, or the tributary (refer to policies WQN3 and WQN4 for setting flow regimes); and
- (d) ensuring that any damming, using, taking or diverting of water from within the water bodies above does not adversely impact on the reliability of supply for existing downstream abstractive users of river flow.

Explanation and principal reasons

The "high naturalness" status is recognition that the water bodies identified in this policy:

- (a) have high natural character;
- (b) have retained their traditional value to Ngāi Tahu;
- (c) provide habitat for significant indigenous plants and animals, particularly birds;
- (d) contain significant spawning areas for salmon and trout;
- (e) include significant wetlands; and
- (f) may be significant natural features.

They also contribute to the surrounding landscape and natural features.

Policy WQN2 recognises that high naturalness warrants careful management. However, this need not rule out the taking or using of water. Accordingly, the policy recognises both the outstanding natural and cultural values, and the potential of these river systems to provide social and economic benefits. The policy thus aims to protect the values it has identified as important, but does not rule out water abstraction, storage or augmentation schemes. Any development involving the taking, damming or using of water will need to ensure a flow regime is maintained that will satisfy the values identified in the policy.

Sensitive development in certain locations could allow the double benefit of environmental protection and provision of water for irrigation on the Canterbury Plains, or for other uses.

The areas covered by this policy are defined in more detail in Schedule WQN5.

Methods

The methods used or to be used to implement Policy WQN2 are:

Method WQN2(a) Advocacy

Environment Canterbury will advocate to and co-operate with district councils, the Department of Conservation and other parties where there are common outcomes and seek complementary management through district plans, conservation management strategies and other relevant plans.

Method WQN2(b) Information and promotion

Environment Canterbury will:

- (a) in consultation with Te Rūnanga O Ngāi Tahu and papatipu rūnanga, develop and maintain a publicly available database of important Ngāi Tahu values, sites and areas, for each high naturalness water body. The level of detail available to the public about precise locations and values may need to be filtered to protect sensitive sites from desecration;
- (b) develop and maintain a database of important instream/intrinsic values for all high naturalness rivers and make this available publicly;
- (c) prepare and disseminate information on the important instream/intrinsic values of these high naturalness areas; and
- (d) work with community groups, or encourage their formation, where this can assist in the protection of these water bodies, e.g. resource care groups.

Method WQN2(c) Investigations

Environment Canterbury will continue investigations of the instream values of all streams for inclusion on data bases.

Method WQN2(d) Regional rules

Environment Canterbury will apply regional rules WQN1-WQN3, WQN6-WQN10, WQN20, WQN22-WQN23, WQN30, WQN34-WQN36 and WQN39-WQN44 to implement Policy WQN2.

Method WQN2(e) Resource consents

Resource consents for the taking, using, damming or diverting of water within these water bodies shall only be granted where they are in accordance with Policy WQN2. Damming of the mainstems of these rivers is a prohibited activity.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA,

and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.⁷⁴

Method WQN2(f) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

⁷⁴ GEN1.102, WQN1.7, WQN1.16, WQN1.140

rūnanga, that detail specific resource management issues and the outcomes that are sought;

- (b) advocate participation of all interested parties in the development of flow and level regimes for Canterbury's water bodies. Approaches may include participation on working parties, e.g. Ashley River/Rakahuri and Ashburton River/Hakatere, advisory groups and technical panels, e.g. Lake Ellesmere/Te Waihora and its catchment, or water users groups⁷⁵;
- (c) advocate to water permit holders and to the people operating under water permits to be aware of, and comply with, the flow and level regimes that apply, particularly when water restrictions are likely; and
- (d) advocate to landowners adjacent to lakes, rivers, streams, wetlands and drains, to agencies responsible for managing these and to users of these, to encourage them to carry out practices (e.g. habitat improvement, riparian planting or sympathetic river works) and to initiate improvements that complement the flow regimes and the management purposes that have been established for each water body.

Method WQN3(b) Information and promotion

Environment Canterbury will:

- (a) in consultation with Te Rūnanga O Ngāi Tahu and papatipu rūnanga, for all water bodies for which water flow or level regimes are set, or to be set in Schedule WQN1, identify significant Ngāi Tahu values, sites and areas, and associated management outcomes sought, including flow or level regimes where these can be identified;
- (b) in consultation with Te Rūnanga O Ngāi Tahu and papatipu rūnanga, develop and maintain a publicly available database that identifies significant Ngāi Tahu values, sites and areas, for each water body. The level of detail available publicly about precise locations and values may need to be filtered to protect sensitive sites from desecration
- (c) develop and maintain a record of important instream/intrinsic values for rivers covered by this policy;
- (d) prepare and disseminate information explaining why minimum flows have been set, how they are to be implemented, and how water abstraction, and groundwater abstraction in particular, can individually and cumulatively deplete stream flow; and
- (e) provide information on river flows and groundwater levels that is of a quality appropriate for making regulatory decisions, including water permit holders, or water users⁷⁶ groups determining the level of restriction on their abstraction(s) that may apply at any time.

Method WQN3(c) Investigations

Environment Canterbury will:

- (a) investigate and establish flow and level regimes for catchments where there is a significant demand for water and the size and extent of the hydrological resource requires comprehensive investigations. The nature, scope, and funding to undertake these activities is outlined in Environment Canterbury's Community Plan. Investigations of the following water bodies are programmed to be completed by 2010:
 - (i) rivers between and including the Pareora and Waihao rivers
 - (ii) Hurunui River and the major tributaries
 - (iii) Waipara River

⁷⁵ WQN1.27

⁷⁶ WQN1.27

- (iv) ~~Waitaki River and tributaries and~~⁷⁷
- (v) Lake Ellesmere/Te Waihora catchment;
- (b) in conjunction with Te Rūnanga o Ngāi Tahu, and papatipu rūnanga identify sites or areas of significance to Ngāi Tahu in or adjacent to waterbodies, or in areas where water related activities could cause significant adverse effects on sites or areas of significance. As appropriate, these sites and areas will be brought into the Proposed NRRP by way of RMA Schedule 1 processes.
- (c) complete investigations in all catchments identified as being sensitive to a change from short to tall vegetation, and identify the appropriate level of controls needed. These will be included in Chapter 5 Schedule WQN15 by way of a variation per Schedule 1 of the RMA; and
- (d) continue its programme of groundwater investigations to ensure stream depletion and other groundwater management information is available for development of planning provisions for specific water bodies as scheduled in Environment Canterbury's Community Plan.

Method WQN3(d) Setting flow regimes

To ensure that it has an adequate level of information for decision-making, when undertaking processes for setting minimum flows/flow regimes for inclusion in Schedule WQN1, for each water body, in addition to anything else that it considers necessary, Environment Canterbury will:

- (a) prepare reports and undertake investigations as necessary to address the flow requirements for each value listed in Objective WQN1 (a) to (h);
- (b) prepare, or commission, a report on the effects on reliability of supply to existing abstractors of and alternative flow regimes, and for larger water bodies, any significant regional economic impacts; and
- (c) initiate community consultation processes that provide adequate time and information for the community to effectively participate in the process, and to provide advice in a report back to Environment Canterbury about their preferences and reasons for particular minimum flows/flow regimes.

Method WQN3(e) Resource care initiatives

Environment Canterbury, through its Resource Care Section, will encourage, facilitate and assist groups and individuals to carry out activities such as riparian management or habitat enhancement. This can complement the management purposes that are identified for water bodies when setting flow regimes.

Method WQN3(f) Water users groups

Environment Canterbury will encourage and, where appropriate, require the formation and operation of water users⁷⁸ groups that can roster water use when there is insufficient water available to meet all abstractors' requirements and/or water restrictions are necessary. A water users⁷⁹ group recognised by Environment Canterbury can share water amongst its members as it sees fit, provided the sum of the takes complies with any restrictions that are in place, and no individual takes more than any condition of their consent allows. Participation in a water users group may be mandatory where the minimum flow reference

⁷⁷ WQN1.57

⁷⁸ WQN1.27

⁷⁹ WQN1.27

point is downstream of the users. Ideally, a water users⁸⁰ group will operate in a co-operative manner. Where this does not happen, mandatory participation in a water users⁸¹ group and compliance with its water sharing arrangements may be required as a condition of consent, where that is a practical option.

Method WQN3(g) Regional rules

Environment Canterbury will apply regional rules WQN1-WQN3, WQN6-WQN11, WQN14, WQN20-WQN23, WQN30, WQN34-WQN42 and WQN44 to manage the taking, damming or diverting of water, and regional rules WQN45-WQN47 to manage the planting of plantation forest in flow-sensitive catchments.

Method WQN3(h) Resource consents

Resource consents for the taking, using, damming or diverting of water within these water bodies, and land use consents for the planting of new areas of plantation forest in flow-sensitive catchments, shall only be granted where they are in accordance with Policy WQN3.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.⁸²

Method WQN3(i) Review of permits

Environment Canterbury will review water permits in accordance with Section 128 of the RMA, when flow regimes incorporated into Schedule WQN1 become operative, or at such later time as is specified in the schedule.

This review of water permits will be commenced within six months of the date when the Schedule WQN1 change becomes operative, or at such later time as is specified in the schedule.

Where Environment Canterbury has determined to review water permits as above, notice will be served on holders of water permits affected. (Refer also to policies WQN14 and WQN17).

Method WQN3(j) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

Method WQN3(k) Environmental Enhancement Fund

Environment Canterbury may through the Environment Enhancement Fund contribute towards the costs of individuals and community groups implementing measures to protect and enhance waterways, indigenous plants or animals and their habitats. Full details of this

⁸⁰ WQN1.27

⁸¹ WQN1.27

⁸² GEN1.102, WQN1.7, WQN1.16, WQN1.140

fund and how to apply are available upon request from Environment Canterbury or from the Council's website, www.ecan.govt.nz⁸³

Policy WQN4 Indicator instream values and matters to consider when setting flow and level regimes

(1) In establishing the flow regime for a river to meet the requirements of Objective WQN1, regard should be given to the associated indicator values for each river type set out below.

