Waitaki Catchment Water Allocation Regional Plan

Material incorporated by reference

Prepared by the Waitaki Catchment Water Allocation Board

September 2005

Waitaki Catchment Water Allocation Board

Te Poari Tiaki Wai o Waitaki

Waitaki Catchment Water Allocation Board
Te Poari Tiaki Wai o Waitaki

Published in September 2005 by the
Waitaki Catchment Water Allocation Board
Te Poari Tiaki Wai o Waitaki
PO Box 1345, Christchurch, New Zealand

ISBN: 0-9582620-6-3

Cover images (clockwise from top left):

1. Aoraki/Mt Cook and Lake Pūkaki
2. Small stream near Clearburn
3. Lower Waitaki River and mouth (Photo courtesy of the *Otago Daily Times*)
4. Lower Waitaki River at Kurow Bridge

This document is available on the Board's pages on the Ministry for the Environment's website:
www.waitakiboard.mfe.govt.nz

Contents

Introduction

This document contains a copy of material that has been incorporated by reference in the Waitaki Catchment Water Allocation Regional Plan as provided for in clause 30 of Schedule 1 of the Resource Management Act 1991. It deals with technical matters and material that is too large or impractical to include as part of the Plan.

Certification

This is a correct copy of:

1. The following provisions of the Proposed Canterbury Natural Resources Regional Plan (adopted by the Canterbury Regional Council on 28 March 2002 and publicly notified on 1 June 2002 for submissions, including variation 1 to that plan, adopted by the Canterbury Regional Council on 27 May 2004 and publicly notified on 3 July 2004 for submissions):
   - Section 1.3.1 Cross boundary processes
   - Objective WQL1 Water quality outcomes for rivers and lakes
   - Objective WQL2 Water quality outcomes for groundwater and contaminated land
   - Objective WQL3 Water quality outcomes for community drinking water sources
   - Section 5.7 Making resource consent applications and providing information
   - Section 5.10 Financial contributions
   - Section 5.12 Water quantity monitoring
   - Table WQN26: Daily Stockwater requirements
   - Table WQN27: Example of application of provisions for stockwater
   - Appendix WTL1: Wetland Assessment Methodology
2. Table A1 in "Schedule WQN9 Revision – Review of seasonal use approach included in proposed NRRP". Report U05/15, May 2005. Prepared for Environment Canterbury by Anthony Davoren and David Scott.

that are incorporated by reference in accordance with clause 30 of Schedule 1 of Resource Management Act in the Waitaki Catchment Water Allocation Regional Plan.

The Board certified this material as a correct copy by resolution duly passed at a meeting held on 30 September 2005, after approving the Plan in accordance with section 26 of the Resource Management (Waitaki Catchment) Amendment Act 2004.

DATED at Christchurch this 30th day of September 2005.

David Sheppard (Judge) Chairperson

Sheila Watson Deputy Chairperson

Dr Nick Brown

Edward Ellison

Claire Mulcock

Waitaki Catchment Water Allocation Board

Te Poari Tiaki Wai o Waitaki

Material from the Proposed Canterbury Natural Resources Regional Plan

The following provisions of the Proposed Canterbury Natural Resources Regional Plan (adopted by the Canterbury Regional Council on 28 March 2002 and publicly notified on 1 June 2002 for submissions, including variation 1 to that plan, adopted by the Canterbury Regional Council on 27 May 2004 and publicly notified on 3 July 2004 for submissions) are incorporated by reference in the Waitaki Catchment Water Allocation Regional Plan.

The table lists the material that is incorporated and the provision in the Plan that refers to the material.

Material from the proposed NRRP	Relevant plan provision
Section 1.3.1 Cross boundary processes	Section 5 – Administrative issues
Objective WQL1 Water quality outcomes for rivers and lakes	Policy 13
Objective WQL2 Water quality outcomes for groundwater and contaminated land	Policy 13
Objective WQL3 Water quality outcomes for community drinking water sources	Policy 13
Section 5.7 Making resource consent applications and providing information	Section 5 – Administrative issues
Section 5.10 Financial contributions	Section 5 – Administrative issues
Section 5.12 Water quantity monitoring	Section 5 – Administrative issues
Table WQN26: Daily Stockwater requirements	Policy 17
Table WQN27: Example of application of provisions for stockwater	Policy 17
Appendix WTL1: Wetland Assessment Methodology	Policy 2, Policy 30 and Rule 4

Proposed Canterbury Natural Resources Regional Plan

Chapter 1: Overview

1.3.1 Cross boundary processes (pages 1–29 to 1–30)

Prepared by: Canterbury Regional Council
Date: 1 June 2002
Report No. R02/3/1
ISBN: 1-86937-439-8

1.3 Administrative processes

1.3.1 Cross boundary processes

Cross-boundary issues involving the jurisdictions of Environment Canterbury and one or more other local authorities or other agencies can arise from:

(a) differences in plan provisions; and

(b) adverse effects of activities in one jurisdiction transferring/occurring in another.

For the following reasons there is potential for such issues to arise:

(a) territorial authority boundaries usually do not match river catchment boundaries;

(b) Waitaki District Council has territory in both the Otago and Canterbury regions;

(c) the northern neighbours Tasman and Marlborough district councils, are unitary authorities with both district and regional responsibilities. Their approach to resource management issues will necessarily be different from that of Canterbury. In addition Canterbury shares boundaries with the Otago and West Coast regional councils;

(d) there is a need for a joint relationship between territorial authorities and Environment Canterbury in managing the coastal environment;

(e) the region includes the Canterbury and part of the Nelson-Marlborough Department of Conservation conservancies;

(f) several Ngai Tahu hapu may have interests across regional and district council boundaries. These include Ngati Kuri in the north, Kati Huirapa in the south and the boundary with Tai Poutini on the West Coast;

(g) utility operators have systems that cross territorial and regional boundaries;

(h) differences in responsibilities under different legislation, for example, Te Runanga O Ngai Tahu responsibilities for Te Waihora (Lake Ellesmere);

(i) shared interest for major issues, for example, Christchurch City Council air quality responsibilities versus Environment Canterbury responsibilities.

Approaches that Environment Canterbury may use to resolve cross-boundary issues include:

(a) forming inter-agency committees, working parties or other liaison mechanisms. As appropriate this may include representation from non-statutory organisations such as runanga or sector interest groups;

(b) establishing inter-regional and regional/territorial committees at councillor and staff level;

(c) using joint processes or consent hearings when other local authorities have an interest in consent applications;

(d) promoting joint investigations where appropriate;

(e) Clarifying policies in the RPS and the Proposed NRRP to territorial authorities. This may include formal and informal participation in their planning processes;

(f) Presenting submissions when necessary on the annual plans of territorial authorities seeking an appropriate allocation of resources to give effect to resource management policies in district and/or regional plans;

(g) Using the statutory processes of the RMA;

(h) Meeting with papatipu runanga and Te Runanga O Ngai Tahu.

Variation 1
Proposed Canterbury Natural Resources Regional Plan

Chapter 4: Water quality

4.5 Issue resolution

Objective WQL1 (pages 4–21 to 4–26)

Objective WQL2 (pages 4–51 to 4–54)

Objective WQL3 (pages 4–78 to 4–80)

Prepared by: Canterbury Regional Council
Date: 3 July 2004
Report No. R04/15/4
ISBN: 1-86937-530-0

Objective WQL1: Water quality outcomes for rivers and lakes

Objective WQL1.1 Rivers:

(1) Where the river water quality or the physical and chemical characteristics of the riverbed substrate are:

(a) in a natural state, the water quality and the characteristics of the substrate are maintained in that state; or

(b) not in a natural state, as a result of point source or non-point source discharges, the water quality and the riverbed substrate are maintained or improved so that:

(i) they are suitable for contact recreation in those reaches that are valued for this purpose;

(ii) water is suitable for stock drinking water;

(iii) they are suitable as a habitat for indigenous species or salmonids;

(iv) they provide for amenity values;

(v) they provide for Ngāi Tahu cultural values, including mahinga kai.

(2) In addition, where the water quality, or the physical and chemical characteristics of the riverbed substrate:

(a) equals or is better than the numerical outcomes for indicators of nutrient status and sedimentation of riverbed substrate for the river type, specified in Table WQL5, the water quality and substrate are maintained in that condition; and

(b) does not meet the outcomes in Table WQL5, the water quality or the characteristics of the substrate are improved so that:

(i) the outcomes in Table WQL5 are achieved; and

(ii) there are no visible heterotrophic slime growths in the river.

(3) Where the water quality of a river, or the physical and chemical characteristics of the riverbed substrate, have been or are likely to be affected by a change to the flow regime of a river as a result of; augmentation of flow, damming, diversion, or discharge of water or contaminants:

(a) the instream values in the river, which existed before a change to the flow regime, are provided for, by ensuring that:

(i) any change to water quality, including changes to; clarity, natural water temperature, dissolved oxygen concentrations, or contaminants caused by reducing or low oxygen conditions;

(ii) sedimentation of the riverbed; or

(iii) excessive growth of periphyton, or aquatic plants;

have no significant adverse effects on the instream values of the river; or

(b) where the instream values have been adversely affected by a change to the flow regime, the water quality of the river and the physical and chemical characteristics of the riverbed substrate, are improved to restore, as far as practicable, the instream values of the river that existed before the change to the flow regime; and

(c) the quality of river water recharging groundwater will not prevent the achievement of Objective WQL2.

Objective WQL1.2 Natural and artificial lakes:

(1) For high country lakes,

(a) where the water quality is in a natural state, it is to be maintained in that state; and

(b) where the water quality is not in a natural state, the water quality is to be maintained or improved so that:

(i) it is suitable for contact recreation;

(ii) it is suitable as a habitat for indigenous species and salmonids;

(iii) it provides for Ngāi Tahu cultural values, including mahinga kai;

(iv) the average annual phytoplankton biomass does not exceed five milligrams of chlorophyll *a* per cubic metre; and,

(v) there is no conspicuous change to the visual clarity of the lake.

(2) For coastal lakes or lagoons that are isolated from or only intermittently connected to the sea, the water quality shall be maintained or where it is necessary, improved so that:

(a) it is suitable as a habitat for indigenous species and trout; and

(b) provides for Ngāi Tahu cultural values, including mahinga kai; and

(c) there are no toxic or nuisance algal blooms.

(3) For artificial lakes, the water quality of the lake shall be maintained so that:

(a) it is suitable for the activities and uses for which the lake and its water is used; and

(b) it does not result in persistent seasonal stratification leading to oxygen depletion in the lake; and

(c) it does not result in toxic or nuisance algal blooms; and

(d) the average annual phytoplankton biomass does not exceed five milligrams of chlorophyll *a* per cubic metre of lake water.

Table WQL5 Numerical outcomes for nutrient indicators and riverbed sedimentation in rivers that are not in a natural state

<table>
<tr><th>River Types (not in a natural state)</th><th colspan="2">Parts of a catchment</th><th>Emergent macrophytes</th><th>Algae mats greater than three millimetres thick</th><th>Filamentous algae longer than two centimetres</th><th colspan="2">Periphyton</th><th>Sedimentation of riverbed substrate</th></tr>
<tr><td></td><td></td><td></td><td>(percentage cover of width of wetted river channel)</td><td>(percentage cover of wetted river channel)</td><td>(percentage cover of wetted river channel)</td><td colspan="2">(milligrams Chlorophyll a per square metre)</td><td>(percentage embeddedness)</td></tr>
<tr><td></td><td></td><td></td><td>Maximum value</td><td>Maximum value</td><td>Maximum value</td><td>Mean monthly value</td><td>Maximum value</td><td></td></tr>
<tr><td>Alpine</td><td></td><td></td><td>N/V</td><td rowspan="2">No conspicuous growths</td><td rowspan="2">No conspicuous growths</td><td rowspan="2">15</td><td rowspan="2">50</td><td rowspan="5">Not to exceed 20 percent</td></tr>
<tr><td>Rivers of upper plains, inland basins and river valleys</td><td></td><td></td><td>Not to exceed 50 percent</td></tr>
<tr><td rowspan="3">Hill country sourced</td><td rowspan="2">Catchment comprises less than 30 percent Tertiary sediment</td><td>Upstream of State Highway One</td><td>N/V</td><td rowspan="2">Not to exceed 40 percent</td><td>Not to exceed 15 percent</td><td>15</td><td>50</td></tr>
<tr><td>Downstream of State Highway One</td><td>N/V</td><td>Not to exceed 30 percent</td><td>N/V</td><td>100</td></tr>
<tr><td>Catchment comprises more than 30 percent Tertiary sediment</td><td></td><td>N/V</td><td>Less than 60 percent</td><td>Not to exceed 30 percent</td><td>N/V</td><td>200</td></tr>
<tr><td>Lowland</td><td></td><td></td><td>Not to exceed 50 percent</td><td>Not to exceed 60 percent</td><td>Not to exceed 30 percent</td><td>N/V</td><td>200</td><td>Not to exceed 40 percent</td></tr>
<tr><td>Volcanic (Banks Peninsula)</td><td></td><td></td><td>Not to exceed 50 percent</td><td>N/V</td><td>N/V</td><td>15</td><td>50</td><td>N/V</td></tr>
<tr><td>Urban</td><td></td><td></td><td>Not to exceed 50 percent</td><td>Not to exceed 60 percent</td><td>Not to exceed 30 percent</td><td>N/V</td><td>200</td><td>Not to exceed 40 percent</td></tr>
</table>

Explanatory notes: (1) The effects of natural perturbations that may affect; water quality, the growth of aquatic plants, or the characteristics of riverbed substrate, are not included in these values. (2) N/V means no value has been set for this parameter.

