UNDER The Environment Canterbury (Temporary Commissioners and Improved Water Management Act) 2010 and The Resource Management Act 1991

AND

IN THE MATTER OF The hearing of submissions on the Proposed Land and Water Regional Plan.

EVIDENCE OF PETER FRANCIS CALLANDER

Introduction

1.1. My name is Peter Francis Callander. I hold the qualifications of BSc (Geology) from the University of Auckland and MSc (Earth Sciences) from the University of Waterloo (Canada). I am a member of the New Zealand Hydrological Society, Water NZ and the USA based National Ground Water Association. Since 1991, I have been employed as a Senior Environmental Scientist with Pattle Delamore Partners Limited, an environmental consulting firm specialising in water resources. In 1997, I was appointed as a Director of that firm. Previously I had been employed for eight years by the Canterbury Regional Council and its predecessor the North Canterbury Catchment Board.

1.2. I have been involved with the management of water resources for a large part of my career, including many projects involving water management and water allocation. This has included work on numerous projects where I have modelled and advised on the management of issues associated with irrigation including work for the Waimakariri Irrigation Scheme, Rangitata South Irrigation, Barhill-Chertsey Irrigation, the Southern Valleys Irrigation Scheme and Wairau Valley Water Enhancement Scheme. I have also reviewed work completed by other parties for the Central Plains irrigation scheme (on

behalf of the Christchurch City Council and others) and applications for irrigated land use change in the MacKenzie basin (on behalf of Meridian Energy). I have been involved with the recent development of groundwater allocation policy for Horizons Regional Council and for the Marlborough District Council.

1.3. I completed the MfE Commissioner Training Course, "Making Good Decisions" in 2008 and the recertification course in 2012. I have been a member of hearing panels on 13 occasions dealing with consent applications for groundwater abstraction and wastewater discharges to land and to surface waterways.

1.4. A copy of my CV is attached to my evidence as Appendix B.

1.5. I have read the Expert Code of Conduct contained in the Environment Court's Practice Note 2011 and I agree to comply with it. I have prepared this evidence in accordance with the Practice Note.

2. Scope of Evidence

2.1. For this Hearing I have been engaged by the Canterbury Primary Sector Policy Group to provide technical evidence on various parts of the submissions lodged by the members of that group.

2.2. The evidence I will present deals with some aspects of the allocation of surface water and groundwater that are set out in the Proposed Land and Water Regional Plan (PLWRP). My evidence raises technical issues with the following Policies and Rules based on my expertise and experience.

- Table 1c on page 4-4 lists default outcomes for Canterbury aquifers. Policy 4.1 says these are the outcomes that must be met if alternative outcomes are not in the sub-regional sections 6-15. However the outcomes regarding Groundwater Pressure and Groundwater Levels are consistent with a minimal groundwater abstraction regime and therefore are inconsistent with the management of abstraction from Canterbury's groundwater system that is specified in Objectives 3.11, 3.12 and 3.14 and Policies 4.2, 4.4, and 4.46 of the notified plan and also in the Section 42A report recommendations, all of which refer to a level of abstraction that will not always match the Table 1c outcomes.

- Policy 4.49 deals with abstractions of groundwater outside of groundwater allocation zones and specifies criteria that will potentially place unrealistic restrictions on groundwater abstractions in a manner that is inconsistent with the remainder of the plan.

- Policy 4.52 deals with the movement of water between catchments and is inconsistent with enabling the type of water infrastructure that is promoted by the Canterbury Water Management Strategy and the Canterbury Strategic Water Study.

- Policy 4.58 specifies an unnecessarily restrictive criteria for groundwater abstractions.

- Rule 5.102: The taking of groundwater outside of a Groundwater Allocation Zone does not necessarily cause any adverse effects compared to any other groundwater abstraction in the region. Therefore classification as a discretionary rather than a non-complying activity would seem appropriate. There is nothing specifically identified in the plan that these takes do not comply with. Similarly, Rule 5.103 should not apply to condition 1 in Rule 5.101.