River type	River size (median flow) (cumeecs)	Indicator instream values
Glacial mountain and mountain	> 50	mauri, natural character, salmon
	> 10 – 50	mauri, salmon and trout
	< 10	mauri, trout
Hill	> 10	mauri, salmon, trout
	> 2 – 10	mauri, trout
	< 2	mauri, native fish
Lowland	> 1	mauri, trout, if in urban areas, amenity
	< 1	mauri, if in urban areas, amenity
Volcanic		mauri, native fish, and trout in the Okana and Okuti rivers

⁸³ WQN1.33

Method WQN4(d) Resource consents

Resource consents for the taking, damming or diverting of water within these water bodies shall only be granted where they are in accordance with Policy WQN4. Resource consents will need to be granted with conditions that are consistent with the flow and level regimes that are established in Schedule WQN1. Where no flow or level regimes are established matters listed in this policy shall be considered when setting a flow or level condition. Consents sought for water permits to take, dam or divert water in the interim period may include a condition that identifies the intention to review conditions.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.⁸⁵

⁸⁵ GEN1.102, WQN1.7, WQN1.16, WQN1.140

Policy WQN5 Review existing minimum flows set via water permits

Within five years of this plan becoming operative, Environment Canterbury will have completed a review, in priority order, of all of the minimum flows set out in Appendix WQN2.

Explanation and principal reasons

The Canterbury region has a long history of setting minimum flows on water permits to protect instream values. About 150 rivers have existing minimum flow provisions. Appendix WQN2 lists rivers with one or more water permits to abstract water from them, and where the abstraction is controlled by minimum flow conditions on the permit(s). Many of these minimum flows pre-date the RPS becoming operative in 1998 and, therefore, may not adequately provide for instream values.

It will not be practical to review all the flow and level regimes in the region simultaneously because of the need to undertake investigations and initiate community consultation. However, completion of this task is programmed in the council's Long-Term Financial Strategy. A number of flows and levels may be able to be set using smaller scale approaches, e.g. instream technical panel, technical panel review and community consultation, while some of the larger water bodies in the region will require a more detailed investigation to be carried out over a period of several years to establish hydrological relationships which can be used to determine the minimum flow and flow regime requirements.

Methods

The methods used or to be used to implement Policy WQN5 are:

Method WQN5(a) Investigations

Environment Canterbury will initiate a progressive review of existing minimum flows and water permits.

The order of priority for review will be based on the following criteria:

- (a) water bodies likely to have more important instream values; and
- (b) rivers where the set minimum flow is the furthest below the seven day mean annual low flow.

Within each of the above categories, priority will be given to:

- (i) Pre-October 1991;
- (ii) 1991 to October 1995 when the RPS decisions were notified; and
- (iii) November 1995 to June 1998 when the RPS became operative.

Where one or more minimum flows in a catchment meet these criteria, it will be more efficient to deal with all existing minimum flows in the catchment that need review.

Method WQN5(b) Water users groups

Where a water users⁸⁶ group exists on a water body that is to have its existing minimum flow reviewed, Environment Canterbury will contact that group early in its investigations and invite their participation, as well as that of other stakeholders.

⁸⁶ WQN1.27

Method WQN6(b) Investigations

Environment Canterbury will:

- (a) map the 7DMALF specific discharges in each sensitive catchment listed in Schedules WQN15.1 – WQN15.4 to identify areas supplying water during times of low flow.

The priority for mapping flow-sensitive catchments will be based on:

- (i) catchments with minimum flows set via a consent or through a plan;
 - (ii) catchments supplying water to a community water supply, or for domestic or stock water needs;
 - (iii) the existing allocation status of catchment; and
 - (iv) where more than 5% of the catchment is already planted in plantation forest.
- (b) support investigations of water augmentation schemes in flow-sensitive catchments, principally through the provision of hydrological information; and
 - (c) investigate the impact of plantation forestry on the recharge of the ground water resource through the development of ground water models.

Method WQN6(c) Verification of areas of exotic tall scrub

Within 12 months of receiving the necessary advice on areas of exotic tall scrub, Environment Canterbury will either arrange to make a site visit with the landholder concerned, to verify the extent of the area of exotic tall scrub, or will confirm the area of qualifying vegetation based on the use of remote sensing techniques.

Method WQN6(d) Regional rules

Environment Canterbury will apply Regional Rules WQN45, WQN46 and WQN47 to manage the effects of plantation forestry on flows in flow-sensitive catchments.

Method WQN6(e) Resource consents

Environment Canterbury may grant resource consents for plantation forestry in flow-sensitive catchments where proposals do not meet the criteria for permitted activities. The assessment criteria set out in Rule WQN45 indicate the matters that Environment Canterbury will consider in relation to any resource consent application.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.⁸⁸

Method WQN6(f) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

⁸⁸ GEN1.102, WQN1.17, WQN1.16, WQN1.140

Method WQN6(g) Territorial authorities

When territorial authorities are considering district plan consent applications for plantation forestry in flow-sensitive catchments identified in Schedules WQN15.1—WQN15.4 they should advise applicants of the possible need to obtain a resource consent from Environment Canterbury.

- (b) make that information available via media such as pamphlets, newsletters, to land holders, abstractors, and those wanting to install bores, on methods for assessing the stream depletion effects of hydraulically connected groundwater.

Method WQN8(b) Investigations

Environment Canterbury will develop groundwater models that can be used to determine water budgets for groundwater management areas where there is an adequate level of resource information. For many areas there is insufficient information and length of groundwater level record to commence development of a detailed water budget model.

Method WQN8(c) Water users groups

Environment Canterbury will encourage and, where appropriate, require the formation and operation of water users⁹⁰ groups that can roster water use when there is insufficient water available to meet all abstractors' requirements and/or water restrictions are necessary. A water users⁹¹ group recognised by Environment Canterbury can share water amongst its members as it sees fit, provided the sum of the takes complies with any restrictions that are in place, and no individual takes more than any condition of their consent allows.

Participation in a water users group may be mandatory where the minimum flow reference point is downstream of the users. Ideally, a water users⁹² group will operate in a co-operative manner. Where this does not happen, mandatory participation in a water users⁹³ group and compliance with its water-sharing arrangements may be required as a condition of consent, where that is a practical option.

Method WQN8(c) Regional rules

Environment Canterbury will use regional rules WQN6-WQN8, WQN10-WQN11, WQN13-WQN16 and WQN19-WQN24 to manage the effects of groundwater abstraction on surface water bodies, and to control the allocation of the surface and groundwater resources.

Method WQN8(d) Resource consents

Resource consents shall only be granted for groundwater takes that have a stream depletion effect on surface water bodies, provided the stream depletion effect, when added together with all other takes that are to be counted as part of the surface water allocation block, is within the allocation block set and that the take complies with other relevant performance standards.

The stream depletion effect is to be determined using an appropriate method acceptable to Environment Canterbury. Environment Canterbury has developed a number of guidelines dealing with specific aspects of assessment and audit of proposals to take and use groundwater. These include a guideline for the assessment of groundwater abstraction effects on stream flows. A copy of this guideline can be obtained from Environment Canterbury to help in preparing an assessment of environmental effects. As indicated in Method WQN8(a)(a) methods for assessing the stream depletion effects of hydraulically connected groundwater will be refined and as a result, the guidelines will be periodically updated as new information and analytical methods are developed.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.⁹⁴

⁹⁰ WQN1.27

⁹¹ WQN1.27

⁹² WQN1.27

⁹³ WQN1.27

⁹⁴ GEN1.102, WQN1.7, WQN1.16, WQN1.140

Method WQN8(e) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

Method WQN9(b) Investigations

Environment Canterbury will develop or have developed groundwater models that can be used to determine water budgets for groundwater management areas where there is an adequate level of resource information. For many areas, there is insufficient information and length of groundwater level record to commence development of a detailed water budget model.

Method WQN9(c) Water users⁹⁵ groups

Environment Canterbury will encourage, and where appropriate, facilitate the formation of water users⁹⁶ groups that can roster water take and water use when water restrictions are necessary. A water users⁹⁷ group registered with Environment Canterbury can share water amongst its members as it sees fit, provided the sum of the takes complies with any restrictions that are in place, and no individual takes more than any condition of their consent allows.

A water users⁹⁸ group can be a very useful mechanism for communicating information about resource limits and steps that users can take to reduce their demands on the water resource.

Method WQN9(d) Regional rules

Environment Canterbury will use regional rules WQN13-WQN16 and WQN19-WQN24 to implement this policy.

Method WQN9(e) Resource consents

Environment Canterbury will monitor the total amount of water that it has allocated via water permits to ensure that they do not exceed any allocation limits set for a groundwater resource.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.⁹⁹

Method WQN9(f) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

Policy WQN10 Woolston/Heathcote groundwater management

⁹⁵ WQN1.27

⁹⁶ WQN1.27

⁹⁷ WQN1.27

⁹⁸ WQN1.27

⁹⁹ GEN1.102, WQN1.7, WQN1.16, WQN1.140

- (1) For the Woolston/Heathcote groundwater management area (Figure WQN6) prepare a groundwater management strategy and set allocation limits for abstraction from within the zones to ensure an overall upward pressure gradient between the first confined aquifer and the overlying confining layer.
- (2) If the water level at the Scrutton's Road monitoring bore is simultaneously below all the groundwater trigger levels (i) and (ii) and (iii) below, all abstractions from the first confined aquifer shall cease until the water level recovers to a level where at least one trigger level is not exceeded:
 - (a) one metre above mean sea level datum when taken as an average over a moving 365-day period;
 - (b) 0.25 metres above mean sea level datum when taken as a 14-consecutive day moving mean; or
 - (c) 0.5 metres below mean sea level datum when taken as an average over a 24-hour period.
- (3) No new water permits to take groundwater from within Zone 1 of the Woolston/Heathcote management area shall be issued after 1 January, 2002. This shall not apply to replacements or transfers of existing permits, where these are for the same or a lesser rate of take.
- (4) Takes from any aquifer within Zone 2 shall not have a significant adverse effect on groundwater levels in the first confined aquifer in Zone 1.

Explanation and principal reasons

The Woolston/Heathcote groundwater management area has a known saltwater intrusion problem due to the extent of groundwater abstraction and relatively slow rate of recharge. Specific management solutions involving the users are needed to address this problem. This will allow development of allocation and management strategies aimed at preventing the thresholds in WQN10(2) being compromised.

Policy WQN10(2) is needed to identify the threshold for when pumping should cease so as to prevent downward movement of contaminants.

Policy WQN10(3) and WQN10(4) limit the effects of new abstractions and should ensure that there is no increase in the risk of contamination. Any transfer of an existing permit will be subject to Policy WQN18.

Methods

The methods used or to be used to implement Policy WQN10 are:

Method WQN10(a) Information and promotion

Environment Canterbury will prepare and distribute information via pamphlets or other suitable media, explaining how groundwater abstractions, individually and cumulatively, can affect the groundwater in the Woolston/Heathcote groundwater management area and how this effect is to be managed.