Explanation and principal reasons

The purpose of the objective is to establish clear water quality outcomes for the region's rivers and lakes. The various river and lake types are shown on the planning maps that accompany this plan. The objective provides a point of reference for measuring the impacts of human activities on water quality and the effectiveness of measures to maintain or improve water quality.

Natural state water quality occurs where the water quality is unaffected or largely unaffected by human activities. Water bodies, where the water quality is in a natural state, are generally low in nutrients and the riverbed substrate is comprised predominantly of gravels with a relatively small proportion of fine sediment.

The water quality of many hill country sourced rivers is significantly influenced by the extent of Tertiary age sediments, many of marine origin, in the catchment. These sediments are a source of nutrients and rivers draining these catchments have naturally higher levels of nitrogen and phosphorus. The distribution of these sediments have been mapped and recorded on geological maps.

Chlorophyll *a* and the presence of algal growths are used as indicators of the nutrient status of rivers and lakes. Chlorophyll *a* is a pigment commonly found in aquatic plants. It provides a measure of the overall productivity of the water body, irrespective of the differing concentrations of nitrogen and phosphorus.

The growth of algal and other aquatic plants is stimulated by nutrients in the water, and the appearance of aquatic plants provides a readily observable indicator of the degree of enrichment of a water body. Plant growth is limited by the frequency of freshes or floods which scour the vegetation from the bed.

The input of nutrients from point and non-point sources to water bodies is one the principal causes of water quality decline, resulting in increased aquatic plant and algal growth in water bodies. Excessive plant growth affects aquatic ecosystems and reduces the amenity and recreation values of the water body. The change in nutrient status is a good indicator of the extent and severity of human activities on water quality.

The accumulation of fine sediment on the beds of small to medium sized rivers, mostly in the lowland parts of Canterbury, has changed the beds of many rivers from predominantly gravel to mostly fine sediments. This has severely reduced the quality of aquatic ecosystems, and affected recreation and aesthetic values of the water bodies. The change in the characteristics of riverbed sediments can be monitored by assessing the “embeddedness” of the substrate, i.e. the proportion of fine sediment to coarse sediments. In addition, some lowland streams, particularly in urban areas, e.g. Avon/Ötakaro River, have accumulations of contaminants, e.g. lead, copper, or zinc, attached to fine sediments. The Objective therefore sets a limit on the change to the riverbed substrate as a result of sedimentation.

Many rivers, especially alpine, hill country, and lake sourced rivers, have high water quality, and very low levels of nutrients. These large rivers are a major source of recharge to the region’s aquifers. Many rivers and high country lakes are outstanding natural features of Canterbury’s landscape and are highly valued by the community. Where the water quality of rivers or lakes currently does not meet the objectives, significant efforts will be required to prevent any further decline in water quality, and improvements water quality may take some time to achieve.

A combination of narrative and numerical values is used to specify water quality outcomes for rivers and lakes in the Canterbury region.

The purpose of the Objective WQL1.1(1)(a) is to ensure that the natural state of water quality is retained because the water quality of these rivers is relatively unaffected by human activities. By maintaining these rivers in this state, the water is suitable for a wide range of uses and instream values. The water quality of the rivers is affected by land uses in the catchment.

The purpose of Objective WQL1.1(1)(b) is to ensure that water quality of rivers continues to be suitable for a wide range of uses and instream values. Ngāi Tahu hold the region's water bodies in high esteem. Sites and some reaches on rivers and tributaries within the takiwa (area) of a rūnanga, are especially significant for cultural or historic reasons. In some places, these rivers and streams are valued for water recreation but are not suitable for this use because of human activities. With the use of appropriate measures, water quality could be improved in these areas and managed so that it meets contact recreation standards.

Objective WQL1.1 (2) and Table WQL5 sets outcomes for water quality and sedimentation of riverbeds, so that the rivers will be suitable for a wide range of uses and instream values. Natural perturbations, such as severe floods or droughts, which occur relatively infrequently, will influence the water quality of rivers and lakes. For example, prolonged periods of low flows and high water temperatures may result in excessive growths of aquatic plants and algae. Monitoring of rivers, lakes and climate patterns by Environment Canterbury will be used to distinguish between naturally occurring and human induced changes to water quality and river bed substrate.

The presence of heterotrophic slime, also known as “sewage fungus”, indicates highly enriched conditions resulting from point source discharges containing high concentrations of organic matter.

In the lower reaches of those hill country rivers that cross the plains, enriched groundwater emerges in the river as seepages and springs, generally downstream of State Highway One. Enriched groundwater may also emerge in some inland rivers, such as the Hakataramea River. During periods of low river flows, groundwater inflow may make up a significant proportion of the river flow, increasing nutrient concentrations in the water, and resulting in prolific aquatic plant growth. Lowland rivers and hill country sourced rivers draining catchments with significant areas of Tertiary sediments generally have the lowest water quality and these rivers may have at times thick algal mats or growths of filamentous algae. For these rivers, high water quality may not be attainable because of the small size of the water bodies, the intensity of land uses in their catchments, their location at the bottom of the catchment, inflows of enriched groundwater, and faecal contamination from populations of waterfowl and riverbed birds. However, some lowland streams have high water quality due to the contribution to flow from high quality groundwater originating from rivers and groundwater where the water quality has not been affected by land uses.

The rivers and streams of Banks Peninsula are small, and are generally not suitable as a habitat for salmonid species, or used for contact recreation except in the lower reaches and estuaries. The waterways are a habitat for several rare aquatic species that are endemic to Banks Peninsula, valued by Ngāi Tahu, and are used as a source of drinking water.

The management of the water quality in rivers needs to be taken into account when a flow regime is established for a river[28]. The purpose of Objective WQL1.1(3) is to provide outcomes for the quality of the water or river bed substrate of a river where the flow is regulated or strongly influenced by the discharge or diversion of water. The state of the water quality or river bed substrate reflect the health of a river and its capacity to support instream values. A change to a flow regime from a transfer of water from one river or lake to another, or the damming or diversion of flow from a river, can have significant adverse effects on the water quality and the sediments that comprise the riverbed. These adverse effects may include; a reduction in quality of the receiving water, increasing deposition of fine sediments, a reduction in the capacity of the river to assimilate or dilute contaminants, or flushing out of fine sediments and excessive growths of aquatic plants. In rivers, the instream values may have been lost or diminished as a consequence of the impacts on water quality and river bed substrate as a result of a change to the flow regime.

When a statutory flow regime is either established or reviewed under Policies WQN2 to WQN6 in Chapter 5, a new statutory flow regime must provide the conditions to enable water quality and the river bed substrate to support the instream values that existed under a natural flow regime. However, there may be situations where the instream values cannot be fully restored, and in these cases the instream values should be restored to the extent that is technically and economically feasible.

Objective WQL 1.1(3)(c) recognises the linkages between the quality of river water recharging groundwater and aquifer water quality. Many rivers, especially the alpine rivers are an important source of recharge for the groundwater system. This river water is generally of very high quality and helps maintain the groundwater in a high quality state and to mitigate the impact of land use activities on groundwater quality.

The purpose of Objective WQL1.2(1) is to maintain the high water quality in high country lakes and to ensure that the low nutrient status of other lakes is maintained. The water quality of large high country lakes is still largely in its natural state, and it is the dominant

---

[28] *Flow guidelines for instream values* Ministry for the Environment, Wellington 2 volumes. May 1998.

influence on the water quality of the rivers that flow from these lakes. The water quality of smaller lakes is more susceptible to the effects of land uses in their catchments. Water clarity is an important characteristic of lakes as it affects light intensity which in turn controls the depth of macrophyte plant communities in the lake. These plant communities are an important habitat and a significant source of primary production in the lake ecosystem.

The purpose of Objective WQL1.2(2) is to maintain coastal lakes in a stable state and to prevent increased enrichment and toxic algal blooms. The present water quality of coastal lakes is the result of; past and present land uses in their catchments, their location at the bottom of a catchment, inflows of enriched groundwater, faecal contamination from populations of birds, and changes in lake levels. The nutrient concentrations and water clarity of these lakes are highly variable, and it is not possible to set a common numerical outcome for these water bodies.

Objective WQL 1.2(3) sets minimum water quality outcomes for artificial lakes to ensure that these lakes do not become nutrient enriched, causing excessive algal growths or generating toxic contaminants. For the purposes of this Chapter, an artificial lake is one that has been created by human action and the surface area of water exceeds eight hectares at its minimum water level. Artificial lakes are created and managed for specific purposes. They may be created on dryland sites, in valleys where there are ephemeral streams, or on permanently flowing rivers. These lakes may undergo significant physical and chemical changes after establishment as the lake evolves to an equilibrium state. This establishment phase may take several years or longer if there are significant areas of organic-rich soils that have been inundated. Seasonal processes, such as temperature stratification, may also occur in areas sheltered from significant wind mixing. Sometimes, this stratification and subsequent lack of mixing of lake water may lead to the depletion of oxygen or anoxia in the cold, bottom-water zone (hypolimnion) of the lake, and the generation of toxic contaminants and soluble nutrients.

Objective WQL2: Water quality outcomes for groundwater and contaminated land

(1) In the Coastal Confined Gravel Aquifer System between the Ashley River/Rakahuri and the Rakaia River, the water quality in each aquifer is maintained at least in the state reported in July 2002, and the water is suitable for human consumption without treatment.

(2) In semi-confined, unconfined, and other confined aquifers or parts of these aquifers, where:

(a) the water quality is unaffected or largely unaffected by human activities, as reported in 2004, maintain the water quality in that state.

(b) the water quality is affected by human activities, the groundwater quality shall meet the following values:

(i) for nitrate-nitrogen, the maximum concentration shall not increase by more than two milligrams per litre above the maximum concentration measured between 1996 and 2001, and reported in 2002, and the maximum concentration shall not exceed 11.3 milligrams per litre;

(ii) the water quality shall remain within the Guideline Value for any aesthetic determinand listed in the Drinking Water Standards for New Zealand 2000[35], except for natural exceedances of the Guideline Value. If the water quality does not meet the Guideline Value, as a

[35] *Drinking Water Standards for New Zealand 2000.* Ministry of Health, Wellington. August 2000. 130pp.

result of human activities, the water quality shall be improved so that the Guideline Value is achieved;

(iii) the median concentration of *Escherichia coli* shall be less than one organism per 100 millilitres of water; and

(iv) any other inorganic or organic determinand of health significance or pesticide (excluding nitrate nitrogen, or *Escherichia coli*,) listed in the Drinking Water Standards for New Zealand 2000 shall not be detected at a concentration greater than one tenth of the Maximum Acceptable Value for that determinand.

(c) On land, where the concentration of a contaminant exceeds the naturally occurring background level and this concentration poses an unacceptable risk to human health or the environment, the land is managed in a way that reduces this risk, and the risk from any discharge from the land to groundwater, to a level that is acceptable for human health or the environment.

Explanation and principal reasons

Canterbury's groundwater resources are a significant natural resource and a strategic economic asset for the region. For Ngāi Tahu, groundwater is regarded as a taonga (treasure) in a way similar to surface water. While the water quality in these aquifers is generally very high, and in many areas it is used as drinking water without treatment, it is vulnerable to contamination from land uses and discharges onto or into land. In some parts of the region, the groundwater is naturally unsuitable for drinking water. The Canterbury community has indicated that the high existing quality of groundwater must be maintained, however, some decline in the quality of the shallow unconfined aquifers must be tolerated if the present level of land use is to continue.

Land use intensification has occurred over the plains and in the basins of Canterbury. This trend is likely to continue into the foreseeable future. Where intensification of land use occurs over a wide area of the unconfined aquifers there is very high risk that groundwater quality will decline unless management practices are adopted to prevent or minimise the entry of contaminants.

Some contaminants can persist for a long time in aquifers because of their slow rate of breakdown, or because groundwater flow is insufficient to flush out the aquifer. A considerable time lag can occur between the land use and the detection of contaminants in groundwater. Contaminant concentrations currently being measured may be the result of land uses from several decades ago rather than from the effects of current land uses. The impact of current land uses on groundwater may not become apparent for many years. The behaviour of contaminants in groundwater and total contribution of contaminants from a mix of different land uses and land use practices across a catchment is not well understood. For these reasons, any decision to allow a decline in groundwater quality must be approached very cautiously.