- Rule 5.104 should not provide the definition of a prohibited activity due to the generic and uncertain nature of the groundwater allocation zone limits. It would seem that a non-complying activity classification would be more appropriate.

- The transfer of water permits should not be used as a mechanism to reduce water use in over-allocated catchments as currently specified in Policies 4.71 and 4.73 and in Rule 5.107 condition 5. Such an approach detracts from the improved efficiency in use of the allocated resource that can be achieved by transfers.

- The recommended use of annual volumes on consents for run-of-river abstractions, as set out in Policies 4.60, 4.63 and 4.66 is a relatively ineffective means of managing those abstractions.

- Rule 5.107 condition 2 should not apply to seasonal or annual volumes for run of river abstractions where the effects on their surface water source are typically based on a flow regime and not on an annual volume. For example in most run of river abstractions seasonal volumes are only specified as a measure of efficient water use and to reduce these volumes during a transfer (as required by the current wording in Rule 5.107) makes the use of the water less efficient which is contrary to Policy 4.66 and Objective 3.11.

2.3. In some instances my evidence discusses suggested alternative wording that in my opinion is likely to achieve a more consistent water management outcome. However in doing this I acknowledge that I am not an expert planner and that the hearing panel has more expertise and experience than I do in the area of plan preparation. Therefore my suggested re-wording is presented as a mechanism to further demonstrate the point I am trying to make rather than defining the precise wording that should be used.

2.4. The details regarding the suggested changes to each of these Policies and Rules are discussed in the following sections of my evidence.

3. **Table 1c Outcomes for Canterbury Aquifers – Groundwater Pressure and Groundwater Levels** (Federated Farmers – submission point 320.19).

3.1. Policy 4.1 makes reference to Table 1 as the default outcomes that are to be met if more specific outcomes are not established in the sub-regional sections 6-15. Table 1c deals with Canterbury Aquifers and has three columns dealing with "Groundwater pressure" and "Groundwater levels" that have implications for the management of groundwater quantity. That is because the groundwater pressure within an aquifer is demonstrated by the groundwater level that is measured within a well and that level reflects the water balance between the amount of groundwater recharge and the amount of groundwater discharge, including the abstractions from bores. So when groundwater is allocated for abstraction it contributes to an increase in groundwater abstraction and groundwater levels will inevitably decline to some extent. This decline can be managed within sustainable limits that are specified through consent conditions and regional plans, such that it is environmentally appropriate and acceptable.

3.2. The abstraction of groundwater is an important component of the management of Canterbury's water resources as it supplies a large number of community water supply, agricultural and commercial activities. In particular, within the PLWRP the abstraction of groundwater is promoted through Objectives 3.11, 3.12, 3.14 in the notified plan and in the amended objectives 3.3, 3.4 and 3.6 of the recommended changes in the Section 42A report.

3.3. However the Groundwater Pressure and Groundwater Levels outcomes in Table 1c all specify a regime which for some areas would mean that no decline in groundwater levels should occur and that the status quo groundwater pressures and levels are to be maintained, which can only occur if no groundwater abstraction were to take place. In particular:

3.3.1. The first column under groundwater pressure applies to coastal confined gravel aquifer systems and says:

"The upwards hydraulic pressure gradient is maintained in all aquifers".

This refers to the relative groundwater pressure between a deeper aquifer and an overlying aquifer. If the deeper aquifer has a higher pressure then there is an "upwards hydraulic pressure gradient." An example of the relative groundwater pressure between overlying and underlying groundwater is shown in Figure 1 attached at the end of my evidence. The eastern (right hand) side of the diagram shows an upward hydraulic pressure gradient. But, as shown in Figure 1, an upward hydraulic gradient does not exist everywhere and it is not essential to maintain that gradient to avoid adverse effects or to achieve the sustainable management of the groundwater system.