Method WQN10(b) Investigations

Environment Canterbury will investigate the degree of restriction necessary when the water level in the first confined aquifer falls to 0.5m below mean sea level datum. A progressive restriction regime will be developed via the management plan to be implemented ahead of this level being reached.

This will rely on all users within this area participating in a water-users group and co-operating in the reduction of their water takes when levels become critical. Failure to co-operate is likely to hasten the lowering of water pressure and increase the degree of saltwater contamination. The groundwater level/pressure regime set by Environment Canterbury is intended to prevent this from occurring.

Method WQL9(c) in Chapter 4 allows for community action that could set out targeted strategies to improve local water quality. This method could also be used to address the wider water management issues for the area.

Method WQN10(e) Regional rules

Environment Canterbury will use regional rules WQN13-WQN14, WQN19, WQN23 –WQN24 to implement this policy.

Method WQN10(f) Resource consents

Resource consents for the taking and using of groundwater within the Woolston/Heathcote groundwater management zones shall only be granted where they are in accordance with Policy WQN10. Conditions on the consent will address effects such as saltwater intrusion and interference between bores. Environment Canterbury will be monitoring groundwater quality in the area. If there is a decline in groundwater quality in any of the abstraction bores of the water users group, the consents may be called in for review.

With respect to the trigger levels, particularly in terms of giving effect to conditions on resource consents, Environment Canterbury will monitor the groundwater level weekly on Fridays about noon, and contact users accordingly if the groundwater level is below any of the trigger levels at that point. For the purposes of giving practical effect to the proposed management, this is considered appropriate as groundwater levels in the monitoring bore respond directly to pumping occurring in the area. Thus as some of the abstractions are reduced over the weekend period, groundwater levels can recover over that two-day period, while the full effect of the sustained abstraction over the working week will be apparent in the Friday water level recordings.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.¹⁰⁰

Method WQN10(g) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

¹⁰⁰ GEN1.102, WQN1.7, WQN1.16, WQN1.140

Policy WQN11 Confined/semi-confined aquifer management

- (1) For the confined aquifer system for which groundwater level regimes have been set in Schedule WQN3, manage abstractions so that the groundwater level in the first confined aquifer is always maintained at or above the level set in Schedule WQN3.
- (2) For the coastal confined aquifers not included in Schedule WQN3, control the rate of abstractions so that the groundwater level in the first confined aquifer is always maintained at least 1.5 metres above mean sea level at the coast.
- (3) For the coastal confined gravel aquifer system between the Ashley River/Rakahuri and Rakaia River, in the area extending 1.5 kilometres inland of the coastal marine area, prevent the installation of pumps for bores abstracting from the first confined aquifer.
- (4) For the coastal confined volcanic rock aquifers, control the rate and duration of individual abstractions to ensure that singly, or in combination with abstractions from other nearby bores, localised pressure reversal does not result in compromising the existing water quality in neighbouring bores.
- (5) For the uppermost confined aquifers, control the rate and duration of individual abstractions to ensure that singly, or in combination with other nearby bores, localised pressure reversal does not result in the downward movement of contaminants.
- (6) For the confined aquifers, in any location where an overall upwards pressure gradient exists between confined aquifers, restrict the taking of groundwater so that at all times the overall upward pressure difference is maintained between any one aquifer and the next overlying aquifer.
- (7) Any bore from which groundwater is taken, shall only take from one aquifer unless:
 - (a) taking from more than one aquifer is provided for in Schedule WQN3; or
 - (b) the bore allows water from each aquifer to be pumped or to flow independently to the surface without risk of cross-flow between aquifers; or
 - (c) it can be demonstrated that the risk of contamination or water loss is low due to:
 - (i) a high level of hydraulic connection between the aquifers;
 - (ii) there being no significant difference in water quality between the aquifers at the time of the application and no likelihood of deterioration over the life of the bore.

Explanation and principal reasons

The above policies are specifically designed to protect groundwater quality from the effects of groundwater abstraction. This is because a reduction in groundwater quantity caused by groundwater abstraction can also cause groundwater quality to decline. Once groundwater is contaminated it is generally very difficult and expensive to remedy, particularly where alternative water supplies also have to be provided.

Confined aquifer systems occur at several places along the Canterbury coast. The most studied and, therefore, most well understood, is the artesian gravel aquifer system that extends from the Ashley River /Rakahuri to the Rakaia River, excluding the bays and

Exceptions may occur and the policy gives guidance for considering these. The exceptions would need to demonstrate that the aquifers that are to be connected through multi-screening, are already connected naturally, so that multi-screening will cause little change. This would be evident in the aquifers having similar pressure gradients. If this is not evident, the application would have to demonstrate that the water quality of the two or more aquifers is the same or similar and that it will remain the same. Consideration should be given to the water quality outcomes set for groundwater bodies in Objective WQL2.

Where these outcomes differ, it would be undesirable that abstraction from more than one aquifer via a single bore occurs. Reference is made to the life of the bore in this policy. Once a bore is established it is often established for good. It is, however, possible to seal off a bore or to grout out a portion of the bore, but it is not common. It would be possible to reverse an abstraction from more than one aquifer via a single bore and any adverse effects of this and this may need to be made a condition of consent if monitoring shows that deterioration is occurring in the water quality. In the first instance, it will be better to prevent the abstraction from more than one aquifer via a single bore from occurring if the risk of contamination is evident at the time or in the future. Other related matters will need to be considered at the time of an application, including significant continuing long-term decline of ground water levels (Policy WQN9), resource availability given allocation limits (Policy WQN14) and interference between bores (Policy WQN20).

Methods

The methods used or to be used to implement Policy WQN11 are:

Method WQN11(a) Information and promotion

Environment Canterbury will develop and distribute information via pamphlets or other suitable media, explaining how groundwater abstractions, individually and cumulatively, can lower groundwater levels, cause pressure reversal, and seawater contamination and other problems.

Method WQN11(b) Investigations

Environment Canterbury will develop or have developed, groundwater models that can be used to create water budgets for a groundwater management area where there is an adequate level of resource information. For many areas, there is insufficient information and length of groundwater level record to commence development of a detailed water budget model. (Also see Method WQN3(c)(c))

Method WQN11(c) Water users groups

Environment Canterbury will encourage and where appropriate, facilitate the formation of water users groups that can roster water use when water restrictions are necessary. A water users group registered with Environment Canterbury can share water amongst its members as it sees fit, provided the sum of the takes complies with any restrictions that are in place, and no individual takes more than any condition of their consent allows.

Method WQN11(d) Regional rules

Environment Canterbury will use regional rules WQN13 – WQN16 and WQN19-WQN23 to implement this policy.

Method WQN11(e) Resource consents

Resource consents for the taking and using of groundwater shall only be granted where they are in accordance with Policy WQN11.

Water permits must contain conditions that reflect the rules for implementing this policy. Monitoring bores may be required as a condition of consent where there is a risk that abstraction could result in contamination of an aquifer. Environment Canterbury has developed a number of guidelines dealing with specific aspects of assessment and audit of proposals to take and use groundwater. These include a guideline for assessing effects of saltwater intrusion. A copy of this guideline can be obtained from Environment Canterbury to

help in preparing an assessment of environmental effects. These are refined in response to use, and are periodically updated.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.¹⁰¹

¹⁰¹ GEN1.102, WQN1.7, WQN1.16, WQN1.140

Method WQN12(b) Investigations

Environment Canterbury will investigate any incidences of saltwater intrusion and, if necessary, promulgate measures to remedy them and/or prevent them from reoccurring.

Method WQN12(c) Water users groups

Environment Canterbury will encourage and, where appropriate, facilitate the formation of water users groups that can roster water use when water restrictions are necessary. A water users group registered with Environment Canterbury can share water amongst its members as it sees fit, provided the sum of the takes complies with any restrictions that are in place, and no individual takes more than any condition of their consent allows.

Method WQN12(d) Regional rules

Environment Canterbury will use regional rules WQN13-WQN16 and WQN19 – WQN23 to implement this policy.

Method WQN12(e) Resource consents

Resource consents for the taking and using of groundwater shall only be granted where they are in accordance with Policy WQN12.

Environment Canterbury will have regard to matters such as bore location, depth of aquifer, rate of take, and risk of saltwater intrusion when considering resource consents to take water from an unconfined aquifer. Environment Canterbury, when granting a water permit, may include conditions requiring regular usage and water level monitoring information to be supplied to Environment Canterbury and, if necessary, abstractors may be required to sample bore water for salinity.

Environment Canterbury has developed a number of guidelines dealing with specific aspects of assessment and audit of proposals to take groundwater. These include a guideline for assessing risk and effects of saltwater intrusion. A copy of this guideline can be obtained from Environment Canterbury to help in preparing an assessment of environmental effects. These are refined in response to use, and are periodically updated.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.¹⁰²

Method WQN12(f) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

Policy WQN13 Localised land subsidence

Control the de-watering of construction sites or dewatering for other activities, by limiting the rate and duration of pumping from groundwater, and/or requiring

¹⁰² GEN1.102, WQN1.7, WQN1.16, WQN1.140

other mitigation measures, to prevent localised land subsidence.

Explanation and principal reasons

Land subsidence following de-watering of a building site is uncommon and in Canterbury is most likely to occur in the coastal confined aquifer area. Deep excavations for building foundations can encounter problems where water keeps seeping into the excavation. This is dealt with by sinking shallow bores around the site and pumping out groundwater to lower the water table in the construction site.

While de-watering of building sites is the most common de-watering activity, de-watering of sites may also be required for other reasons. For example, lowering groundwater levels or pressures to increase infiltration of discharge down through the soil profile of wetlands for treatment purposes. This also raises the potential for subsidence to occur.

It is necessary to recognise the need for the taking and discharging of water in order to lower the water table in construction site or other de-watering site areas. The taking of such water may be significant for larger-sized developments, and there is a risk that subsidence could cause damage to adjacent buildings, or pipes, e.g. sewerage lines. The Building Act 1991 requires that the off-site effects of construction be considered in the design and development of a building. Site excavation standards are also provided in Rule WQL25.

Methods

The methods used or to be used to implement Policy WQN13 are:

Method WQN13 (a) Regional rules

Environment Canterbury will use regional rules WQN17 and WQN18 to implement this policy.