Experience has shown that by the time groundwater contamination has been detected it is usually difficult to control, and to prevent further decline in groundwater quality. Remediation of groundwater quality, even if it is technically feasible, is likely to be extremely costly and take a considerable amount of time. Changes to land use would also be very difficult to reverse. If contaminant concentrations of any determinand (a constituent of water measured to assess quality) specified in the Drinking Water Standards for New Zealand 2000 that exceeds the standard, then alternative supplies would need to be found or existing supplies treated to remove the contaminants. Either option is likely to be costly and may not be available locally if contamination is widespread.

The purpose of the Objective is to state the water quality outcomes to be achieved and the limits for acceptable change to groundwater quality in different aquifers and aquifer types.

The dates specified in the Objective provide a reference point for assessing the extent of change to water quality in an aquifer.

The Objective limits the extent to which water quality of an aquifer, or part of an aquifer already affected by human activities, may change. The minimum area comprising part of an aquifer will generally be an area of groundwater that underlies an individual property, however, in some cases, part of an aquifer may comprise an area smaller than an individual property, for example, where there are likely to be adverse effects in surface water bodies from emerging groundwater within a property.

It is not practicable to define groundwater quality to a high level of precision at every point in an aquifer. Environment Canterbury will monitor changes in groundwater quality by sampling groundwater from a set of wells across the region to assess whether the groundwater quality objectives are being met. Where a change in groundwater quality is detected in a monitoring bore, or where there is insufficient information on groundwater quality, more intensive monitoring of groundwater may be undertaken to determine the water quality characteristics for that part of the aquifer.

For areas where there is little or no water quality data, the water quality will be inferred from land use activities, hydrological data, and by comparison with areas with similar land uses where groundwater quality is well understood. For a consent application at a specific location, groundwater quality may be inferred from existing monitoring data, but in some cases, additional site specific data may need to be collected.

The Coastal Confined Gravel Aquifer System is the principal source of water for more than 300,000 people in Christchurch City, Kaiapoi and other settlements. Because of the very high quality, the water in these aquifers can be generally used for potable supplies without treatment, although there are areas where naturally occurring contaminants affect the quality of the water. The availability of very high quality, untreated, potable water is one of the features that distinguishes Christchurch from other New Zealand cities. The aquifers are a significant economic asset and the water quality is highly valued by the community. For these reasons, Objective WQL2(1) seeks to maintain the water quality of coastal confined gravel aquifers in the current high quality state so that it continues to provide potable water supply needs in the future. A comprehensive analysis of the water quality data for these aquifers was published in July 2002[36].This work is the basis setting a benchmark in the Objective against which changes to water quality can be measured.

The water quality of some parts of the Coastal Confined Gravel Aquifer System has been affected by human activities, particularly in the Woolston-Heathcote area where localised saltwater contamination of the aquifer has occurred. Chapter 5 establishes a groundwater management zone in this area to control the pumping from bores to remediate the groundwater quality.

The unconfined and semi-confined aquifers beneath the Canterbury Plains are composed of many water bearing layers at various depths. Water in these layers moves generally laterally towards the coast. It is understood that contaminants entering the groundwater nearest the land surface generally remain in the upper layers and are transported with relatively little mixing with the water in the deeper layers of the aquifer. The depth to the uppermost water bearing layer may vary from a few metres to over a hundred metres depending on the location. It is generally shallower close to large rivers or nearer the coast.

In the inland parts of Canterbury, the upper river valleys and inland basins are infilled with gravels containing shallow, unconfined water bearing layers, recharged predominantly by the loss of water from rivers. The groundwater quality is generally high except in areas, where intensive land uses are occurring, such as the Amuri Basin. The unconfined, semi-confined, and other confined aquifers are naturally vulnerable to contamination, depending on the

[36] Hayward, S. (2002) *Christchurch-West Melton Groundwater Quality: a review of groundwater quality monitoring data from January 1986 to March 2002.* Environment Canterbury unpublished report no. U02/47, Environment Canterbury, July 2002. 141 pp.

source of recharge, depth to groundwater, and nature of the overlying sediments and soil. In some areas, the water quality of the shallow aquifers remains high even though there may be intensive land uses. This is because the large volume of water entering the aquifer from large braided rivers dilutes contaminants in the groundwater. Where the intensity of land use over the aquifer is low, little contamination is occurring. In other areas, the intensity of land use and the lack of significant river recharge have resulted in elevated concentrations of contaminants in groundwater.

The concentration of nitrate-nitrogen in groundwater will vary seasonally with the highest concentrations occurring after winter, as the result of increased leaching and low rates of plant growth. The maximum concentrations are reasonably easy to monitor, because unlike other statistical measures of trends they do not require a large amount of data to be collected over a long period. A comprehensive analysis of the water quality data for these aquifers was published in 2002[37].

The principal uses for unconfined, semi-confined, and other confined aquifers are drinking water for humans and stock, irrigation water, and commercial and industrial uses. Most of the groundwater is of higher quality than the Ministry of Health's Drinking Water Standards for New Zealand 2000. By maintaining the quality of the water at or higher than these standards, the water will be able to be used for a wide range of uses without the need for significant treatment. Objective WQL2(2)(b) uses the Drinking Water Standards for New Zealand 2000 to establish limits to changes in the water quality of the aquifers relative to the existing groundwater quality. The use of numerical or guideline values provides clear outcomes against which changes to water quality can be measured and assessed.

Elevated concentrations of contaminants in land can reduce the versatility of land for alternative uses, such as residential, agricultural or amenity purposes, and result in the contamination of groundwater and connected surface water. The purpose of the Objective WQL2(3) is to ensure that contaminated land is managed or remediated to a point that it does not pose an ongoing risk to people or groundwater quality. Many of the substances that may be found in contaminated land are present naturally in soils at low concentrations. However, when the concentration of a substance exceeds the natural background level in soils or leaches into groundwater it may pose a risk to human or animal health.

[37] Hanson, C., (2002) *Nitrate concentrations in groundwater:-a review of existing data*. Environment Canterbury report no. R02/17, Environment Canterbury, August 2002. 83pp.

Objective WQL3: Water quality of community drinking water sources

The source water for a community drinking water supply is suitable for use as a water supply, by ensuring that:

(1) in a Community Drinking Water Supply Protection Zone, or a upstream of a community water supply intake;

(a) where the surface water or groundwater quality is in a natural state, the water quality is maintained in that state; or

(b) where the surface water quality is not in a natural state, the water quality at the water supply intake meets both Objective WQL1.1(2) and the following values:

(i) the concentration of microbiological contaminants of health significance does not exceed the capacity of a treatment system to remove these contaminants; and

(ii) the water is not tainted or contaminated so as to make it unpalatable to humans; and

(iii) any other inorganic or organic determinand of health significance or pesticide, excluding microbiological contaminants, listed in the Drinking Water Standards for New Zealand 2000 is not present at a concentration greater than one tenth of the Maximum Acceptable Value for that determinand.

(c) where groundwater quality is not in its natural state, the water quality is maintained or improved so that at the community water supply well:

(i) the water quality meets Objective WQL2 (2)(b), except that the maximum concentration of nitrate–nitrogen in the water shall not exceed 5.6 milligrams per litre; and

(ii) the water is not tainted or contaminated so as to make it unpalatable to humans.

(2) in the Christchurch Groundwater Recharge Zone, the quality of unconfined and semi-confined groundwater is maintained or improved so that:

(a) the groundwater entering the Coastal Confined Gravel Aquifer System meets Objective WQL2(1); and

(b) **the groundwater quality in Zone 1 and in the unconfined aquifer in Zone 2 meets Objective WQL2(2)(b), except that the maximum concentration of nitrate-nitrogen shall not increase by more than one milligram per litre, and the maximum concentration shall not exceed 5.6 milligrams per litre.**

Explanation and principal reasons

Clean, safe drinking water is an essential requirement for human health into the foreseeable future. Most of Canterbury's population obtain their drinking water from a community supply. The Canterbury community places a very high value on maintaining the quality of community drinking water supplies for present and future generations, especially in areas where the water is potable without treatment. Christchurch, which comprises 60% of the region's population, is supplied with high quality untreated groundwater from confined aquifers which are recharged from the west of the City.

The areas where sources of community drinking water need protection from contamination are:

(a) the Community Drinking Water Supply Protection Zone around a well or upstream of a surface water supply intake, where activities could directly affect the quality of the source water, and

(b) the Christchurch Groundwater Recharge Zone where groundwater is replenished by rainfall and inflows from the Waimakariri River and the groundwater flows into the confined aquifers underlying Christchurch City.

It is better to protect the quality of the water in the community drinking water supply protection zones rather than trying to redress the impacts of contamination later. Experience from overseas and within New Zealand has shown that unless community water supplies are protected from the adverse effects of land uses or point source discharges, the quality of these water resources will soon decline. The community will then be faced with increasing costs to treat the water, or having to find alternative high quality sources of water.

While Objectives WQL1 and WQL2 establish water quality outcomes for all surface and groundwater bodies in the region, the purpose of Objective WQL3 is to identify water quality outcomes for sources of community drinking water and to reduce the likelihood of contaminants entering drinking water sources thereby reducing the risk to public health.

Water quality in its natural state is water which is unaffected or largely unaffected by human activities. While this water may not be pristine, it is the highest quality water that is available as sources of community drinking water in the region.

For community water supplies where the water is not in its natural state, the Objective sets specific outcomes for water quality so as to maintain the source water at a consistent quality, enabling community water supply operators to plan for and operate efficient and effective water treatment systems. If the source water does not meet the specified quality, an investigation to identify the source of contamination and remedial measures may be required to restore the water quality.

The area of land to the west of Christchurch bounded by the Waimakariri River to the north and a line approximately between Halkett and Prebbleton to the south, is the principal recharge zone for the Coastal Confined Gravel Aquifer System that is the source of Christchurch City's water. The water resource is a major economic asset to Christchurch and the high quality untreated drinking water is highly valued by the community. However, there is significant threat to water quality from intensive agriculture and the spread of residential and industrial development over the Recharge Zone.

The quality of water in Aquifer 1 of the Coastal Confined Gravel Aquifer System is more likely to be affected by intensive land use activities occurring over the Recharge Zone. If contaminated water enters the confined aquifers it may take many decades for the contaminated water to be flushed from the aquifer. Therefore, the water quality in the unconfined part of the recharge zone must be maintained in a high quality state in order to prevent a decline in the quality of the Coastal Confined Gravel Aquifer System.

The purpose of Objective WQL(3)(b) is to prevent such a decline from occurring in this area, as this would have serious and costly consequences for the water supply to Christchurch City. Once contaminants enter groundwater, it may take a considerable amount of time and resources to determine the extent of contamination, and to apply remediation measures, if remediation is possible.

The Christchurch Groundwater Recharge Zone has been divided into two zones. Zone 1 comprises the predominantly rural area to the west of Christchurch City and includes Christchurch International Airport and several areas are currently used for industrial or commercial uses. Substantial areas of this land have very thin soils over highly permeable gravels, and all this land is underlain by very shallow groundwater. The groundwater in this area is the principal source of water for the confined aquifers that supply Christchurch City with water. Zone 2 comprises the existing urban area bounded approximately by Johns and Russley Roads, Marshland Road, and the Port Hills. This area is the transitional zone between the unconfined aquifer and the Coastal Confined Gravel Aquifer System. The combination of increasing thickness of the overlying confining layer and the artesian pressure provide some natural protection for the groundwater in the confined aquifers.

The water quality in Zone 1 and the unconfined aquifer in Zone 2 of the Christchurch Groundwater Recharge Zone will be characterised using an array of monitoring bores. These will be selected so that there is a sufficient density of bores in any given part of the Zones to ensure that the monitoring results can be used collectively to characterise the water quality for that part of the Recharge Zone. Each bore will be located to avoid the effects of land use activities or discharges in the vicinity of the bore.

Variation 1
Proposed Canterbury Natural Resources Regional Plan

Chapter 5: Water quantity

5.7 Making resource consent applications and providing information (pages 5–163 to 5–171)

5.10 Financial contributions (pages 5–192 to 5–193)

5.12 Water quantity monitoring (pages 5–196 to 5–203)

Schedule WQN11 Daily stock water requirements (page 5–260)

Table WQN27 Example of application of provisions for stockwater (page 5–260)

Prepared by: Canterbury Regional Council
Date: 3 July 2004
Report No. R04/15/5
ISBN: 1-86937-531-9

5.7 Making resource consent applications and providing information

5.7.1 Form of application

Application for a resource consent or other authorisation contemplated within the the Proposed NRRP should be made in accordance with the procedures and forms established by the RMA and guidelines established by Environment Canterbury with respect to specific authorisations.

Applications for resource consent should be in accordance with section 88 and the Fourth Schedule of the RMA. Section 88 specifies the information that must be provided with a consent application. In particular, an assessment of any effects the activity may have on the environment is required. The Fourth Schedule describes the matters that should be included and considered in such an assessment of effects.

The information provided shall be in such detail as to correspond with the scale and significance of the actual and potential effects that the activity may have on the environment. In other words, if the environmental effects are likely to be minor, less detail will be required than if the effects could be significant or their extent is not known.