I presume the reason for wanting to maintain an upward hydraulic gradient is to lessen the risk of contaminants moving downwards through the aquifer system and to avoid potential adverse effects on surface waterways that receive seepage from groundwater. However, just because an upward gradient is reversed does not automatically mean that contamination will occur or that surface

waterways will be adversely impacted, as shown by many other areas where an upwards gradient is not present.

There are two problems with the proposed outcome. Firstly, the natural groundwater flow system in Canterbury's aquifers has some areas in the coastal confined ground aquifer system where an upwards hydraulic pressure gradient does not exist. It is therefore not possible to maintain an upward pressure gradient in all aquifers. Secondly in some aquifers the upward hydraulic pressure gradient is quite small and would readily be reversed by any deep aquifer abstraction. As an example, many of the abstractions that are used to provide the Christchurch City water supply come from deep aquifers and the use of these bores will not maintain the upwards hydraulic pressure in the general vicinity of the abstraction point. It seems inappropriate for the PLWRP to discourage such abstractions, by having a policy that requires the outcome in Table 1c to be met.

3.3.2. The second column under Groundwater Pressure relates to salt-water intrusion and applies to all the regions aquifers. It says:

"*There is no landward movement of the salt-fresh water interface and saltwater contamination of freshwater aquifers is avoided*".

The salt-fresh water interface is a naturally occurring zone within all coastal aquifers that typically occurs close to the shoreline or may be some distance offshore in deep confined aquifers as shown schematically in Figure 2 attached at the end of my evidence. Its position moves backwards and forwards depending on the groundwater levels and the rate of groundwater flowing through the aquifer. Therefore any abstraction of groundwater will contribute to the movement of the salt-fresh water interface in a

landward direction, but if that movement does not affect any area where groundwater abstraction might occur then the landward movement of the interface does not constitute an adverse effect. So once again my concern is that this outcome could be interpreted as promoting a natural groundwater flow system with no groundwater abstraction, even though there are many situations where abstraction could occur without causing adverse effects. The outcome in the notified plan may be appropriate in some settings, but should not be applied on a region wide basis.

3.3.3. The last column in Table 1c deals with Groundwater levels and applies to unconfined gravel aquifers. It says:

"*Long-term average groundwater water levels, and the flow and levels in surface bodies is maintained*"

However, if any groundwater abstraction is to occur then there will be some decline in long-term average groundwater levels and or the long-term average flow and level in surface water bodies that are hydraulically connected to groundwater. The only way to achieve the outcome that is currently stated is to not have any groundwater abstraction. This is at odds with some of the Policy direction that is advanced within the PLWRP. There is no adverse effect that automatically arises from any decline in long term groundwater levels and some degree of decline is inevitable if groundwater abstractions are to occur.

3.4. These Groundwater Pressure and Groundwater Level outcomes are potentially in conflict with Policy 4.2, which refers to managing the cumulative effect of abstractions, Policy 4.4, which refers to managing abstractions and it is also not consistent with the enabling approach of Policy 4.46. All those policies infer that some cumulative abstraction

effects are expected to occur. Instead the outcomes in the last 3 columns of Table 1c are supportive of a natural groundwater flow regime with minimal abstraction.

3.5. I expect that the Groundwater Pressure criteria in Table 1c are intended to maintain groundwater pressures to protect groundwater quality and to maintain groundwater seepage into surface water bodies. In my view this can be achieved with the following wording:

3.5.1. First column under groundwater pressure

"Groundwater pressures in aquifers with an upward hydraulic pressure gradient should be managed to minimise the risk of near surface contaminants causing adverse effects in wells that utilise confined aquifers and to minimise adverse effects on surface waterways."

3.5.2. Second column under groundwater pressure – salt-water intrusion

"Groundwater pressures in coastal aquifers should be managed to minimise the risk of saltwater contamination of those areas where an aquifer is used for fresh water abstraction."