Method WQN13 (b) Resource consents

Resource consents for the taking and using of groundwater shall only be granted where they are in accordance with Policy WQN13.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.¹⁰³

Method WQN13 (c) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

¹⁰³ GEN1.102, WQN1.7, WQN1.16, WQN1.140

In order to maintain an accurate allocation regime and to maximise the allocation of available water, it will be necessary to clearly determine the period of abstraction of each permit. Policy WQN14(3)(c) and WQN14(3)(d) intend that the allocated amount of water shall be counted for each month. This will allow water to be allocated for abstraction at different times of the year, up to the allocation block limit that applies for that month. For example, a take for direct use for irrigation will occur only through the irrigation season. However, water could also be in demand for storage during the off-season. Providing the abstraction period is clearly defined, water could be allocated to both these uses, without compromising the allocation regime. Not all permits currently have a period of abstraction attached to them. Where this is the case, (d) describes how this will be determined.

There will be occasions where the flow in a river is modified due to damming and storage. The Waitaki River is the best example of this. Where this occurs, it may be appropriate to also establish an annual allocation limit, as has been done in the Waitaki catchment under the Waitaki Catchment Water Allocation Regional Plan.¹⁰⁴ The interim policy is not able to do this and it will be necessary to develop a specific water allocation regime for this catchment. Policy WQN(14)(3)(e) provides direction for determining the effective allocation where storage is occurring and the resource is being managed on the basis of annual volumes.

Policy WQN14(4) provides a level of reliability that will be targeted when setting allocation regimes for surface water bodies. However, it allows for local catchment-based solutions as the most appropriate way to allocate the water resource and resolve possible over-allocation. It is intended to develop catchment-specific allocation regimes progressively during the life of the plan. Allocation regimes have been set in Schedule WQN1 in accordance with this policy for the following water bodies:

- (a) Ashburton River/Hakaterere;
- (b) Ashley River/Rakahuri;
- (c) Avon River/Ötakaro;
- (d) Heathcote River;
- (e) Rangitata River.

Reliability of supply indicators have been developed for setting allocation limits with specific emphasis on irrigation¹⁰⁵. Different reliability of supply standards are considered appropriate for surface and groundwater. With rivers, a characteristic is that the supply can reduce or cease numerous times during an irrigation season as a result of the minimum flow being reached. If the resource is to be reasonably utilised there needs to be tolerance of higher risk. With groundwater, the shortfall occurs as the season progresses. The availability can be determined at the start of the season and any shortfall calculated well in advance. It is a more reliable resource and has attracted higher investment dependent on this reliability. A higher reliability standard is set to meet this expectation, to be consistent with the reliability expected from storage/augmentation initiatives and to prevent groundwater irrigation becoming less desirable than surface water-fed systems.

The aim is to allocate surface water for land uses so that, on average, water can be taken 95% of the time in six years out of 10. This should cause little disruption to farm operations with the water shortage able to be addressed by on-farm management with no significant decrease in annual production potential. However, there will be three years out of 10 when restrictions are more significant and one year out of 10 when the river will be subject to a severe event when water can only be taken for 60% of the season. This severe event will cause a significant decrease in annual production potential. The amount of water that can be allocated to different land use activities to satisfy this reliability of supply varies. However, it

¹⁰⁴ **WQN1.57**

¹⁰⁵ Lincoln Environmental. (June 2001) Reliability of Supply for Irrigation in Canterbury. Prepared for Environment Canterbury U 01/1

is considered inappropriate to favour one activity above others. What Environment Canterbury has done, is select pastoral land use as the indicator land use. This affords arable farming with a better reliability of supply in this situation.

This reliability of supply approach is best applied where there is information on the flow duration of the individual river. The alternative is to derive the flow duration from knowledge of the 7DMALF (seven day mean annual low flow) and the river type. Environment Canterbury has a programme to develop this information.

Activities other than irrigation will have different reliability of supply characteristics. In the case of industry and municipal supply, the demand will extend over the whole year. These uses depend on a high level of reliability. Water will be needed for these activities at all times though it is likely that there will be seasonal peaks. For example, for municipal supply, per capita water use can double from winter to summer. This policy does not assure greater reliability for these activities, however, except that where a water permit is allocated for domestic or stockwater supply, that amount that is required for essential human and stock water purposes will be able to be taken even when the river is flowing below the minimum flow. If the resource is fully allocated, new or additional takes for essential uses, will not be able to seek water if this, in combination with the rest of the takes that are to be counted, increases the amount allocated to more than the allocation block limit.

Water demand for electricity generation also extends over the entire year. Electricity is demanded all year, with daily and seasonal peaks. Electricity generation can occur in a run of river situation (e.g. Montalto and Highbank stations on the Rangitata Diversion Race), but is more likely to involve storage. Where storage is involved, then nearly all flows in a catchment can contribute to and be utilised for electricity generation. Storage changes the reliability demanded to seasonal volumes rather than to the natural instantaneous flows of a river. The reliability of supply required for electricity generation is further complicated by the network of generation systems across the country. While the water that may fall within a catchment may be demanded for hydro- electricity generation, shortfalls in one catchment can be offset by generation elsewhere in the country, including by other methods of generation – up to a limit. The electricity market and strategic pricing of electricity can also be used to influence demand for electricity through encouraging efficient electricity use and tempering demand. Publicity and information on shortages can also affect demand. The reliability of supply of water demanded for hydro-electric power generation does not fit simply into the approach proposed for other uses. Hydro electricity is likely to demand water from all blocks. The water captured in a flood will be as valuable as the water available in a low-flow period. This points to the need for specific allocation strategies in catchments that involve storage of water for hydro-electricity power generation. This policy intends that specific strategies will be developed but provides an interim approach until this occurs. No specific priority is given to hydro electricity generation as a water use but the complications are recognised. These are addressed further in Policy WQN14(12).

Policy WQN14(5) provides the approach for establishing the interim allocation regimes for surface water that provide an A allocation block with the reliability of supply targeted in the preceding part of Policy WQN14. The process in Schedule WQN2 can be used to set these in most cases. Once this allocation block is fully utilised, new applicants will only be able to take from a block with a lower reliability of supply. A resource consent application to take water over and above the interim allocation block limit is included as a non-complying activity in the rules. It is intended that this make it clear that allocation of water in excess of the allocation block limit is generally not to happen. The exceptions will need to show that the reliability of supply targeted will not be compromised by the additional allocation of water sought. It may be that the interim allocation regime understates the amount that can be allocated, and that given specific data on the resource, a larger allocation block can be established. It is anticipated that Environment Canterbury will carry out this closer assessment for each river to establish an allocation block limit in Schedule WQN1. If an individual is able to do this sooner to a sufficient degree, and demonstrate that water is available, then a water permit may be granted. If they are not, then the activity should be

Methods

The methods used or to be used to implement Policy WQN14 are:

Method WQN14(a) Information and promotion

Environment Canterbury will:

- (a) ensure resource information is available by developing and maintaining:
 - (i) a register of the allocation status of surface water catchments or groundwater allocation zones for which flow and allocation regimes are set in Schedule WQN1 or WQN3, or can be determined using Schedule WQN2 or WQN4;
 - (ii) a data base of consents, that also records the total amounts of water allocated from each catchment or water resource; and
 - (iii) a register suitable for facilitating water permit transfers; and
- (b) making this information available for inspection at the Environment Canterbury offices in Christchurch and Timaru, and via the Environment Canterbury web site (www.ecan.govt.nz); and
- (c) produce information brochures, and as appropriate, work with district councils, landcare groups, Federated Farmers, industry, and other agencies to inform and promote:
 - (i) the importance of good practices in relation to water resources;
 - (ii) the availability of water within the allocation limits;
 - (iii) methods for monitoring water use;
 - (i) methods for improving efficient use; and
 - (ii) measures for transferring permits.

Method WQN14(b) Investigations

Environment Canterbury will:

- (a) investigate and determine seven day mean annual low flows for rivers and streams in the region from which water is taken or likely to be taken;
- (b) investigate whether allocation regimes can be established for aquifers more appropriately than by the approach set out in Policy WQN14(7). Where this can be established, revised groundwater allocation regimes will be incorporated into Schedule WQN3 by way of First Schedule processes.

Methods WQN14(c) Water users groups

Environment Canterbury will encourage the formation of water users groups to assist in achieving efficient and effective distribution and use of the water resource. There is opportunity to achieve best use of the available resource through water sharing and rostering, so that individuals can get some water for longer, during periods of restriction.

Method WQN14(d) Regional rules

Environment Canterbury will apply regional rules WQN1-WQN16, WQN19-WQN26 and WQN29-WQN30, and schedules WQN1 -WQN4 to manage the allocation of the region's water resources.

Method WQN14(e) Resource consents

Resource consents shall only be granted for takes where they are considered to be in accordance with Policy WQN14. (Note: a running total of the amount of water effectively allocated from within any allocation block will be maintained as per Method WQN14(a)(a)(i)).

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA,

and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.¹⁰⁶

Method WQN14(f) Review of permits

Environment Canterbury will review water permits in accordance with Section 128 of the RMA, when allocation regimes incorporated into Schedule WQN1 or Schedule WQN3 become operative, or at such later time as is specified in the schedules.

This review of water permits will be commenced within six months of the date when the Schedule WQN1 or Schedule WQN3 change become operative, or at such later time as is specified in the schedules.

In addition, where an interim groundwater allocation block has been determined in accordance with Schedule WQN4, Environment Canterbury may review consent conditions in order to assign annual volumes, determine stream depletion effects, to apportion the amounts that are to be allocated from surface and groundwater allocation blocks, and/or to require measurement and recording of water abstraction.

Where Environment Canterbury has determined to review water permits as above, notice will be served on holders of water permits affected.

Method WQN14(g) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

Method WQN14 (h) Environment Canterbury water allocation panel

Environment Canterbury will operate a water allocation panel to establish and review interim allocation block limits determined for surface water catchments or groundwater allocation zones via Schedule WQN2 or Schedule WQN4. The water allocation panel shall be responsible for determining the allocation block limits and for reviewing these when additional information becomes available that may justify change. Where a change to the allocation block limit is found to be appropriate, the water allocation panel shall direct that the register be changed and the web site be updated.

Policy WQN15 Bores to adequately penetrate the aquifer

- (1) **Enable full access to the available groundwater resource, and minimise interference effects between bores by encouraging new and existing shallow bores to adequately penetrate the aquifer from which water is to be taken.**
- (2) **An adequate penetration depth for a bore shall be determined as follows:**
 - (a) **where the aquifer is included in Schedule WQN3, it shall be the depth specified in the schedule; or**

¹⁰⁶ GEN1.102, WQN1.7, WQN1.16, WQN1.140

Methods

The methods used or to be used to implement Policy WQN18 are:

Method WQN18(a) Investigations

Environment Canterbury will undertake investigations to identify water bodies or parts of water bodies within which transfer of permits may occur and include them in Schedule WQN5.