Environment Canterbury has prepared application forms and information booklets to assist applicants when preparing a consent application. **Resource Consent Information Series Booklet 1 – Applying for a Resource Consent** – describes how the application will be processed by Environment Canterbury. Other information booklets provide more specific guidance regarding information required for specific types of consent applications, for example taking of surface water and bores and groundwater.

The application forms, information booklets and fee schedules are available from your nearest Environment Canterbury office or from our customer services section by phoning **0800 EC INFO** (0800 324 636). A list of consultants who may be able to help you prepare an assessment of the effects of the activity is also available.

5.7.2 Information to be provided for all resource consent applications

(a) full name, postal address, home and business telephone numbers of the person or organisation to whom the consent is to be issued.

(b) name, address and telephone number of the person or consultant who is fully conversant with all aspects of the consent application.

(c) name and address for service of documents (if different from above).

(d) a description of the activity, its nature, purpose and duration.

(e) the location of the activity together with a site plan, legal description, and map references (topographical map 260 1:50,000).

(f) a description of possible alternative locations or methods and the reasons for making the proposed choice.

(g) the scale of the activity, including the size of the area required for the activity in hectares or square metres.

(h) an assessment of any actual or potential effects of the activity on the environment.

(i) a description of the measures to be undertaken to avoid, remedy or mitigate any effects on the environment.

(j) a list of names and addresses of property owners or occupiers likely to be adversely affected by the activity.

(k) an identification of those people adversely affected by the activity, any consultation undertaken, and any response to the views of those consulted. The extent of the consultation will depend on the type of activity proposed, its scale or location. These people might include:

(i) Māori;

(ii) papatipu rūnanga;

(iii) Te Rūnanga o Ngāi Tahu;

(iv) Department of Conservation;

(v) territorial authorities;

(vi) Fish and Game councils;

(vii) commercial user groups;

(viii) New Zealand Historic Places Trust;

(ix) recreation user groups;

(x) the community in general; and

(l) a statement of all other resource consents or approvals that the applicant may require from Environment Canterbury or any other consent or approval authority to undertake this and every other activity associated with the proposal, and whether or not the applicant has applied for, or obtained, such consents or approval. Note that where other resource consents will be required in respect of the proposal to which the application relates, Environment Canterbury or any other consent or approval authority may require that these are all proceeded with at the same time.

5.7.3 Specific information requirements

In addition to the general information requirements described in the above documents, the following particular information is required as indicated below, in order to audit the resource consent application or request for approval.

5.7.3.1 The taking, using, damming or diverting of surface water

In addition to the general information outlined above, applications for the taking, use, damming or diversion of surface water must include the following information, where appropriate:

(a) a site map showing the location of the proposed point or points of abstraction (to an accuracy of 10 metres), damming or diversion, location of neighbouring (upstream and downstream) abstraction points, and location of the water body for which the activity is proposed in relation to springs, drains, tributaries, streams and rivers. If the water abstracted is to be used for irrigation, then the location of the area to be irrigated must also be shown;

(b) a description of the proposed pumping schedule, including the following detail relating to each abstraction point: instantaneous maximum pump rate; the hours of pumping; proposed maximum weekly volume; and proposed maximum seasonal volume;

(c) if water is to be dammed, details of the maximum safe volume of water to be dammed. A site map should be provided showing the location of the dam and dammed water. In addition, the following information must also be included in the assessment of environmental effects provided with the application:

(i) the design of the dam, including the dam dimensions, detail of the material the dam will be constructed out of, and the spillway capacity;

(ii) an analysis of the geology of the area and whether there are any geological features that could affect the dam and result in it failing. A dam-break analysis, undertaken by a suitably qualified professional, which includes detail of who would be affected by a dam-break and to what extent, what on-going maintenance programme is proposed to be implemented during first filling and then on-going;

(iii) details of the maximum safe quantity of water to be dammed and maximum rate/volume diverted. Details of the storage capacity sought, of the proposed flow regime and augmentation flows following damming;

(d) if water is to be diverted, a description of whether the diversion is continuous or intermittent. If the diversion occurs on an intermittent basis, a description of the diversion schedule should be provided, including, the instantaneous rate of diversion, the hours per day the diversion will occur, and the number of days the diversion will occur;

(e) a description of the use to which the water is to be put, including a demonstration of the reasonable use of the water:

(i) for irrigation use, this will need to consider the intended land-use activity, irrigation system used and on-site physical factors such as soil water-holding capacity and evapotranspiration. It will need to include details of other existing resource consents and permitted activities, to use surface and/or groundwater for irrigating land on the same property, and show that cumulatively, the exercise of all resource consents will be an efficient use of water;

(ii) for community and/or stockwater supply purposes, it will need to consider the proposed quantity of water per head of population and per hectare or stock unit supplied, potential growth in demand, method of conveyance and evidence that it is efficient (i.e. that excessive quantities are not leaked from the system), as well as detail of water shortage strategies;

(iii) for industrial uses, this will need to consider the product output per unit of water used, and include a water audit of the whole business. For guidance on this, obtain a copy from Environment Canterbury of guidelines that have been developed for auditing industrial water use;

(f) an assessment of the effect of the take, use, diversion and damming of surface water on other surface water resource users and owners of land upstream on a river or on the edge of the lake near an intake for a community drinking water supply. The techniques used to assess effects may include some or all of the following:

(i) knowledge of the effects of existing surface water abstractions and hydraulically connected groundwater abstractions in the area;

(ii) a list of all surface water users or land owners, who may be adversely affected by the proposal. Describe any consultation with these people and any measures proposed to avoid remedy or mitigate adverse effects, including written approvals if these have been obtained. Environment Canterbury can provide copies of standard forms for recording of written approvals, if required, and can also provide a list of resource consent holders within the catchment. The effects of the proposal on permitted users should also be considered;

(iii) in the case of damming of surface water, specifically, consideration must be given to the effects of changing the way the river flows on recreational users such as fishers, canoeists and jet boaters, etc. Consideration must also be specifically given to the effect of the damming on downstream users (including permitted activities) – on whether they will have the same, better or less reliability of supply.

(g) An assessment of the effect of the take, use, diversion and damming on surface water flows and surface water quality, including:

(i) a description of the water body from which water will be taken, used, diverted or dammed, including: low, average and maximum flow rates; variability of flow; seasonal fluctuations; proposed lake levels; flora and fauna values, recreational values and Tāngata whenua values; other users of the resource; and water quality;

(ii) a description of the minimum flows and the allocation block that the applicant considers any take, damming or diversion will be limited by, or that may be affected by any damming;

(iii) details, specifically, of how damming may impact on aquatic species as a result of any change to river flow, including residual flows being released from the dam and passage of fish; impacts on the geomorphology and hydrology of the river system; impacts on bed loading and coastal erosion;

(iv) details to show how storage lake water quality will be maintained above required levels by avoiding and remedying problems such as:

(1) nutrient and carbon enrichment from lake-bed soils and vegetation;

(2) nutrient enrichment from changing surrounding land uses;

(3) changes in thermal regimes in lakes;

(4) thermal stratification (layering);

(5) low oxygen concentrations and chemical changes in bottom layers;

(6) changes upon lake remixing;

(7) lake drawdown effects; and

(8) sedimentation, e.g. re-suspension of lake shore sediments.

(v) details specifically of how the taking and use of surface water, when used for augmentation, may impact on groundwater. In particular, consideration must be given to the potential for incidental recharge to cause land drainage problems because of elevated groundwater levels, and the impact this may have for other land users, for example, land-based sewerage discharge systems;

(vi) details of how the take, dam or diversion will be monitored and how the effects of these will be monitored and by whom;

(vii) an assessment of any actual and potential effects that the activity may have on the environment, including any effects on:

(1) aquatic ecosystems values;

(2) cultural and spiritual values;

(3) human use values, including recreational use values and food gathering;

(4) natural character, amenity and aesthetic values; and

(5) water quality.

5.7.3.2 The taking and use of groundwater

In addition to the general information outlined above, applications for the taking or use of groundwater must include the following information, where appropriate:

(a) a description of the location of the bore or bores from which the proposed abstraction is to occur, as well as specific detail for each individual bore from which it is proposed to abstract, including bore depth, screen depths and lengths, bore diameter, geological log, and water level information, also detail of the depth, length, width, orientation, and construction design of any associated gallery. Also provide a report prepared by an appropriately qualified person to demonstrate compliance with conditions in rules WQL36 and WQL38. A site map showing location of proposed abstraction bores (to an accuracy of plus or minus 10 metres); the location of all other neighbouring bores; and the location of any surface water bodies such as springs, drains, streams, and rivers. If the water abstracted is to be used for irrigation, then the location of the area to be irrigated should also be shown;

(b) a description of the proposed pumping schedule including the following detail relating to EACH bore it is proposed to abstract from – instantaneous maximum pump rate, proposed maximum weekly volume and proposed maximum seasonal volume;

(c) a description of the use to which the water is to be put, including a demonstration of the reasonable use of water:

   (i) for irrigation use, it will need to consider the intended land-use activity, irrigation system used and on-site physical factors such as soil water holding capacity and evapotranspiration. It will need to include details of other existing resource consents (including permitted activities) to use surface and/or groundwater for irrigating land on the same property, and show that, cumulatively, the exercise of all resource consents will be an efficient use of water;

   (ii) for public and/or stockwater supply purposes, it will need to consider the proposed quantity of water per head of population and/or per hectare or stock unit supplied, potential growth in demand, method of conveyance and evidence that excessive quantities are not leaked from the system, as well as detail of water shortage strategies;

   (iii) for industrial uses, it will need to consider the product output per unit of water used, and include a water audit of the whole business. For guidance on this, obtain a copy from Environment Canterbury of guidelines that have been developed for auditing industrial water use;

(d) a description of the allocation block (see Policy WQN14) from which the applicant wishes to abstract water and what the applicant considers the abstraction will be limited by;

(e) an assessment of the effect of the take and use of groundwater on the groundwater resource. The techniques used to assess effects may include some or all of the following:

   (i) use of water balance estimates based on estimated recharge and through flow to show the proposal will not result in unacceptable stress to the groundwater resource;

   (ii) use of quantitative tools such as numerical modelling to show the proposal will not result in unacceptable stress to the groundwater resource;

(f) an assessment of the effect of the take and use of water on other groundwater resource users. The techniques used assess effects may include some or all of the following:

   (i) knowledge of the effects of existing groundwater abstractions in the area, including the existing cumulative impacts on neighbouring well yields;

   (ii) use of quantitative tools such as analytical equations or numerical modelling for estimating well interference impacts on neighbouring wells. It will need to be demonstrated that appropriate hydrogeological data is used (see Table 3 for the appropriate aquifer test information to use in analytical equations or numerical modelling). For guidance on using these techniques, obtain a copy from Environment Canterbury of guidelines that have been developed for auditing well interference effects;

   (iii) a list of all the neighbouring well owners, with details of their wells, who may be potentially adversely affected by the proposal. Describe any consultation with these people, including written approvals if these have been obtained. Environment Canterbury can provide copies of standard forms for recording of written approvals, if required, and can also provide a list of the wells currently listed in the WELLS database operated by the council;

(g) an assessment of the effect of the take and use of groundwater for group or community drinking water supply on other groundwater resource users, including neighbouring land owners; and a risk assessment of the potential for contamination of the water supply. The assessment should include:

(i) the number of dwelling houses or other buildings, and the number of people to be served by the supply scheme to determine whether the use is for group or community drinking water supply; and

(ii) where the use is for community drinking water supply, the extent of and establishment of a community water supply protection zone for the protection of the quality of the water to be supplied from the take;

(iii) where the use is for community drinking water supply, a risk assessment of the potential for groundwater contamination to occur, and measures that will be taken to ensure the risk is minor;

(iv) consideration of the effects of establishing such a community water supply protection zone on neighbouring land owners and/or occupiers and any measures proposed to avoid remedy or mitigate adverse effects;

(v) in addition to (ii) and (iii) above, the following information is to be provided and used to determine the dimensions of any Community Water Supply Protection Zone:

(1) hydrogeology of the aquifer;

(2) assessment of the vulnerability of the groundwater to contamination;

(3) pumping rate of the well;

(4) population served by water supply;

(5) identification of existing potential sources of contaminants, their volume, concentration and pathways into groundwater;

(6) time of travel of identified contaminants to the well;

(7) mitigation methods, such as water treatment; and

(8) determination of risk, including modeling of credible worst-case risk scenarios;

(h) an assessment of the effect of the take and use of groundwater on surface water flows. The techniques used for assessing effects may include some or all of the following:

(i) a general description of the source water body from which water will be taken, including: low, average and maximum flow rates, variability of flow, seasonal fluctuations, flora and fauna values, recreational values, other users of the resource, water quality and Tāngata Whenua values;

(ii) resource availability, including a description of the minimum levels or flows and the surface water allocation block (see Policy WQN14) which the hydraulically linked groundwater will be limited by;

(iii) use of quantitative tools such as analytical equations or numerical modelling for estimating stream depletion effects. It will need to be demonstrated that the appropriate hydrogeological data is used (see table below for the appropriate collection of field measurements to use in analytical equations or numerical modelling). For guidance on using these analytical equations and numerical modelling obtain a copy from Environment Canterbury of guidelines that have been developed for estimating stream depletion effects;

(i) an assessment of the effect of the take and use of groundwater on saltwater intrusion – where the take is within 2000 metres of the coast. The techniques used to assess effects may include some or all of the following:

(i) use of quantitative tools such as analytical equations or numerical modelling for estimating a change in the saltwater/freshwater interface at the coast. It will need to be demonstrated that appropriate hydrogeological data is used (see table below for the appropriate collection of filed measurements to use in analytical equations or numerical modelling). For guidance on using these analytical equations and numerical modelling, obtain a copy from Environment Canterbury of guidelines that have been developed for auditing for saltwater intrusion effects;

(ii) if a replacement take is sought, then information to show there have been no such adverse effects occurring in the past;

(iii) details, specifically, of how the taking and use of groundwater, when used for augmentation, may impact on groundwater in another area. In particular, consideration must be given to the potential for incidental recharge to cause land drainage problems because of elevated groundwater levels and the impact this may have for other land users, for example, land-based sewerage discharge systems.