Method WQN18(b) Regional rules

Environment Canterbury will apply Regional Rule WQN33 to manage the transfer of water permits. This allows for surface water take permits to be transferred as a permitted activity within transfer zones that have been identified in Schedule WQN5.

Method WQN18(c) Resource consents

Resource consents may be granted for the transfer of water permits.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.¹⁰⁸

¹⁰⁸ GEN1.102, WQN1.7, WQN1.16, WQN1.140

5.5.7 Water Restrictions

Issue WQN6 Water allocation during restrictions

- (1) During periods when the allocated amounts of water are not available from a water body to meet the needs of all individual water permit holders, water restrictions need to be applied in a manner that is practicable and fair to all users.
- (2) For public reticulated water supply systems that supply more than domestic and stock water, e.g. industrial and commercial uses, there is difficulty in applying restrictions. This creates inequities between urban and industrial activities that may be able to carry on using water, and irrigators who have to cease abstraction when the minimum flow or level is reached.
- (3) Abstractions of water for a person's reasonable domestic needs and the reasonable drinking water needs of their stock are enabled by the Resource Management Act provided they do not have an adverse effect on the environment (Section 14). Matters for consideration are the point at which these takes are likely to have or do have an adverse effect and the amount of water that may remain unrestricted

Objective WQN6 Equitable application of water restrictions

- (1) To achieve a practical and fair sharing of water during periods when there are restrictions on the taking of water.
- (2) To ensure restrictions on individual and community domestic and/or stock water supplies minimise adverse effects on any river flow or water level regimes set to help achieve Objective WQN1 or Objective WQN2.

Explanation and principal reasons

There will be times when there is insufficient water in water bodies to maintain minimum flows or flow regimes and to satisfy the needs of abstractors. At these times, there will need to be a rationing of the water resource that is available above the minimum flow or level or the flow regime. This needs to be fair and equitable for all abstractors, able to be clearly understood and simple to implement.

Policy WQN19 Restriction of water use during times of low water availability

- (1) Unless an alternative approach has been set out in Schedule WQN1 for rivers and streams, takes from surface water, or takes from groundwater that are classified as having a high or moderate degree of hydraulic connection to a surface water body as set out in Policy WQN8 and that are above the cut-off limit, will be restricted on a pro rata or step basis depending on the location of the monitoring site:
 - (a) the pro rata approach will be preferred when the minimum flow site is upstream of takes and the flow at this site reaches the minimum flow plus the allocation limit (but this may be implemented by an operating schedule); and
 - (b) the step approach will be preferred where the monitoring site is downstream of the takes.
- (2) For takes from groundwater that are classified as having a high or moderate

Policy WQN19(5) provides for water being taken for fire-fighting as of right at any time. Providing there are no adverse environmental effects, water may be taken for an individual's reasonable domestic needs, or the reasonable needs of an individual's animals for drinking water. It is intended that these should have priority when restrictions commence.

Policy WQN19(6) provides that when the minimum flow is reached and takes are required to cease there will be a tolerance for takes that supply domestic, stockwater and fire-fighting uses. The tolerance is specified in the policy. For community water supplies, particularly those that leak a significant percentage of what they take, an allowance needs to be made, in the first instance, to provide time for remedial action to be taken. It is envisaged that district councils will need to programme expenditure into Environment Canterbury's Community Plan to do this (see Method WQN17(a)).

Policy WQN19(7) provides for an alternative to restricting essential takes during periods of full restriction as prescribed in policy WQN19(6). If the supply agency has a water supply asset management strategy that appropriately restricts the use of water at times of low water availability, then this will be acceptable. This alternative may be secured as a condition of consent.

Methods

The methods used or to be used to implement Policy WQN19 are:

Methods WQN19(a) Information and promotion

Environment Canterbury will produce information brochures and make that information available via media such as pamphlets and newsletters and, as appropriate, work with territorial authorities, landcare groups, federated farmers, water users¹⁰⁹ groups, industry and other agencies to provide:

- (a) seasonal outlook and resource status reports at the beginning of the irrigation season and at regular intervals if drought conditions develop;
- (b) river flows and groundwater levels and restriction status of water bodies through the Environment Canterbury website (www.ecan.govt.nz), newspapers, and flow phone (083 22 55 22); and
- (c) information on methods and land-use practices to mitigate the effects of droughts on water dependent activities.

Method WQN19(b) Investigations

Environment Canterbury will investigate and monitor groundwater use and trends in groundwater levels to determine whether there is a need for an allocation and restriction regime.

Methods WQN19(c) Transfer of water permits

Environment Canterbury will investigate, and where suitable, develop systems to allow the temporary transfer of water permits where this enables access to water during restrictions without compromising the minimum flows/levels or other users' access to the restricted resource.

Methods WQN19(d) Water users¹¹⁰ groups

Environment Canterbury will encourage and, where appropriate, oblige the formation of water users groups to assist in achieving effective distribution and use of the resource during periods of water shortages. Water users¹¹¹ groups are groups of abstractors who, with the

¹⁰⁹ WQN1.27

¹¹⁰ WQN1.27

¹¹¹ WQN1.27

agreement of Environment Canterbury, have formed to share or roster available water during times of shortage.

Methods WQN19(e) Regional rules

Environment Canterbury will apply regional rules WQN2-WQN3, WQN5-WQN11, WQN14-WQN16, WQN19-WQN23, WQN27-WQ28 and WQN30-WQN31 to implement this policy.

Methods WQN19(f) Resource consents

Environment Canterbury will, when granting or reviewing resource consents, include conditions that will require takes to reduce and cease under certain conditions. These shall be in accordance with restriction rules that apply to the water body concerned, where they have been set and otherwise will be determined through the consent process.

Methods WQN19(g) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

Policy WQN20(f) defines bores with an existing authorisation. Not all existing bores are currently used or able to be used (some have had casing removed, for example), and not all existing bores currently in use, are used for abstractive purposes. Those bores for which there are existing water permits, either through an operative permitted activity rule or a resource consent for the taking of groundwater for any abstractive use, will be included in the term. In addition, bores that are used for water level observation and water quality monitoring will also be included, and will have protection under this policy.

Methods

The methods used or to be used to implement Policy WQN20 are:

Method WQN20(a) Information and promotion

Environment Canterbury will produce information and make that information available via media such as pamphlets and newsletters to landcare groups, Federated Farmers, water users¹¹² groups, industry and other agencies to provide:

- (a) technical understanding or knowledge of the groundwater resource including water levels and adequate penetration depths; and
- (b) methods for assessing the effects of interference between bores.

Method WQN20(b) Regional rules

Environment Canterbury will apply regional rules WQN13–WQN16 and WQN19–WQN23 for the development and abstraction of groundwater. These include standards or assessment criteria intended to address the interference effects of between bores.

Method WQN20(c) Resource consents

Resource consents for the taking of groundwater shall only be granted where they are in accordance with Policy WQN20.

Environment Canterbury has developed a number of guidelines dealing with specific aspects of assessment and audit of proposals to take groundwater. These include a guideline for assessing the effects of interference between bores. A copy of this guideline can be obtained from Environment Canterbury to help in preparing an assessment of environmental effects. These are refined in response to use, and are periodically updated.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.¹¹³

Method WQN20(d) Compliance and enforcement

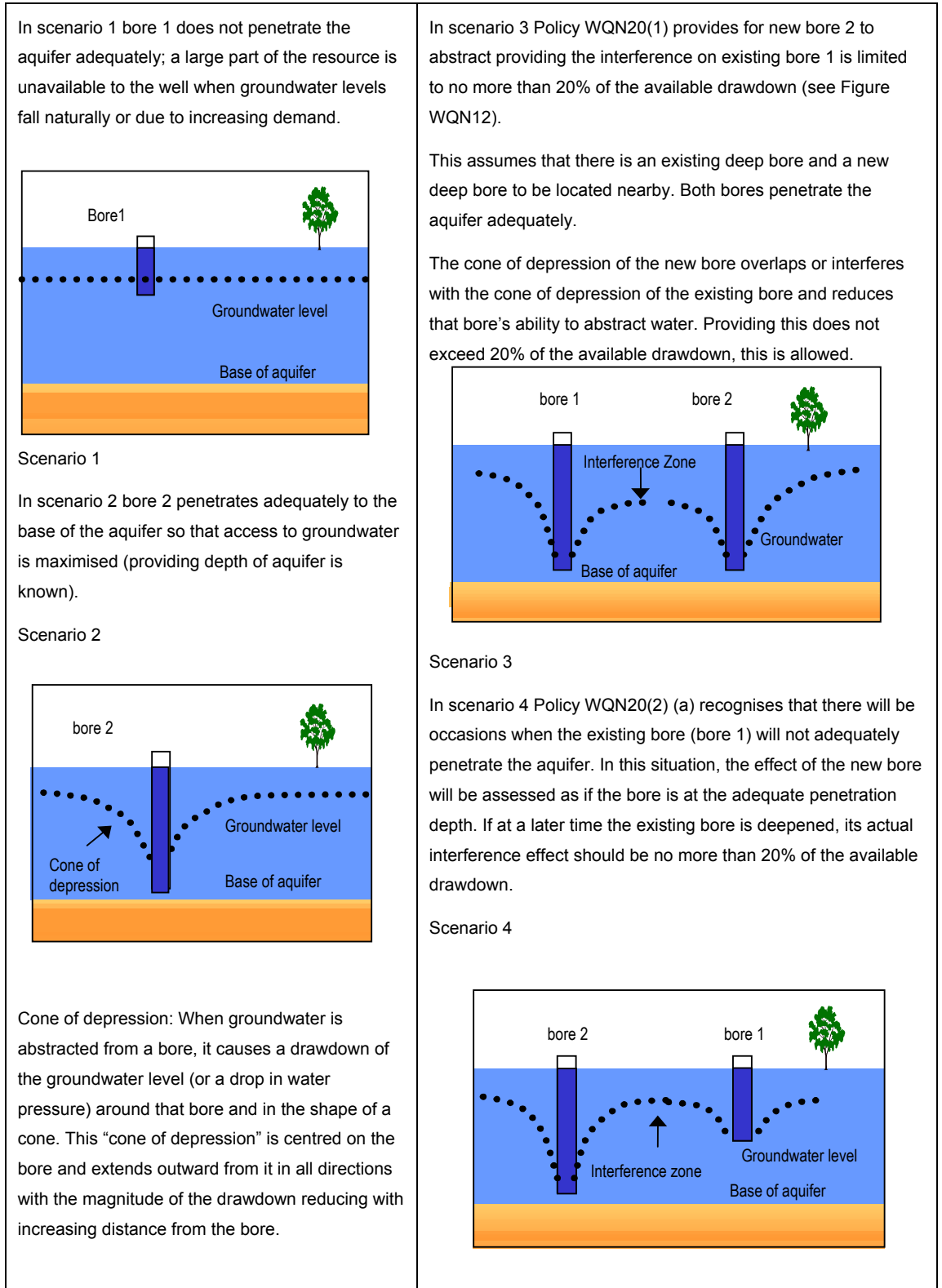
Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

¹¹² **WQN1.27**

¹¹³ **GEN1.102, WQN1.7, WQN1.16, WQN1.140**

Figure WQN7: Illustration of adequate and inadequate penetration of the aquifer and of bore interference



distribution and use of the water. Also, the effects of any augmentation on the environment and on Ngāi Tahu values must be established and measures to avoid, remedy or mitigate these must be determined. Effects on the values listed in Objective WQN1(a) to (h) must be addressed. Any effects on water quality through the storage and/or diversion and discharge of water will need to be assessed and will need to be considered in relation to objectives and policies in Chapter 4.

Policy WQN21(2) requires that the effects on any established allocation regime be identified along with the measures that may be required to accommodate these.

It is not fair to disadvantage existing water users from having access to the same amount and reliability of water that would have been available to them under a non-augmented regime, if they are not participants and beneficiaries of the augmentation scheme. Environment Canterbury's intention is to ensure an equitable treatment of parties where augmentation is proposed.

Policy WQN21(3) recognises that where augmentation does occur it is appropriate that those who contribute to its development and operation should be the main ones to benefit, after the effects on the water body are mitigated.

Policy WQN21(4) allows that there may be occasions where it is appropriate to allow the taking or diversion of water to continue below the minimum flow to augment another water body. This may occur where the environmental cost to the source river is less than the environmental gain to the receiving water body, i.e. there is a significant net environmental benefit across both water bodies. The minimum flow should not be compromised in the source water body if the water is to augment flows for out-of-stream use.

Policy WQN21(5) recognises that there may be justifications for Environment Canterbury to provide financial support for augmentation proposals. This would only be where the augmentation is intended for environmental purposes, e.g. to enhance a degraded water body or reinstate a wetland (see Wetland Chapter).

Methods

The methods used or to be used to implement Policy WQN21 are:

Method WQN21(a) Information and promotion

Environment Canterbury will make available data and information that will assist studies looking at augmentation options.

Method WQN21(b) Regional water distribution strategy

Environment Canterbury will participate in studies that contribute to an overall regional water distribution strategy that could lead to optimal distribution of the region's water.

Method WQN21(c) Financial incentives and assistance

Environment Canterbury may provide financial resources to support augmentation proposals for environmental purposes.

Method WQN21(d) Regional rules

Rules for damming, diverting, taking, and using water may apply depending on the nature of the augmentation. Specific assessment criteria are included for damming proposals in regional rules WQN9-WQN10, WQN22, WQN29-WQN30, WQN32 and WQN41-WQN42. Regional Rule WQN43 prohibits damming in the main stem of high naturalness water bodies. Discharge rules included in Chapter 4 may also apply.

Method WQN21(e) Resource consents

Resource consents will be required for all augmentation proposals except where they are minor and are solely for environmental enhancement purposes. The assessment criteria set out in Rule WQN41 indicate the matters that Environment Canterbury will require to be

provided with any resource consent application involving damming in order to provide augmentation.

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.¹¹⁴

Method WQN21(f) Compliance and enforcement

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

¹¹⁴ GEN1.102, WQN1.7, WQN1.16, WQN1.140

5.8 Duration of resource consents

When considering the duration of any permit to take, use, dam or divert water, or heat and energy from water, or heat and energy from the material surrounding any geothermal water, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Chapter 1, Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8.1 below.

The examples of consent durations below are guidelines only. The maximum term that can be granted for a water permit under the RMA is 35 years. Any person is entitled to apply for a different consent duration to those specified in the tables set out in these guidelines. The Council retains its discretion to grant consents for any duration up to 35 years, subject to the rights of appeal provided for under section 120 of the Resource Management Act 1991.

5.8.1 Water permits

Table WQNxx : Guidelines for consent duration of water permits

<u>Level of knowledge of the resource</u>	<u>Sensitivity of the environment to the activity</u>		
	<u>Low</u>	<u>Moderate</u>	<u>High</u>
<u>Low</u>	<u>Up to 10 years</u>	<u>Up to 7 years</u>	<u>Up to 5 years</u>
<u>Moderate</u>	<u>10 – 15 years</u>	<u>Up to 10 years</u>	<u>Up to 7 years</u>
<u>High</u>	<u>15 – 35 years</u>	<u>10 – 15 years</u>	<u>Up to 10 years</u>

In terms of Table WQNxx, the consent authority will use as many of the criteria listed below that are relevant to the particular circumstances of a take, use, dam or diversion of water to determine **the sensitivity of the receiving environment.**

The consent authority may also consider any other matter which, in its opinion, is relevant to the determination of the sensitivity of the receiving environment.

<u>Classification</u>	<u>Criteria</u>
<u>Low</u>	<ul style="list-style-type: none"> • <u>The activity is of a temporary or short-term nature, e.g. bore development and pumping tests, site de-watering;</u> • <u>In terms of the potential for cumulative effects:</u> <ul style="list-style-type: none"> a) <u>the activity will have no or only a minimal effect on an allocation block;</u> b) <u>there is water available within allocation blocks set in either Water Conservation Orders , or Schedules WQN1 and WQN3;</u> c) <u>monitoring of the water taken or diverted will be carried out in accordance with Schedule WQN13.</u> • <u>For an application for a water permit to take and use groundwater:</u> <ul style="list-style-type: none"> a) <u>the activity will be consistent with Objective WQN3;</u> b) <u>the majority of existing water permits in the same allocation block:</u> <ul style="list-style-type: none"> i) <u>have annual volumes fixed in the conditions of the water permit</u>

	<p>according to Policy WQN14(6);</p> <ul style="list-style-type: none"> ii) <u>have been assessed for stream depletion effects according to Policy WQN8, and if appropriate, have restrictions on the taking of groundwater according to Policy WQN19 fixed in the conditions of the water permit; and</u> c) <u>the bore or gallery from which the water is to be taken complies with Schedule WQL4 “Standards and Terms for the construction and maintenance of bores and water infiltration galleries”;</u> d) <u>the proposed new take is not classified as having a high or moderate degree of hydraulic connection with a surface water body according to Policy WQN8;</u> e) <u>the proposed new take would meet the criteria in Policy WQN20 in terms of the direct cumulative interference effects not exceed more than 20% of the available drawdown in any other bore with an existing authorization that is within two □ characteri.</u> <ul style="list-style-type: none"> • <u>For an application for a water permit to divert, take or use surface water:</u> <ul style="list-style-type: none"> a) <u>the activity will be consistent with Objective WQN1;</u> b) <u>the majority of existing water permits in the same allocation block have the period of abstraction fixed on the consent;</u> c) <u>the take or diversion will be reduced and shall cease in accordance with Schedule WQN1, except for that part of the take which is needed for essential domestic and stock water supplies. Refer to Policy WQN19 and Schedule WQN11;</u> d) <u>the measures set out in Schedule WQN12 “Fish screen standards” will be used to prevent fish entering the water intake;</u> e) <u>the take or diversion is not from a natural state water body listed in Schedule WQN5, or from any wetland listed in Schedule WTL1: or assessed in accordance with Appendix WTL1 as of moderate and higher significance.</u>
<p><u>Moderate</u></p>	<ul style="list-style-type: none"> • <u>In terms of potential for cumulative effects.</u> <ul style="list-style-type: none"> a) <u>there is water available within the allocation blocks as determined using Schedules WQN2 and WQN4;</u> b) <u>the monitoring of the water taken or diverted will be carried out as set out in Schedule WQN13.</u> • <u>For an application for a water permit to take and use groundwater:</u> <ul style="list-style-type: none"> • <u>the minority of existing water permits in the same allocation block have annual volumes fixed in the conditions of the water permit.</u> • <u>a desktop assessment of stream depletion effects has been carried out by applying Policy WQN8; and this assessment has been used to determine the annual volume that is to be allocated from the groundwater allocation block by applying Policy WQN14(6)(b);</u> • <u>the bore or gallery from which the water is to be taken may not comply with Schedule WQL4 “Standards and Terms for the construction and maintenance of bores and water infiltration galleries”, but any potential adverse effects will be avoided or mitigated by use of measures that meet Policy WQL10(3) and Policy WQN11(7);</u> • <u>the proposed new take is:</u>

	<ul style="list-style-type: none"> i) <u>classified as having a high or moderate degree of hydraulic connection with a surface water body according to Policy WQN8; and</u> ii) <u>will be subject to conditions to give effect to Policy WQN19.</u> • <u>the proposed new take may directly affect one or more neighbouring bores in excess of the criteria in Policy WQN20, but this effect will be avoided or mitigated in a way that Policy WQN20(1) is met.</u> • <u>For an application for a water permit to divert, take or use surface water:</u> <ul style="list-style-type: none"> a) <u>the minority of existing consents in the same allocation block have a period of abstraction fixed in the conditions of the water permit;</u> b) <u>the take or diversion will be reduced and shall cease in accordance with minimum flow requirements in Appendix WQN2 or as recommended following a technical panel assessment undertaken, except for that part of the take which is needed for essential domestic and stock water supplies (refer to Policy WQN19 and Schedule WQN11);</u> c) <u>the measures to prevent fish from entering a water intake may not comply with Schedule WQN12 “Fish screen standards”, but other measures can be used to prevent fish from entering the intake;</u> d) <u>the take or diversion is not from a natural state water body listed in Schedule WQN5, or from any wetland listed in Schedule WTL1 or assessed in accordance with Appendix WTL1 as of moderate or higher significance.</u>
<p>High</p>	<ul style="list-style-type: none"> • <u>In terms of potential for cumulative effects,</u> <ul style="list-style-type: none"> a) <u>the allocation block, determined by the approach set out in Schedules WQN2 and WQN4, is fully allocated;</u> b) <u>the monitoring of the water taken or diverted will not be carried out as set out in Schedule WQN13, but by some other means that may at times not meet the requirements of Policy WQN16.</u> • <u>Where the adverse effects will be more than minor and the proposal may not adequately remedy or mitigate them.</u> • <u>For an application for a water permit to take and use groundwater:</u> <ul style="list-style-type: none"> a) <u>the minority of existing consents have annual volumes fixed in the conditions of the water permit, and where stream depletion assessments have not been carried out for the allocation zone;</u> b) <u>the bore or gallery from which the water is to be taken may not fully comply with Schedule WQL4 “Standards and Terms for the construction and maintenance of bores and water infiltration galleries”, however</u> <ul style="list-style-type: none"> i) <u>any potential adverse effects that may arise from this will be avoided or mitigated by use of measures that met Policy WQL10(3) and Policy WQN11(7); and</u> ii) <u>will require on-going monitoring to ensure the proposed mitigation is effective;</u> <ul style="list-style-type: none"> ○ <u>the proposed new take is classified as having a high or moderate degree of hydraulic connection with a natural state or high naturalness water body, or with a wetland listed in Schedule WTL1, according to Policy WQN 8;</u> ○ <u>the proposed new take may directly affect one or more neighbouring bores in excess of the criteria in Policy WQN20, however, this effect will be avoided or mitigated such that Policy WQN20(1) is met, and will require on-going monitoring to ensure the proposed measures are</u>