Many of the techniques that should be used to assess the different potential adverse effects will need to use hydrogeological data collected, based on field measurements carried out in the vicinity of the proposed activity. Outlined below in Table WQN3 is a list of the types of field measurements that may need to be undertaken to provide the appropriate data. As can be seen from the table, many field measurements will provide hydrogeological data that can be used to assess a number of different potential adverse effects.

Table WQN3: Field measurements available to provide appropriate hydrogeological data in the form of aquifer parameters to assist in carrying out assessments of environmental effects

Field Measurements	Description	Parameters Obtained
Single well pumping tests		
Specific capacity test	Specific capacity	Potential well yield Rough estimate of interference effects
Step test	Well performance parameters B (combination of linear well and aquifer losses) C (non-linear well loss co-efficient) Transmissivity	Potential well yield Interference effects (including stream depletion and saltwater intrusion)
Constant rate test	Transmissivity	Interference effects (including stream depletion and saltwater intrusion)
Recovery (usually done in combination with one of the above tests)	Transmissivity	Interference effects (including stream depletion and saltwater intrusion)
Slug test (suitable for very low transmissivity sites)	Hydraulic conductivity Transmissivity (where aquifer thickness is known)	Interference effects (including stream depletion and saltwater intrusion)
Test pumping with observation wells		
Constant rate test	Transmissivity Storativity Leakage parameters (in semi-confined aquifers)	Interference effects (including stream depletion and saltwater intrusion)
Variable discharge tests	If rate changes are recorded then: Transmissivity	Interference effects (including stream depletion and saltwater intrusion)

Field Measurements	Description	Parameters Obtained
	Storativity Leakage parameters (in semi-confined aquifers)	
Recovery test (usually done in combination with one of the above tests)	Transmissivity	Interference effects (including stream depletion and saltwater intrusion)
Tests related to stream depletion (in general order of increasing reliability)		
Infiltration tests	Streambed vertical hydraulic conductivity Streambed conductance where stream width is known	Stream depletion taking account of streambed clogging layer
Seepage surveys	Streambed vertical hydraulic conductivity Streambed conductance where stream width is known	Stream depletion taking account of streambed clogging layer
Pumping test with observation wells adjacent to stream	Transmissivity Storativity Streambed Conductance	Interference effects (including stream depletion taking account of streambed clogging layer)
Combined gauging and piezometric surveys	Streambed conductance	Stream depletion, taking account of streambed clogging layer, if transmissivity and storativity are already known

A guideline on how to carry out pumping tests is also available from Environment Canterbury.

5.7.3.3 The planting of forestry in flow-sensitive catchments

In addition to the general information outlined in 5.7.2, the following specific information is to be provided with any application for a land use consent to plant new areas of forestry in flow-sensitive catchments listed in Schedules WQN15.1-WQN15.4:

(a) a description of the proposed forest planting, including the species to be planted, the timing and management of plantings, site preparation and the management of the area (including weed and ground cover management);

(b) a detailed site plan outlining:

(i) the location of the forest and the sites to be planted;

(ii) a description and map of the existing vegetation cover in the area to be planted;

(iii) a map showing details of any rivers or other water bodies including springs and wetlands within the catchment to be planted; and

(iv) management of the riparian margins of any water bodies, including location and width of any unplanted margins, and the proposed management of these margins;

(c) a description of any existing uses or values for the water within the catchment to be planted;

(d) an assessment of any actual or potential effects of the forest, at maturity, on:

(i) water flows and levels for the water bodies, including any change to the frequency and duration of occurrences of flows below the set minimum flow or 7DMALF, as measured at the monitoring site identified for the catchment in Appendix WQN4; and

(ii) any values or existing uses of the water bodies; and

(e) details of any measures taken, or options, to avoid, remedy or mitigate:

(i) any reductions in flows or levels for the water bodies; or

(ii) any adverse effects on values and uses of the water bodies.

5.10 Financial contributions

Financial contributions:

(a) any resource consent granted in accordance with rules in this chapter may include a condition requiring a financial contribution. Such a contribution may be in the form of money, land or a combination of money and land (see section 108(9) RMA);

(b) the purpose of such financial contributions is to offset the actual or potential loss or reduction of instream or riparian habitat values through the exercise of resource consents. In the case of damming this may include the loss of instream and riparian habitat values due to inundation, the loss of fish passage due to the dam itself, or the loss of natural flows down-stream due to the storage and the controlled release of the water. In the case of diversion or taking of water, this may include the loss or reduction of instream and riparian habitat values or the loss or reduction of natural flows downstream due to individual diversions or takes or the cumulative effect of diversions or takes;

(c) financial contributions may be made for the purpose of providing land at another location, or funding or both for reinstatement, enhancement or protection, of the type of natural resources that were inundated by damming, for providing fish passage or alternatives to fish passage that offset the effect of damming, or for works, planting or other riparian management that reduce the effects of changes to flow regimes, and that enhance or improve the instream and riparian habitat values;

(d) when considering the need for a financial contribution, Environment Canterbury will have regard to the criteria in the assessment matters below. A financial contribution may not be appropriate in every case, even where there are adverse effects;

(e) every resource consent will be considered on a case-by-case basis as to the nature and extent of any contribution that may be required. Environment Canterbury does not intend that adverse environmental effects be fully mitigated or fully compensated in every case by way of financial contributions. The actual amount of any contribution will vary according to the specific circumstances of each activity and the application of the assessment matters below;

(f) financial contributions may be in the form of money, land or a combination of the two. Contributions of money to Environment Canterbury shall be paid into the Environmental Enhancement Fund or another fund operated by Environment Canterbury and used for the general purpose for which such contributions are taken;

(g) when deciding whether or not to impose financial contributions, the types of contribution and their value, Environment Canterbury will have particular regard to the following matters:

 (i) the extent to which any adverse effects resulting from the activity can and should be remedied or mitigated, instead, by way of works or services carried out on or near the site;

 (ii) the extent to which a financial contribution may offset or provide compensation to the community or environment for adverse effects caused or contributed to by the activity and not otherwise avoided, remedied or mitigated by the consent holder;

 (iii) the extent to which a financial contribution would achieve the objectives and policies of this plan;

 (iv) the necessity for establishing or continuing the activity;

 (v) the reasonableness of the contribution and consistency with the purposes of the Resource Management Act, and the relationship between the activity for which the consent has been granted and its effects;

(vi) any other financial contribution required by any other statutory authority with respect to that activity;

(h) when deciding the actual value of the financial contribution required, Environment Canterbury will have particular regard to:

(i) the size and extent of the effects of the activity for which the consent is granted and that the contribution is in reasonable proportion to the significance of any adverse effects caused or contributed to by the activity;

(ii) the extent to which any positive effects of the activity offset any adverse effects.

The actual value of any financial contribution (whether land or money) shall not exceed 10% of the capital value of the development.

Bonds

A bond may be required for the performance of any condition or conditions of consent.

These may include:

(a) conditions relating to remedial, restoration work, or work in mitigation of effects, or

(b) conditions relating to ongoing monitoring of long-term effects.

5.12 Water quantity monitoring

5.12.1 Monitoring procedures

A regional plan is required by Sections 35(2)(b) and Section 67(1)(i) to state the procedures to be used to monitor the efficiency and effectives of policies, rules, or other methods. A regional plan has to be reviewed not more than ten years after it has been made operative. For a review to be successful it is necessary to know how efficient and effective the policies and methods have been in contributing to achieving the plan's objectives and environmental results anticipated. In particular it is necessary to know whether each individual policy, and the methods to implement it, are contributing positively, neutrally or negatively.

Linked to this is the need to monitor the state of the environment and understand the causes of any changes, and the extent to which provisions in this chapter may have brought about those changes.

Chapter 1.3 of the Proposed NRRP outlines the general procedures to be used to monitor the overall effectiveness of the Proposed NRRP. Section 5.12 of this chapter is additional to that. This section sets out the general procedures to be used in Chapter 5 to monitor the:

(i) Achievement of the anticipated environmental results

(ii) Efficiency and effectiveness of the chapter's policies and methods.

It also identifies some other areas of environmental monitoring that Council intends to undertake. From time to time Council may need to deviate from the specific programmes listed if it is shown that the monitoring identified is no longer appropriate, or there is a more effective way of undertaking the monitoring."

The procedures to monitor the suitability and effectiveness of the water quantity objectives and policies are outlined below. To meet the requirements of section 35 of the RMA, Environment Canterbury will carry out the following types of monitoring:

(a) monitoring of key human activities that are likely to exert pressure on the region's water resources and impact on surface and groundwater bodies;

(b) monitoring of the state of the environment to assess whether anticipated environmental results are being achieved;

(c) monitoring of surface flows and groundwater levels to assist in the implementation of flow and allocation regimes; and

(d) compliance monitoring of resource consents, permitted activities and other processes to ensure compliance with conditions and rules.

5.12.2 Monitoring of environmental pressures

Table WQN4: Water quantity pressure indicators

Pressure	Indicator	Location of monitoring	Method of monitoring	Frequency of monitoring	Method of reporting
Surface water takes	Number of takes and volume of water allocated from a surface water body Proportion of primary allocation block allocated Actual volumes of water taken	Each surface water body	ECan database	Continuous	Annual reporting
Ground water takes	Number of bores/ volume of water allocated from an aquifer and/or allocation zone Proportion of primary allocation block allocated Actual volumes of water taken	Each allocation zone	ECan database	Continuous	Annual reporting
Irrigation	Area of land under irrigation Irrigation application method and rate Development patterns	Whole region	ECan consents database MAF AgriBase database Statistics New Zealand Satellite imagery or aerial photography Production sector reports	Continuous	Annual reporting
Dams and diversions	Number, location and size of new dams and/or diversions	Whole region	ECan consents database	Continuous	Two-yearly
Forest plantations in flow-sensitive catchments	Area of planting Changes in flow	Flow-sensitive catchments	Satellite imagery or aerial photography Production sector reports Flow monitoring ECan consents data base	Continuous	Five-yearly

5.12.3 Monitoring anticipated environmental results

Environment Canterbury will undertake to monitor the condition and the water flows, levels and pressures of the region's water bodies to determine how effectively the policies and methods in the plan are achieving the environmental results anticipated and provide a baseline to measure environmental changes. The monitoring programme is outlined in Table WQN4.