	<p><u>effective;</u></p> <ul style="list-style-type: none"> ○ <u>the proposed new take only meets Policy WQN11, Policy WQN12 or Policy WQN13 on the basis of proposed mitigation that will require on-going monitoring to ensure the proposed mitigation is effective.</u> • <u>For an application for a water permit to divert, take or use surface water</u> <ul style="list-style-type: none"> e) <u>the take or diversion is in or affects a natural state or high naturalness water body, or a wetland listed in Schedule WTL1;</u> f) <u>the take or diversion is likely to have an adverse effect on values of significance to Ngai Tahu but this effect can be mitigated or remedied to the satisfaction of Ngai Tahu;</u> g) <u>the take or diversion is potentially able to reduce the flow in a surface water body in the immediate vicinity to a level that may cause adverse effects on instream values that are more than minor;</u> h) <u>the minority of existing water permits in the same allocation block have the period of abstraction fixed in the conditions of the water permit;</u> i) <u>the take or diversion will be reduced and shall cease in accordance with minimum flow requirements in Appendix WQN2 or as recommended following a technical panel assessment undertaken, except for that part of the take which is needed for essential domestic and stock water supplies (refer to Policy WQN19 and Schedule WQN11);</u> j) <u>The measures to prevent fish from entering a water intake may not comply with Schedule WQN12 "Fish screen standards". Other measures, however can be used to prevent fish from entering the intake, but these will require on-going monitoring to ensure that they are effective;</u>
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In terms of the Table WQNxx, the level of knowledge of the resource relates to the existence or otherwise of any flow, level and allocation regimes for the water body affected by an activity; and the level of certainty associated with the estimate of how much of the allocation block is already allocated. The level of knowledge of the resource is characterized by the following attributes:

- a) **Low** is where there is little or no recorded information on the water body, and its hydrological, physical and ecological relationships and values are poorly understood.
 - i) For surface water bodies, this would include:
 - 1) rivers for which no minimum flows have been set (the water body is not included in Appendix WQN2) and for which no allocation regime is able to be set using Schedule WQN2, or
 - 2) rivers for which there are existing minimum flows included in Appendix WQN2 but for which no allocation regime is able to be set using Schedule WQN2.
 - ii) For groundwater resources, this would include:
 - 1) areas outside of any groundwater allocation zone,
 - 2) from within a groundwater allocation zone and where the interim allocation regime is determined using the Schedule WQN4(b) approach; or

- 3) any areas of geothermal water
- b) **Moderate** where there is a level of recorded information on the water body, and its hydrological, physical and ecological relationships and values are known to the extent that:
 - i) for groundwater, there is an interim allocation regime determined for the groundwater allocation zone using the Schedule WQN4(a) approach;
 - ii) for surface water bodies, this would include:
 - 1) rivers for which there are existing minimum flows in Appendix WQN2 and an allocation regime is able to be set using Schedule WQN2, or
 - 2) rivers for which there has been a technical panel assessment undertaken.
- c) **High** where there is a level of recorded information on the water body, and its hydrological, physical and ecological relationships and values are known to the extent that:
 - i) for groundwater, where there is an allocation regime set for the groundwater allocation zone in Schedule WQN3.
 - ii) for surface water, this would include rivers for which there is an environmental flow and allocation regime set in Schedule WQN1;

5.8.2 Land use consents

The only land use activities covered by rules in this chapter relate to planting new areas of plantation forest in flow-sensitive catchments. Because of the length of rotation in plantation forestry (commonly 28 years) and because these activities can be for an unlimited duration, unless otherwise specified in the consent, no specific guidance is provided here for limiting the duration of resource consents granted for these activities.

5.9 Common expiry and review dates of resource consents

When considering the duration of any water permit, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, but retain the discretion to set common expiry and review dates having particular regard to Section 1.3.5 and to the following matters:

- (a) Where permit holders in a catchment or sub catchment wish to collaborate and prepare a joint assessment of environment effects that considers the cumulative effects of all takes within their area.
- (b) Where permit holders agree that it is more cost effective and efficient to prepare one assessment of environment effects and to share the cost between consent applicants.
- (c) Where the cumulative effects of the diverting, damming, taking and using of water, in combination with other activities, is not well understood and some time is needed to gather more information before reconsidering whether the activities should continue and to the same degree.
- (d) If a water permit is sought within five years of a common expiry date, the expiry date may be set on the following common expiry date, and a review of permit conditions under s 128 on the earlier date.
- (e) Where there are other water permits already existing that are related to the same property.

- (f) The demand on the Council's administrative resources and the practicability of processing renewals for water permits within the statutory time frames set by the RMA 1991.¹¹⁶

¹¹⁶ GEN1.102, WQN1.7, WQN1.16, WQN1.140

5.12.5 Implementation of the plan

A review of the plan's policies, rules and other methods must be undertaken, and be made publicly available at least every five years. The review will consider effectiveness and efficiency of policies, rules and other methods, and include such matters as practicality, cost-effectiveness, and the extent to which they address impacts on water quality, aquatic ecosystems and instream values

Table WQN7: Monitoring effectiveness and efficiency of policies, rules and other methods




Plan implementation	Criteria for assessment	Method of assessment	Reporting
Policies	The extent to which policies in the plan provide guidance for the interpretation of rules Activities or issues that affect water quantity and that are not covered by plan policies	Feedback from Environment Canterbury staff Evaluate the extent to which policies guided decisions on a selection of applications or resource consents for damming, diverting and taking of surface water, and the taking of groundwater	A report every three years
Advocacy	Environment Canterbury's point of view as expressed formally in meetings, hearings, or correspondence		A report every three years
Information and promotion	Awareness of, and extent to which, relevant guidelines for assessment of potential adverse effects of proposals are being used Information is published or has been disseminated	Survey of water permit holders to determine the appropriateness of brochures and guidelines available	A report every three years
Investigations	The extent to which investigations identified in this chapter have been initiated or completed	Review of projects in the Environment Canterbury Annual Plan A project has been initiated, staff time or resources allocated to undertake or support the work Publication of progress report or a completed technical report or paper	Annual progress reports Final report presenting the results of the investigation
Non-statutory strategies	The extent to which non-statutory strategies identified in this chapter have been initiated or completed	Review of non-statutory strategies in the Environment Canterbury Annual Plan Record of non-statutory strategies that have been initiated, staff time or resources allocated to undertake or support the work Publication of and acceptance of non-statutory strategy by those affected	A report every three years
Resource care initiatives	The extent to which such initiatives are tied with general progress in specific catchments relating to water quantity issues	Record of activities or initiatives undertaken by local groups Annual plan reporting	A report every three years

Plan implementation	Criteria for assessment	Method of assessment	Reporting
Water users ¹²⁰ groups Woolston/Heathcote water users group	The extent to which water users ¹²¹ groups are involved in co-ordinating abstractions at times of restrictions, and the extent of compliance with restrictions when such groups are involved	Compliance with consent conditions at times of restrictions Record of active water users groups in the region	Annual resource report to group prepared by Environment Canterbury
Woolston/Heathcote groundwater management strategy	The extent to which current groundwater abstractions affect the trigger levels set in Policy WQN10 (which is effectively the current management strategy)	Monitoring of groundwater levels in trigger well Variation sought to adjust Policy WQN10 if required	Users group meeting minutes
Regional water distribution strategy	The extent to which such a strategy has been initiated or completed	Annual plan reporting	Annual plan report
Water audits	The extent to which water audits are carried out, either as a result of voluntary actions (including as a result of a water users group action), or to comply with water permit conditions	Compliance with consent conditions Publication of a guideline for carrying out water audits by Environment Canterbury	Environment Canterbury annual compliance monitoring report Compliance monitoring reports
Regional rules	The extent to which activities comply with conditions or standards and terms The practicality, enforceability, and relevance of conditions or standards and terms The extent to which the conditions or standards and terms address adverse effects of the activity on water quantity, aquatic ecosystems and instream values Ease of use and consistency of interpretation	A review of monitoring of compliance with permitted activities and enforcement of unauthorised activities Feedback from Environment Canterbury staff about the effectiveness and practicality of the conditions or standards and terms in the rules of this chapter	Compliance monitoring reports As specified in Tables WQN3, WQN4, WQL4, WQL5 and WQL6
Resource consents	Frequency of standard conditions for a particular activity The extent to which the specific effects caused by a type of activity are addressed by the consent The extent to which a consent application identifies potential adverse effects and proposes measures to avoid, mitigate or remedy the effects Compare predicted adverse effects against the results of monitoring Applicant satisfaction with consent processing, including time and cost The extent to which the application is assessed against the objectives and policies of the plan The practicality, enforceability, and relevance of the consent conditions	A selection of at least three applications and consents for at least five activities requiring a water permit Compliance and enforcement monitoring Monitoring of anticipated environmental results The results of Environment Court decisions Survey of consent holders	A report every three years Compliance monitoring reports As specified in Tables WQN3, WQN4, WQL4, WQL5 and WQL6
Compliance and enforcement	Frequency of non-compliance and complaints for specific activities, in particular for breaches of low flow or level restriction conditions	Compliance and enforcement monitoring	Compliance monitoring reports Annually in the Environment