Table WQN5 Surface water and groundwater quantity – anticipated environmental results and associated monitoring and reporting

Anticipated environmental result	Environmental indicator(s)	Method of monitoring/ investigation	Frequency of monitoring/ investigation	Reporting
No decline in naturalness of flows and lake levels in natural state and high naturalness water bodies	Natural (baseline) river flows and, lake and wetland water levels, where no or low rate of abstraction	Routine water flow/level recording of a sample of two of each river and lake type in natural state and high naturalness water bodies	Continuous monthly recording	Five-yearly summary report
	River flows and, lake and wetland water levels	River flows if any relevant activity in the area Lake levels if required	As required	Five yearly summary report
Sufficient levels of water and sufficient flows (flow regimes) of water for the protection of instream values, including fisheries, wildlife, natural character and recreation in lakes and rivers	Lake and wetland levels, and spring-fed stream and river flows. The effect of abstraction on water levels and on flows and flow frequencies	Permanent river flow measurement sites and identified gauging sites Groundwater levels in spring discharge zones	Automatic with continuous recording and others on an as required basis Monthly water level measurements	Annual reporting
	The ecological status of lake, wetland and river ecosystems (see "Diversity and productivity of fisheries" Table WQL4 and WQL5)	Liaise with DoC, Fish and Game Council, Royal Forest and Bird Protection Society and other environmental agencies; Ministry of Agriculture and Forestry; and water permit holders	Annually	Annual reporting
	Ambient water quality – periphyton growth – sedimentation of gravel beds with fine sediment Ecosystem health – biotic health index – habitat health index	Same as in Table WQL4 and WQL5	Quarterly or monthly sampling At least twice per year over summer	Annual activity report Three-yearly data analysis report Three-yearly regional technical report
	The maintenance of the natural character of water bodies (including natural flow regimes)	Routine water flow/level recording of a sample of two of each river and lake type where little or no abstraction occurs	Continuous monthly recording	Five-yearly summary report
	The recreational opportunities available regionally and in association with specific water	Survey recreational opportunities and community satisfaction	Carry out as part of any minimum flow review then	Five-yearly

Anticipated environmental result	Environmental indicator(s)	Method of monitoring/ investigation	Frequency of monitoring/ investigation	Reporting
	bodies		five-yearly	
Sufficient depth of water and flows for the protection of mauri and for ensuring mahinga kai, wāhi tapu and wāhi taonga requirements are satisfied.	Quality and abundance of mahinga kai Use of the Cultural Health Index (CHI) if appropriate	Ngāi Tahu – survey of selected water bodies Complaints	Ongoing	Report to Environment Canterbury
The risk of an increase in the frequency, duration or severity of low flows in flow-sensitive catchments as a result of land use change is reduced, due to improved understanding, and management of land use change, and riparian planting.	Changes to frequency, duration or severity of occurrences of low flows in flow-sensitive catchments	River flow recording sites or stream gaugings	At least annually	Annual reporting
	Level of understanding by groups within community	Surveys of awareness and practices	5 yearly	Five-yearly reporting
	Area of scrub and forest reversion, spread of wilding pines, trends in spread in flow-sensitive catchments	Aerial or satellite surveys of vegetation type and extent	At least 5 yearly	Five-yearly reporting
	Riparian habitat – species composition and density of canopy in flow-sensitive catchments	Aerial or land based surveys	At least 5 yearly	Five-yearly reporting
No long-term contamination of groundwater as a result of changes in groundwater levels or pressures due to groundwater abstraction.	Coastal groundwater levels	Network of coastal groundwater monitoring bores Specifying appropriate consent conditions	Annually, monthly, six-monthly, or otherwise, depending on risk	Annual reporting As per specific policy or schedule requirements
	Coastal groundwater quality	Network of coastal groundwater monitoring bores (see also Table WQL6) Geophysical surveys where appropriate Specifying appropriate consent conditions	Annually, monthly, six monthly, or otherwise, depending on risk	Annual reporting As per specific policy or schedule requirements
	Groundwater levels and pressures	Network of groundwater monitoring bores Specifying appropriate consent conditions	Annually, monthly, six monthly, or otherwise, depending on risk	Annual reporting As per specific policy or schedule requirements
	Groundwater quality	see Table WQL6	see Table WQL6	see Table WQL6
De-watering of aquifers due to groundwater abstraction does not cause localised land subsidence	Groundwater levels Observation of subsidence	Network of groundwater monitoring bores Specifying appropriate consent conditions	Annually, monthly, six monthly, or otherwise, depending on risk	Annual reporting

Anticipated environmental result	Environmental indicator(s)	Method of monitoring/ investigation	Frequency of monitoring/ investigation	Reporting
Water that is taken is used more efficiently	Adoption of efficient methods of using water	Liaison with Ministry of Agriculture and Forestry, water permit holders, national or regional organisations for producers (e.g. Fruit and Vegetable Growers and Federated Farmers)	Ongoing	Annual reporting
	Test efficiency of methods with consent application, review and renewal	Review or renewal of permits. Specifying appropriate consent conditions	Progressively review on a catchment basis	Annual reporting
	All irrigation methods 80% efficient by 2015	Survey water use and water use methods	Five-yearly	Five-yearly
Allocation limits are established to provide reliable supplies of water enabling sustainable use	Water allocation and compliance with allocation limits	Maintain a register of water allocated	Ongoing	Annual reporting
	Community satisfaction	Survey catchment communities	Progressively as specific flow/level and allocation regimes are implemented	Annual reporting
	Frequency of restrictions	Maintain a record of restrictions	In the event of water shortages	Annual reporting
	Impact on regional productivity and wellbeing of water shortages	Liaison with Ministry of Agriculture and Forestry, water permit holders, and national or regional organisations for producers (e.g. Fruit and Vegetable Growers and Federated Farmers)	In the event of droughts	Two-yearly
	Long term trends in groundwater levels	Network of groundwater monitoring bores Groundwater models Climate variability monitoring	Up to monthly	Annual reporting
Adverse effects on reliable supplies of water are no more than minor in flow-sensitive catchments due to plantation forestry or reversion to woody species	Change in land use Frequency of restrictions	Aerial or satellite surveys of vegetation type and extent River flow measurement and gauging Maintain a record of restrictions	On going In the event of water restrictions	Five-yearly
Improved availability and enhanced supply of water for abstractive and instream uses as a result of augmentation	What augmentation has occurred River flow measurement sites and gauging sites	Monitor applications		Five-yearly.
All anticipated environmental results	Incidents recorded, or reported to the Regional Council, relating to low river flows, or non-compliance	As reported	As reported	Six-monthly

5.12.4 Compliance monitoring

The following table sets out the compliance monitoring and reporting that Environment Canterbury will undertake to ensure that activities comply with rules and consent conditions. The indicated method and frequency of monitoring is a general description of the minimum monitoring that may be undertaken. In addition, Environment Canterbury will respond to complaints received about any particular matter. The response may include monitoring of resource consents or unauthorised activities, and subsequent enforcement action.

Table WQN6: Compliance monitoring

Type of authorisation	Method of monitoring	Frequency of monitoring	Reporting
Prohibited activities, unauthorised activities	Response to complaints or site inspections	As required	Annually in the Environment Canterbury annual compliance monitoring report
Permitted activities to take, dam or divert water or for plantation forestry	Site inspections Monitoring the area of plantation forestry per property	On a programmed catchment basis in line with the long-term financial strategy	
	Response to complaints.	As required	
Permits to take water	Assessment of electronic abstraction records and/ or on site monitoring of abstraction rates	On a programmed catchment basis in line with the long-term financial strategy During water short periods when restrictions are applying Annually for groundwater takes allocated water on a seasonal basis	Annually in the annual environmental incidents and enforcement report
	Response to complaints	As required	
Permits to dam or divert	Site inspections	In conjunction with monitoring of permit to take Following any major flood event or during low flows As required as a condition of consent and if poor performance requires closer monitoring	
	Response to complaints	As required	
Permits to use.	Assessment of efficiency and improvements required as condition of consent	In conjunction with monitoring of permit to take As required as a condition of consent and if poor performance requires closer monitoring	
	Response to complaints	As required	
Land use permits for plantation forestry	Site inspections Flow measurements Monitoring impact of mitigation measures on instream and out-of-stream values and uses	Five-yearly, or on a programmed catchment basis	
	Response to complaints	As required	

For more information on compliance monitoring of resource consents refer to Resource Consent Information Series Booklet 9 **available from your nearest Environment Canterbury office or from the Customer Services section by phoning** 0800 EC INFO **(0800 32 4636)**

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
Water user groups Woolston/Heathcote water users group	The extent to which water user 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	The extent to which current groundwater abstractions affect the trigger levels	Monitoring of groundwater levels in trigger well	Users group meeting

Plan implementation	Criteria for assessment	Method of assessment	Reporting
groundwater management strategy	set in Policy WQN10 (which is effectively the current management strategy)	Variation sought to adjust Policy WQN10 if required	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 Canterbury annual compliance monitoring report Annually in the annual environmental incidents and enforcement report

Schedule WQN11: Daily stock water requirements

Table WQN26: Daily stockwater requirements

Stock type		Litres/head/day
Dairy cattle	- in lactation - dry	70 45
Beef cattle		45
Calves		25
Horses	- working - grazing	55 35
Breeding ewes		3
Sows		25
Pigs		11
Poultry	- per 100 birds	30
Turkey	- per 100 birds	55

For the purposes of determining stockwater requirements for rules WQN1, WQN3, WQN13 or WQN28 the total daily amount shall be determined by establishing the number of each stock per type, multiplying the number of stock on the property by the litres per head per day for each of the different stock types and summing these. This result may be multiplied by a factor of 1.2 to allow for peak demand and for some potential loss from the system.

Table WQN27: Example of application of provisions for stockwater

Land use	Stock numbers		Litres/head / day	Total L/day	Total x 1.2 L/day
Sheep and beef	Sheep	1780	3	5340	
	Beef	660	45	29700	
Total demand				35040	42048
Dairy	Dairy cows	300	70	21000	25200
Total demand				21,000	25,200

Variation 1
Proposed Canterbury Natural Resources Regional Plan of the Canterbury Regional Council

Chapter 7: Wetlands

Appendix WTL1 Wetland assessment methodology (page 7–58 to 7–76)

Prepared by:	Canterbury Regional Council
Date:	3 July 2004
Report No.	R04/15/7
ISBN:	1-86937-533-5

Appendix WTL1: Wetland assessment methodology

This procedure was developed by Environment Canterbury with assistance from outside experts. As at 4 February 2004 it had been trialled on a limited number of sites and generally found to be satisfactory. Other trials were to continue in conjunction with a working party convened by Environment Canterbury to advise on any need for the procedure to be amended.

Introduction

Wetland surveys carried out in accordance with this plan, and any resulting schedule of moderate or higher significance wetlands, will focus on:

(a) palustrine ecosystems (dominated by shallow or sub-surface fresh water with attached root vegetation, and including wetlands in the margins of rivers and lakes); and

(b) estuarine ecosystems (coastal wetlands semi-enclosed by land and dominated by effects of saline water).

These surveys have two purposes, to document the nature and extent of wetlands in the region and provide a basic assessment of their ecological and hydrological significance. Practical limitations mean that no more than a rapid assessment of any one site, focused largely on vegetation and the generalised hydrology, is possible. The information compiled in this way will be sufficient to define the significance thresholds relied on by provisions in the plan, and to facilitate ongoing trend monitoring. However, depending on the circumstances, applicants for resource consent for activities affecting wetlands may need to furnish information beyond the scope of this type of survey (see *Chapter 7.8 Information to be provided with resource consent applications*).

The Ministry for the Environment (MfE) has developed a national standard process for the classification and assessment of estuarine and palustrine wetlands (Clarkson *et al* 2002). In classifying wetlands, and assessing their condition and pressure indicators, ecological field surveys of wetlands carried out for the purpose of this plan will follow the MfE methodology.

Mapping wetland extent during field surveys will provide for baseline monitoring of this indicator, necessary for wetlands inventory at both the regional and national level. Monitoring wetland extent at a regional level can be used to test the effectiveness of policies aimed at reducing wetland loss, achieving no net loss, or increasing the area and number of wetlands (Ward and Lambie 1999).

Generally, the presence of certain indicator plant species provides the most practical method for delineating the edge of a wetland (Anderson 2001). Indicator species will vary depending on locality (i.e., coastal, lowland, high country). The dryland-wetland edge will typically be defined where one or more of these wetland indicator species are spaced less than four times their ungrazed height apart. Alternatively, analysis of soils can be used to help determine wetland-dryland boundaries.

Following field survey of a wetland site, an assessment will be made of its significance from both a hydrological and ecological viewpoint. The ecological assessment process will interpret the site information collected on wetland type and condition in the light of the following criteria: representativeness, rarity/distinctiveness, ecological context and viability (Norton and Roper-Lindsay 1999). Each wetland will be assessed as having low, moderate or high ecological significance using these criteria.

Each wetland will also be assessed as having high, moderate or low significance in relation to its hydrology. The aspects to be considered in making hydrological assessments are listed in Part D of this appendix.

The overall significance of any wetland is the higher of its ecological or hydrological significance.

It is important to realise that wetlands assessed as having low hydrological and/or ecological significance may still have considerable restoration potential. Any such restoration is, however, entirely voluntary.

Part A: The MfE method for wetland classification and recording condition and pressure indicators

The *Handbook for Monitoring Wetland Condition* (Clarkson *et al* 2002) provides a framework for classification of wetlands (Figure WTL4) and a standardised wetland field record sheet (Figure WTL5). (Those not familiar with this handbook should refer to it before embarking on a wetland survey.) The information on the field record sheet, together with a map showing wetland extent and main vegetation types, will help inform subsequent assessment of the wetland's ecological significance. The scores of the various state- and pressure-indicators can also form a baseline for subsequent monitoring of the general condition of a wetland site.

A.1.1 Wetland classification

The first box on the wetland field record sheet deals with wetland classification. Each surveyed wetland is classified based, in descending order, on:

(a) The wetland system (i.e., estuarine or palustrine);

(b) Wetland subsystem, based on water flow regime (e.g., intertidal, non-tidal, permanent, ephemeral);

(c) Wetland class, based on substrate and site chemistry (e.g., saltmarsh, mudflat, swamp, bog, flush);

(d) Wetland form, based on landform (e.g., estuary, lagoon, shore, slope, channel, basin).

The main vegetation types (indicated on an accompanying map) would also be recorded on the field sheet, together with notes on native fauna and other general comments.

A.1.2 Recording wetland condition

In the second box on the field record sheet, wetland condition at the time of survey is assessed and scored on the basis of five state indicators and six pressure indicators. The state indicators are:

(a) Change in hydrology.

(b) Change in physico-chemical parameters (e.g., fire damage, sedimentation, erosion, nutrient enrichment).

(c) Change in ecosystem intactness (i.e., loss in area of original wetland, fragmentation).

(d) Change in browsing, predation and harvesting regimes (i.e., effects of introduced herbivores, predators and humans).

(e) Change in dominance of native plants (i.e., proportion of introduced species in canopy and understorey).

Each state indicator is scored on a 0-5 scale where a low score indicates a high degree of modification, giving a total wetland condition index / 25. The higher the score, the better the wetland condition.

Hydrology is probably the single most important determinant of the establishment and maintenance of wetlands and wetland processes. In the absence of existing monitoring or historical information on hydrological regime, the presence of man-made structures (e.g., drains, stopbanks) that influence hydrology can be used as simple indicators of modification.

Sedimentation, nutrient enrichment and fire are the physiochemical parameters most commonly affecting wetlands. Runoff of suspended sediment into wetlands can smother vegetation and reduce light penetration into standing water. Sediment input is often associated with nutrient enrichment, but wetland nutrient enrichment may also result from groundwater loading and surface run-off. Sedimentation and nutrient enrichment lead to changes in the vegetation (often with increases in exotic plant species) and cause the habitat to become more anaerobic, with negative effects on invertebrate, fish and bird populations. Fires may occur naturally, but most often are of human origin. Fires disrupt wetland nutrient cycles, destroy wildlife habitat, and provide opportunities for weed invasion.

A large, intact wetland ecosystem is better able to maintain its viability and resist human effects. Wetlands that have been reduced in extent or fragmented are more vulnerable to disturbance, and can no longer offer habitat for species with low dispersal capability. The original extent of wetlands can be estimated using historical information and soil maps.

Domestic stock can cause severe damage to soil and plants from trampling and browsing; the extent of which is usually obvious. Feral animals also damage wetland flora and fauna, but are less visible than domestic stock and are much harder to control.

The change in abundance of native plants indicator is assessed by determining the extent to which native plants have been displaced by introduced plants, as introduced plants are one of the major threats to wetland condition.

A.1.3 Recording wetland pressure indicators

Pressure indicators, also scored on a 0-5 scale, with 0 being no pressure and 5 very high pressure, are:

(a) Modifications to catchment hydrology

(b) Catchment water quality

(c) Animal access (livestock or other introduced mammals)

(d) Key undesirable species (weeds or pests)

(e) Proportion of the catchment in introduced vegetation

(f) Other pressures (as specified).

The total wetland pressure index will thus be scored out of 30, with a high score indicating a greater degree of pressure on the site.

In the state (or condition) indicators, the section on change in hydrological integrity focused on modifications within wetlands. In addition, an important risk to wetlands is from changes in the catchment hydrology that can lead to lowered regional groundwater tables or reduced surface water inputs. Features affecting this score include drains and other structures that divert water from or into the catchment, clearance of vegetation within the catchment, and extraction of groundwater from shallow bores.

Deteriorating upstream water quality is an indication of future deterioration in wetland condition. Surface water and groundwater quality data from upstream of the wetland can be used, as well as other indices such as the stream health monitoring assessment kit.

Assessing the animal access indicator can be based on direct observations during the site visit or can be deduced from the nature of the catchment and the size of the wetland itself. Some background knowledge of factors such as predator control operations in the vicinity may be required to score this feature accurately.

Once key undesirable species have invaded and become established in wetlands, control and eradication can be difficult and expensive. As most undesirable species that enter wetlands usually do so only after being present in the catchment for some time, identification of these species before invasion is an important pressure indicator. The relevant species are those plants and animals that are known to be damaging to wetlands—the most common examples are willows which are able to survive and out-compete native species in most wetland habitats.

For the proportion of the catchment in introduced vegetation feature, the score is based on quantification from 0 = 0% to 5 = 100%. The reason for its inclusion is that the risk of new weed arrivals is much greater if the catchment has introduced vegetation, and that predominantly introduced catchments are less likely to allow migration of desirable animal species. For restored and created wetlands, a predominantly native catchment provides a greater likelihood of desirable plant and animal species re-introducing themselves.

Other pressures that might be scored in the final category of the pressure indicator box are residential development, mining, dairy conversions, deer conversions, off-road vehicle use, logging activity and other land-use change. Surrounding gardens may also be an important threat, as many wetland weeds are garden escapes.

Figure WTL4: Classification framework for palustrine and estuarine wetlands

Level I **Hydrosystem**	**Level IA** **Sub-System**	**Level II** **Wetland Class**	**Level IIA** **Wetland Form**	**Level III** **Structural Class** **[examples]**	**Level IV** **Dominant Cover** **[examples]**
Estuarine *(Alternating saline and fresh water)*	Intertidal Subtidal Non-tidal Inter-dunal	Saltmarsh Seagrass meadows Algalflat Mudflat Cobbleflat Rocky reef Sandflat	Estuary Lagoon Dune slack	[e.g. herbfield] [e.g. (wire) rushland] [e.g. forest] [e.g. wormfield] [e.g. cocklebed] [e.g. gravelfield] [e.g. musselreef] [e.g. sand]	[e.g. Zostera] [e.g. Leptocarpus/Juncus] [e.g. Avicennia] [e.g. Polychaetel [e.g. Austrovenus] [e.g. Diatomfelt] [e.g.-: Perna] [e.g. Muehlenbeckia]
Palustrine *Vegetation emergent over fresh water, not including floating plants)*	Permanent Ephemeral	Marsh Swamp Fen Bog Flush Seep	Shore Artificial Slope Channel Flat Basin Pool	[e.g. reedland] [e.g. algalbed] [e.g. macrophyte bed] [e.g. sedgeland] [e.g. cushionfield] [e.g. rushland] [e.g. rockfield]	[e.g. Typha] [e.g. Enteromorpha] [e.g. Ruppia] [e.g. Carex] [e.g. Leptospermum/ Cordyline] [e g. Donatia] [e.g. Schoenus] [e.g. Nostoc] [e.g. Spirogyra]
Basis of discrimination: Hydrological setting, Salinity	Flow Regime	Substrate, pH, Chemistry	Land Form	Biotic Structure	Dominant species

Source: Clarkson *et al*, Handbook for monitoring wetland condition, Ministry for the Environment

Figure WTL5: Wetland Record Sheet

Wetland name:	Date:
Region:	GPS/Grid Ref:
Altitude:	No. of plots sampled:

Classification: I System	IA Subsystem	II Wetland Class	IIA Wetland Form

Field team:

Indicator	Indicator components	Specify and Comment	Score 0– 5[9]	Mean score
Change in hydrological integrity	Impact of manmade structures			
	Water table depth			
	Dryland plant invasion			
Change in physico-chemical parameters	Fire damage			
	Degree of sedimentation/erosion			
	Nutrient levels			
	von Post index			
Change in ecosystem intactness	Loss in area of original wetland			
	Connectivity barriers			
Change in browsing, predation and harvesting regimes	Damage by domestic or feral animals			
	Introduced predator impacts on wildlife			
	Harvesting levels			
Change in dominance of native plants	Introduced plant canopy cover			
	Introduced plant understorey cover			
Total wetland condition index /25				

Main vegetation types:

Native fauna:

Other comments:

Pressure	Rating[10]	Specify and Comment
Modifications to catchment hydrology		
Water quality within the catchment		
Animal access		
Key undesirable species		
% catchment in introduced vegetation		
Other pressures		
Total wetland pressure index /30		

Source: Clarkson *et al*, Handbook for monitoring wetland condition, Ministry for the Environment, August 2002.

Part B: Assessing ecological significance

To assess ecological significance, site information contained on the wetland record sheet will be evaluated in terms of the criteria described below. Note that the bald scores for wetland

[9] Assign degree of modification thus: 5=v. low/ none, 4=low, 3=medium, 2=high, 1=v. high, 0=extreme

[10] Assign pressure scores as follows: 5=very high, 4=high, 3=medium, 2=low, 1=very low, 0=none

condition and pressure as given on the wetland record sheet cannot be directly translated into an assessment of ecological or hydrological significance. However, the scores and comments on the field sheet will assist in assessing the relative significance of similar types of wetlands (e.g., comparing several high country lake-edge wetlands from within the same ecological district).

B.1.1 Criteria for assessing ecological significance of wetlands

Various criteria and methodologies used for assessing ecological significance under section 6(c) of the Resource Management Act have been developed to assist territorial authorities in the identification of significant natural areas (SNAs) for their district plans. A similar but slightly different approach can be applied to assess the ecological significance of wetlands surveyed for a regional plan. The SNA approach is not fully transferable, because both the context of the assessment and the present pattern of wetland distribution in the wider landscape are different and necessitate some changes to method. The hydrological component, so important to an overall assessment of a wetland's significance is another point of difference. Thus, for example, it is quite possible that wetlands considered of only low or moderate ecological significance under an SNA process may rank more highly in this exercise.

The criteria and methods used for assessing ecological significance under the RMA described by Norton and Roper-Lindsay (1999) have been widely used by a number of local authorities, and will be used, in modified form, to assess the ecological significance of wetlands for this plan. Under this approach, the four main criteria for assessing ecological significance are:

(a) Representativeness

(b) Rarity/distinctiveness

(c) Ecological context

(d) Viability

B.1.1.1 Representativeness

Representativeness compares elements of natural diversity (usually ecosystem diversity) in the present landscape with the same patch of landscape as it existed at some time in the past. Ideally the only changes should be those that would have occurred naturally (that is, without human intervention).

Since wetlands can seldom be regarded as climax ecosystems, with ongoing change being more typical, the most fundamental question to be answered is: which time in the past? Wetland change was much more marked following European settlement, and a baseline can be established with greater certainty for this than for any earlier period.

Ideally, then, the plan would be aiming to identify a range and distribution of wetlands in the region that is representative of the immediate pre-European period, but there is a problem. With the passing of more than 150 years, irrespective of European settlement, wetlands would have continued to change naturally. It is not simply a matter of establishing what a particular landscape was once like and trying to represent that, there have to be some adjustments.

In making these adjustments, two of three possible kinds of change are relevant:

(a) Natural evolutionary changes in response to variations in the natural background, including, changes to climate, changes to adjacent ecosystems, and natural hydrological changes.

(b) Induced evolutionary changes in response to bush and forest clearance, land drainage, rivers trained to single courses, and naturalisation of a whole range of exotic plant and animal species.

The third kind of wetland change includes deliberate wetland destruction and wetland loss as the direct result of land development. This is not taken into account when deciding representativeness, since it is not a natural process.

Any assessment of representativeness also needs a spatial scale to define the landscape patch being represented. Ecological districts provide a well-established and suitable frame of reference for this purpose.

Assessing wetland representativeness begins, then, with developing an understanding of the types and extent of wetlands in each ecological district immediately before European settlement. This baseline must then be adjusted for changes that would have occurred since, either entirely naturally or induced by environmental changes.

For example, it is generally unrealistic to expect to adequately represent plains swamp forest now that almost all the plains have become pasture. Often the best that can be hoped for is to represent the sort of wetland such a swamp forest would probably have evolved into given the changes that have occurred, and excluding any deliberate damage.

In adjusting the baseline to the present day, sources of information may include early survey maps, soil maps, the Land Cover Database, and Land Environments New Zealand, together with relevant studies of wetland ecology and ecological change.

While soil mapping provides little insight into ecosystem character, it affords a particularly useful and easily accessible baseline for determining wetland loss within an ecological district.

This is valuable information because the greater the wetland loss, the more significant what is left becomes. Given similar condition, wetlands in an ecological district that has only two or three percent of its original wetlands are more significant than where a much higher percentage still remains.

Land Environments are also helpful. They identify climatic and landform factors likely to influence the distribution of species. Land Environments can predict the likely natural occurrence of wetlands in an area, allowing what actually exists to be assessed not only in terms of potential extent but also ecological character.

It is generally to be expected that:

(1) Lowland wetlands that retain even a small proportion of their original character will be of *very high* representative significance because their previous extent has been so vastly reduced.

(2) Coastal wetlands will generally be of high representative significance as they have likewise been substantially reduced from their previous extent and are likely to have retained a higher proportion of their original character.

(3) Hill and high country wetlands having retained more of their original extent and character will tend to be distinguished to a greater degree by ecological functioning and health rather than by mere existence. These wetlands may well present a wider array of representative significance levels.

B.1.1.2 Rarity/distinctiveness

This criterion looks at the presence of particular indigenous species or groups of species within a site. It recognises that it is not only the common and typical features of our environment that contribute to ecosystem functioning and health.

A significant habitat need not be predominantly indigenous provided there is rarity or distinctiveness in the indigenous species found there. Rarity in this context need not mean nationally rare, but rare at a local or regional level. Species rarity is assessed on knowledge of the species taxonomy and distribution.

Classification systems for rarity are still evolving and being developed to overcome problems such as the need to distinguish between species that are naturally rare and species that are rare because of human influences. In assessing rarity, the best authorities currently available should be used.