¹²⁰ WQN1.27

¹²¹ WQN1.27

Catchment/Area	Catchment Number	Water Resource/ minimum flow site	Map Reference	Minimum Flow l/s	Principal minimum flow site for determining Schedule WQN2 interim allocation regime	Date Set	Plan / Consent
		South Opuha at Clayton Rd Bdg (Monument Bdg)	J37:373-882	500	Opihi at State Highway 1	1998	CRC990306
		Station Creek at Clayton Rd	J37:385-906	140	Opihi at State Highway 1	2000	CRC000486
		Unnamed trib. Opihi River At Lyon prop. (T1/T2 confl.)	J38:549-657	50	Opihi at State Highway 1	1999	CRC990327
Pareora	7010000						
	7010000	Pareora River At Mt Horrible Recorder site	J39:553-423	300	√√√	1992	CRC921501
Waimate	7080100						
	7080100	Waimate Creek At Kirks prop.	J40:526-077	15	√√√	1998	CRC981312
	7080200	Sir Charles Creek At Haymans Rd Bge	J40:6431-0488	100	√√√	1998	CRC981741
Waihao	7090000						
	7090000	Waihao River At McCullochs Bge	J40:497-989	250	√√√	1983	SCY780200
	7090000	Waihao River At McCullochs Bge	J40:497-989	"B" permit - 400	√√√	2000	CRC991829
	7090110	Buchanans Creek at Fletchers Bridge	J40:630-019	112	√√√	1998	CRC972243
	7090500	Waihao River - South Branch At Waihaorunga		"B" permit - 90	Waihao River At McCullochs Bge	2000	CRC991829
Waitaki	7110000						
	711810	Mary Burn At SH 8 ??? Irishman Creek	H38:960-669	Oct - Apr 170 (2002 - 2003) 210 (2003 - 2004) 250 (2004 - 2005) 290 (2005 - 2006) May - Sep 1000	Waitaki River At Waitaki Dam	1987 1998 2002	WTK872481A-C CRC981958 CRC011554
	7116830	Temple Creek immediately below intake	H39:7488-4417	40	Waitaki River At Waitaki Dam	2004	CRC020364
		Twizel River * d/s of DoC diversion	H38:770-660	500	Waitaki River At Waitaki Dam	1999	CRC990007

Catchment/Area	Catchment Number	Water Resource/ minimum flow site	Map Reference	Minimum Flow l/s	Principal minimum flow site for determining Schedule WQN2 interim allocation regime	Date Set	Plan / Consent
	7116600	Ōhau River At Lake Outlet	H38:661-536	May – Oct 8000 1Nov – Apr 12000	Waitaki River At Waitaki Dam	1991	CRC905330
	7113720	Wairepo Water Race at Benmore/Willowburn bndry	H39:701-430	30	Waitaki River At Waitaki Dam	1994	CRC940233B
	7113720	Barclays Creek At Glenbrook/Benmore bndry	H39:755-468	30	Waitaki River At Waitaki Dam	1994	CRC940428C
	7116100	Coal Creek At Falconer prop.	H39:873-348	50 Coal Creek	Waitaki River At Waitaki Dam	2000	CRC001119
	7116100	Shepards Creek At Falconer prop.	H39:858-354	70 Shepards Creek	Waitaki River At Waitaki Dam	2000	CRC001119
Ahuriri	7115000	Ahuriri River At South Diadem recorder site	G39:497-320	10000 1 Feb – 30 Apr 12000 1 May – 1 Jan	Ahuriri Water Conservation Order	1990	National Water Conservation (Ahuriri River) Order 1990
	7115100	Omarama Stream At Omarama Stn Bge	H39:678-306	500 1Nov – 30 Apr 1200 1May – 31 Oct	Ahuriri Water Conservation Order	1990	National Water Conservation (Ahuriri River) Order 1990
	7115100	Omarama Stream At Tara Hills	H39:624-260	250 1Nov – 30 Apr 750 1May – 31 Oct	Ahuriri Water Conservation Order	1990	National Water Conservation (Ahuriri River) Order 1990
	7113600	Hen Burn * At Munro prop. Hen Burn at Sutherland property	H39:633-335 H39:5591-3419	Same as Ahuriri 20	Ahuriri Water Conservation Order	1972 (2000) 2002	WTK710026 (CRC001096) CRC020508
	7111700	Awahokome	140:0350-1000	Oct – Apr 50 May – Sep 100			
	7111500	Awakino River at SH83	140: 0713-0873	Oct – Apr 170 May – Sep 210		2000	CRC000668
Hakataramea	7111400	Hakataramea River At SH82	140:112-062	500		1991	CRC916726
	7111410	Padkins Creek Hakataramea River At SH82	140:112-062	500	Hakataramea River At SH82	1994	CRC950409
	7111415	Farm Stream trib. Padkins Ck d/s of dam Hakataramea River At SH82	140:114-165	500	Hakataramea River At SH82	1996	CRC961543
	7111450	McKays Stream At confl. Hakataramea R	139:237-239	30	Hakataramea River At SH82	1990	CRC895057B

	Catchment/Area	Catchment Number	Water Resource/ minimum flow site	Map Reference	Minimum Flow l/s	Principal minimum flow site for determining Schedule WQN2 interim allocation regime	Date Set	Plan / Consent
		7110400	Maerewhenua River * At Kellys Gully	I41:197-820	400	√√√	1999	CRC992096
		7110400	Corrigal's Drain	I40:269-923	100	√√√	2000	CRC001203
	Otiake	7111010	Lone Creek	I40:092-930	50	√√√	1970	WTK-698411 CRC001010
		7111100	Malcolm's Creek (tributary)	I40:0774-9664	15	√√√	2004	CRC011285
		7110100	Waikakahi Stream At Glenavy Tawai Rd	J41:571-871	210	√√√	1996	CRC961014
		7110100	Waikakahi Stream At Old Ferry Rd Bge	J41:547-890	200	Waikakahi Stream At Glenavy Tawai Rd	1986	WTK860131A
		7110150	Whitney's Creek	J41:639-869	10	√√√	1999	CRC000598
		7110000	Waitaki River At State Highway One	I40:079-988	80000	√√√	1990	Draft mainstream flow allocation policy for the Waitaki Catchment — adopted by CRC 2/11/90
		7110000	Waitaki River At Waitaki Dam	I40:060-101	120000	Waitaki River At Waitaki Dam	1988 1990	Draft mainstream flow allocation policy for the Waitaki Catchment — adopted by CRC 2/11/90 CRC905360
127	Lake Aviemore		Lake Aviemore Fish Spawning Race	I40:002-134	300	√√√	1991	CRC905356

¹²⁷ WQN1.57

Appendix WQN3: Water conservation orders

To be inserted when the NRRP is operative to assist in water management.

Technical efficiency * means using a resource in a way that any given output is produced at least cost, including avoiding waste. This contrasts with 'allocative efficiency' which means obtaining the best use for the resource.
Territorial authority ³² means a city council or a district council.
Timber preservative means any chemical used to treat timber and includes: copper/chromium/arsenic formulations, boron, light organic solvent preservatives and anti-sapstain chemicals.
Topsoil means the upper layer or layers of soil.
Transpiration in vegetation is the loss of water vapour through the stomata on the leaves.
Trigger flow means a flow higher than the minimum flow at which abstractive uses may be required to reduce their take in order to share the water that is available and to sustain instream flows.
Trigger level means a specified groundwater level used to indicate capacity remaining in an aquifer or to indicate actions by users will be needed.
Unconfined aquifer means an aquifer that lacks an overlying layer of fine sediment, and is not under pressure. The water level in a well is the same as the water table outside the well.
Unitary authority means an authority with the functions of both a territorial authority and a regional council.
Upconing – process by which saline water underlying freshwater in an aquifer rises upward into the freshwater zone as a result of pumping water from the freshwater zone.
Vegetation clearance is the removal of vegetation by physical, mechanical, chemical or other means, except burning by fire . Burning of vegetation in the hill and high country is subject to Part IV of the Land and Vegetation Management Regional Plan. ³³
Vegetation includes all plants and the produce thereof, live or dead, standing, fallen, windblown, cut, broken, pulverised, sawn, or harvested, natural or disturbed.
Wāhi taonga * means places (wāhi) of special value.
Wāhi tapu * means a place of sacred and extreme importance.
Waste means materials which are unwanted or surplus to process requirements that the holder discards, or intends to, or is required to discard.
Waste minimisation means implementation of the waste management hierarchy to: reduce, reuse, recycle, recover and manage residual waste.
Water
(a) <i>Means water in all its physical forms whether flowing or not and whether over or under the ground;</i>
(b) <i>Includes fresh water, coastal water, and geothermal water;</i>
(c) <i>Does not include water in any form while in any pipe, tank, or cistern.</i>
Water blasting means the use of high pressure water as the blasting medium to remove surface coatings or prepare surfaces.
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.
Water conservation order has the meaning set out in section 200 of the RMA.
Water flow measuring device is a device used for measuring the rate of flow or quantity of water over a set period of time.
Water harvesting means the taking of water for storage and later use.
Water infiltration gallery is a device or structure placed in the ground to intercept shallow groundwater for water supply purposes.
Water management regime means in relation to water bodies, any mix of flow, level and allocation regimes.
Water race or water supply race means a type of artificial water course used for the

³² Section 2(1) Local Government Act 1974

³³ GEN2.154

<u>managed conveyance of water often, but not exclusively, for stockwater or irrigation purposes. It is not a drain^{34 35}.</u>
Water restriction means a reduction in the authorised take during periods of low flow or water level in order to share the water that is available for abstraction and use, and is usually included as a condition of consent.
Water table means the water surface of the saturated zone of an unconfined aquifer; that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.
Water users³⁶ group is a group of users with existing authorization to take water, grouped to achieve beneficial management of the water resource collectively allocated to them.
Water yield means the amount of water run-off coming out of a catchment over a specific period of time.
Weir means a dam erected across a river to raise the level of the water.
Well (see definition for bore above).
Wetland boundary means the point in the transition from wetland to dryland where wetland plant species occur more than four times their ungrazed height apart. Wetland edge has a similar meaning.
Wetland creation is similar to wetland restoration, except that the site need not have been a natural wetland and may require a greater degree of engineering.
Wetland enhancement means to improve the natural qualities and/or extent of an existing wetland by such means as limiting access by domestic and feral animals, controlling pests, and providing for a more nearly original quality and quantity of water.
Wetland <i>includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.</i>
Wetland restoration has a similar meaning to wetland enhancement, but the starting point is a former rather than an existing functioning wetland. It may thus also be necessary to restore the water regime and/or reintroduce appropriate plants and wildlife.
Whitebait stand means a temporary or permanently structure placed in the bed of a lake or river to aid the use of a whitebait net or to direct whitebait.

³⁴ Note the definition of drain. [GEN2.15]

³⁵ GEN2.15

³⁶ WQN1.27