Distinctiveness refers to unusual species, communities or habitats. Distinctive species may or may not be rare nationally. They can be common nationally and rare locally. The assessment of distinctiveness must be based on a good understanding of species and habitat distributions. Factors to consider include:

(a) The presence of a species or habitat at a national distributional limit.

(b) The presence of a species or habitat that only occurs in that area (i.e., an endemic species).

(c) The presence of a species or habitat that although common elsewhere is particularly uncommon in that ecological district.

Distinctiveness can also encompass the seasonal presence of migratory species in the area. In assessing rarity/distinctiveness, particular attention is drawn to the possibility of the area being Canterbury mudfish (*Neochanna burrowsius*) habitat.

B.1.1.3 Ecological context

Wetlands do not occur in isolation, but as part of a wider landscape in which ecosystems interact and connect in a variety of ways. In the lowlands, hill country and inter-montane basins of Canterbury, the ecological landscape is typically patches and corridors of remnant indigenous or semi-indigenous ecosystems within a matrix dominated by agricultural, urban and plantation systems. Both the matrix and the patches/corridors can contain a mixture of native and exotic elements. There are cases where a corridor or patch of great value to native fauna is made up of exotic plant species.

Ecological context is most important to animals able to make use of corridors to move between patches. Context can also be important in assessing waterways and wetlands that depend for so many of their characteristics on the wider catchment. Examples of wetlands that could be ecologically significant on the basis of context alone include:

(a) Wetland remnants that provide stepping stones for birds between larger wetland areas.

(b) A wetland within an area of native shrubland or mixed gorse and native shrubland where each ecosystem provides connectivity between the other.

(c) Wetlands where adjacent vegetation provides vital buffering from grazing animals or other pressures.

(d) A wetland connected to a river will be more valuable to native fish habitat than another wetland that might have more native plant species but no river connection.

(e) A site that might have low botanical significance but provides seasonal food for native birds.

Ecological context is assessed on the actual or potential role of a site in:

(1) Enhancing connectivity between patches.

(2) Buffering or otherwise influencing a specific site.

(3) Providing seasonal habitat for particular indigenous species.

B.1.1.4 Viability

The viability criterion does not consider the significance of sites *per se*, but is an assessment of priority for protection management and the type of management needed.

Viability relates to the likely future condition of a wetland site. Such places need not only to be significant now, but also have potential to be significant in the future. Factors that should be considered include:

(a) The type of ecosystems, habitats or species present and how well their ecological requirements are met.

(b) The presence of disturbance—plant or animal pests, land uses, extent of fencing, water takes or discharges.

(c) The size of the area.

(d) The shape of the area.

(e) Ecological context—the distance to other areas and habitats.

(f) Conservation management needed to achieve self-sustainability, and the feasibility of that.

B.1.2 Applying the criteria

This flow chart shows application of the criteria used in assessing ecological significance. Each site is evaluated sequentially for the three main criteria—representativeness, rarity/distinctiveness and ecological context. The viability factor is evaluated as a sub-criterion for each of the three main criteria, and must be satisfied in each case.

Figure WTL6: Ecological significance flow chart

1. REPRESENTATIVENESS

Q: Does the area contain an under-represented or depleted ecosystem/habitat?

YES | **NO** – to question 2 (Rarity)

Q: Is that ecosystem/habitat sustainable or potentially so?

YES | **NO** – science/heritage site

Significant area

2. RARITY AND DISTINCTIVENESS

Q: Does the area support a rare species or distinctive feature?

YES | **NO** – to question 3 (Ecological context)

Q: Is the place likely to be viable for that species?

YES | **NO** – science/heritage site

Significant area

3. ECOLOGICAL CONTEXT

Q: Does the area play an important role in the ecology of its locality?

YES | **NO** – **OUT** (having also failed criteria 1 and 2)

Q: Is this role sustainable?

YES | **NO** – science/heritage site

Significant area

Part C: Recording hydrological factors

C.1.1 Hydrological information for wetland and catchment

The form reproduced below as Figure WTL7 provides a standardised field record of information relevant to the quantity and quality of water in the wetland and its catchment. This information, together with the ecological field records will inform subsequent assessment of the wetland's significance.

Figure WTL7: Wetland water quantity and quality summary sheet

Purpose:

(a) To provide input into assessments of the sensitivity of the subject wetland to changes in upstream water quantity and quality.

(b) To provide input into assessments of the significance of the wetland in maintaining water quantity in its downstream catchment.

(c) To provide input into assessments of the significance of the wetland in maintaining and improving water quality in its downstream catchment.

Owner/occupier:

Wetland name:

Location:

Area of wetland (hectares):

Record hydrological information for wetland and catchment	
Landscape setting	
Geomorphology of wetland	
Geology of catchment surface	
Dominant water source	
Other significant water sources	
Location of water source (e.g., seepage from terrace, aquifer discharge, natural dam, coastal beach barrier, oxbow cut-off, rainfall ponding, etc)	
Flow direction	
Periodicity of flow	
Dominant wetland vegetation	
Fertility (vegetation indicators)	
Presence of peat soils	
Groundwater level records	
Rainfall records	
Stream flow records	
Catchment vegetation: past/present/likely future	
Instream features of the stream draining the wetland:	
Bed material (e.g., cobble, fine gravel, sand, silt)	
Signs of algal or macrophyte growth	
Quality of water in relation to fish habitat, use for livestock, domestic or public supply	
Assess hydrological relationship of wetland to downstream catchment	
Flood attenuation	
Groundwater recharge	
Sediment retention	
Nutrient transformation	
Contaminant retention	

Continued on next page

Estimate sensitivity of wetland to change	
Interception of inflows/drainage of the wetland	
Stock access to the wetland	
Impact of plant or animal pests on the wetland	
Abstraction of water from the wetland's catchment	
Changed wetland water quality	

Part D: Assessing hydrological significance

The hydrological significance of a wetland includes both its water flows and its associated role in maintaining or improving downstream water quality.

In evaluating hydrological significance, field information gathered from each site will be integrated with existing catchment data to provide an assessment from two perspectives:

(a) The significance of the current hydrological regime to the wetland itself.

(b) The significance, hydrologically, of the wetland to water quantity and quality within the catchment.

In addition to the location and size of the wetland, notes will generally be made of the surface geology of the catchment, the nature of the main and any other sources of water. Some factors likely to indicate the degree of any vulnerability to changes will also be recorded.

Among these will be an estimate of any direct or indirect hydrological effects of changes in the vegetation cover of the contributing catchment. Particular note will be taken of alterations to the hydrological regime such as occur when water is intercepted before reaching the wetland or is drained from the wetland or the immediate vicinity.

The field record will include a general description of the past, present and likely future vegetation of the wetland itself, noting in this connection any effects of grazing animals. The notes will include an estimate from a water quantity and quality perspective of the effects of any changes to the wetland vegetation.

In making the hydrological significance assessment, attention will typically be paid to effects on the present ecology of the wetland and on the quantity and quality of water in hydraulically linked water bodies. Particular note will be taken of the significance of the wetland to instream values and any other purposes for which a linked water body is managed.

D.1.1 Significance of water quantity to the wetland

(a) Wetland hydrology is of high significance if the wetland has moderate or higher ecological significance and the present hydrological regime cannot be altered without being likely to impact permanently on the ecology of the wetland.

(b) Wetland hydrology is of moderate significance if the wetland has moderate or higher ecological significance and minor alterations to the present hydrological regime are unlikely to impact permanently on the ecology of the wetland.

(c) Wetland hydrology is not significant if no foreseeable alterations to the current hydrological regime would impact permanently on the ecology of the wetland, whatever its ecological significance.

D.1.2 Significance of wetland water quantity and quality within the catchment

(a) A wetland is significant within its catchment if any alteration to the present hydrological regime would be likely to have a significant adverse effect. Examples of significant adverse effects include:

    (i) Reducing the flow from a wetland that contributes most of the low flow to a stream or other water body.

    (ii) Reducing the flow from a moderate sized wetland (greater than two hectares) that contributes significant low flow to a stream or other water body.

    (iii) Reducing water storage and/or flood attenuation over a wide area (high significance) or a localised area (moderate significance).

    (iv) Reducing groundwater recharge from a wetland greater than two hectares.

    (v) Reducing the effectiveness of water quality improving processes such as sediment filtration and retention, nutrient transformation and contaminant retention.

(b) A wetland is not significant with regard to water quantity or quality in the downstream catchment if altering the present outflow regime would have little or no significant adverse effects. Examples of adverse effects that would not be significant in this respect include:

(i) Reducing the flow from a wetland that makes a negligible contribution to any other water body.

(ii) Reducing water storage and/or flood attenuation within the boundaries of the property or properties on which the wetland is located.

(iii) Reducing groundwater recharge from a wetland of two hectares or less.

(iv) Increasing the outflow from a wetland while maintaining or improving the water quality of that outflow.

Part E: Recording wetland management factors

E.1.1 Historical information

The form reproduced below as Figure WTL8 provides a standardised field record of information relevant to the past, present and future progression of the site, including its relationship to ongoing management of the adjoining land. This provides a perspective beyond the wetland itself and may often provide an insight into its future outlook. This information is only relevant to determining a wetland's significance insofar as there is any need to consider its future viability.

Figure WTL8: Wetland management factors

Purpose:

(a) To provide historical background and guidance on the likely future management of the wetland and its surroundings.

(b) Where either of these factors is relevant, to assist assessment of the wetland's future viability.

Owner/occupier:

Wetland name:

Location:

Area of wetland (hectares):

Record historical information for wetland and catchment	
Historical drainage/diversion of water	
Historical abstraction of water	
Historical vegetation clearance within the wetland	
Historical vegetation clearance outside the wetland	
Historical changes in water clarity	
Historical changes in nutrient status	
History of plant and animal pest invasion	
Historical protection measures:	
- Fencing from stock	
- Grazing restrictions/types/intensity of grazing	
- Plant and animal pest management	
Historical introduction of native plants and/or fauna	
Historical introduction of exotic plants and/or fauna	

Record current environmental factors	
Current adjoining land use(s)	
Current pastoral management role if any:	
- summer grazing/type/intensity/duration	
- grazing at other periods/type/intensity/when	
- emergency grazing/type/intensity/duration/when	
- emergency water storage	
- stock shelter	
- other	
Current stock access: stock excluded /restricted*/unrestricted	
Established plant and animal pests	
Incipient plant and animal pests	

*Note type of restrictions

Continued on next page

Record projected future management	
Projected adjoining land use(s)	
Projected pastoral management role if any:	
- summer grazing/type/intensity/duration	
- grazing at other periods/type/intensity/when	
- emergency grazing/type/intensity/duration/what circumstances	
- emergency water storage	
- stock shelter	
- other	
Projected stock access: stock excluded/restricted*/unrestricted	
Projected plant and animal pest problems	
Projected introduction of plants and/or fish or wildlife	
Projected voluntary restoration to more natural state	

*Note type of restrictions

Material from Schedule WQN9 Revision – Review of seasonal use approach included in proposed NRRP. Report U05/15

Table A1 in "Schedule WQN9 Revision – Review of seasonal use approach included in proposed NRRP". Report U05/15, May 2005 (Prepared for Environment Canterbury by Anthony Davoren and David Scott) is incorporated in the Waitaki Catchment Water Allocation Regional Plan.

The table lists the material that is incorporated and the provision in the Plan that refers to the material.

Material from Report U05/15	Relevant plan provision
Table A1	Policy 16

Schedule WQN9 Revision
Review of seasonal use approach included in Proposed NRRP

Appendix 1: Proposed schedule and total seasonal demands

Table A1 Proposed schedule for seasonal total demand

Prepared by:	Anthony Davoren and David Scott for Environment Canterbury
Date:	May 2005
Report No.	U05/15

Appendix 1: Proposed schedule and total seasonal demands

Table A 1 Proposed schedule for seasonal total demand

Soil Type		PAW Class, (mm)	Peak Design Demand (mm/day)	System Capacity to meet peak demand (l/s/ha)	Total Seasonal Demand (mm)
Intensive Pasture					
Very light and light, shallow depth with stones	Lismore silt loam, Paparua silt loam, Eyre silt loam	< 75	5.5-6.0	0.8	815
Light, shallow and medium depth with stony or sandy sub-soil	Chertsey silt loam Templeton shallow silt loam, Wakanui shallow silt loam, Waimakariri sandy loam	75-110	4.5-5.5	0.65-0.8	750
Deep, heavy	Templeton deep silt loam, Temuka and Wakanui silt and clay loam	>110	4.0-4.5	0.58-0.65	670
Arable					
Very light and light, shallow depth with stones	Lismore silt loam, Paparua silt loam, Eyre silt loam	< 75	5.5-6.0	0.8	750
Light, shallow and medium depth with stony or sandy sub-soil	Chertsey silt loam Templeton shallow silt loam, Wakanui shallow silt loam, Waimakariri sandy loam	75-110	4.5-5.5	0.65-0.8	625
Deep, heavy	Templeton deep silt loam, Temuka and Wakanui silt and clay loam	> 110	4.0-4.5	0.58-0.65	550