3.6. I suggest that the Groundwater Level outcome in Table 1c should be deleted because:

- It is poorly worded and in my opinion is inconsistent with the other aspects of the plan that promote some level of groundwater abstraction.

- It is not related to a water quality outcome and therefore is inconsistent with the general intent of the other parts of Table 1a, 1b and 1c.

- The groundwater allocation regime that it relates to is already dealt with in the suite of policies that describe the abstraction of water (Policies 4.46 - 4.63) which therefore makes the last column on Table 1c an unnecessary and unhelpful duplication of an issue that is dealt with elsewhere in the suite of policies.

3.7. Page 112 of the Section 42A Report notes that Tables 1a-1c and the submissions related to them have been technically reviewed by Dr Adrian Meredith and for the reasons in his memo, no changes are recommended. Dr Meredith's technical memorandum appears on page 456 (Appendix 1) of the Section 42A Report and only deals with Table 1a and 1b. So it appears that there is no technical review of the Table 1c issues that is presented in the Section 42A report and no reason is given for not changing Table 1c in response to submissions which sought a review or replacement of its contents.

4. Policy 4.49 – Abstractions of Groundwater Outside of Groundwater Allocation Zones (Federated Farmers – submission point 320.44, Beef and Lamb NZ Ltd – submission point 318.22, Deer Industry NZ – submission point 319.19).

4.1. Similar to Table 1c, Policy 4.49 has wording that potentially indicates that groundwater abstractions outside of groundwater abstraction zones should not occur.

4.2. Clause (a) requires that the abstracted groundwater is not stream depleting. However, almost any groundwater will ultimately have some stream depleting component. That is why Schedule 9 of the PLWRP classifies stream depleting effects as "Direct", "High", "Moderate" or

"Low" with "Low" effects not to be included in the surface water allocation limit. Therefore clause (a) should be re-worded to say,

(a) *"the groundwater abstraction has a low ~~is not~~ stream depleting* effect ~~groundwater~~*, or does not contribute to over-allocation of ~~have a long-term low-level hydraulic connection to~~ any surface water body ~~which is fully or over-allocated for abstraction~~;"*

4.3. Clause (b) requires that the groundwater:

(b) *"is not hydraulically connected to any groundwater allocation zone in Sections 6-15 of this Plan which is fully or over-allocated for abstraction"*

4.4. This clause (b) should be deleted as the groundwater allocation zones have been defined on zone maps and it seems somewhat arbitrary to draw in other areas that are "hydraulically connected" as the entire Canterbury Region could be considered "hydraulically connected", as identified by the ECan by-line on the title of the PLWRP, "Everything is connected"

4.5. Clause (c) requires that "the groundwater abstractions will not alter the hydraulic pressure or gradient of any other aquifer". However, the boundaries within a vertical sequence of aquifers are often poorly defined and leakage between the aquifers is very common. So clause (c) should also be deleted as it potentially restricts a large number of potential abstractions that would cause no adverse effects.

4.6. The Section 42A Report presents a modified version of this policy, however the changes do not address my concerns. I still prefer my wording of clause (a) (paragraph 4.2 above) and the deletion of clause (b) and (c) because, "Everything is connected".

4.7. The proposed new wording for clause (d) in the section 42A report says:

d) "the cumulative average rate of abstraction does not exceed the estimated rate of recharge of the aquifer, taking into account losses to natural sources;"

4.8. This is inappropriate because all recharge that is not abstracted is contributing to losses to natural sources, Therefore clause (d) is saying no increase in groundwater abstraction can occur.

5. Policy 4.52 – Movement of water between catchments (Federated Farmers – submission point 320.47, RDRML – submission point 197.40, Silver Fern Farms – submission point 257.50).

5.1. The movement of water between catchments is one of the key aspects of the Canterbury Water Management Strategy (CWMS) and the Canterbury Strategic Water Strategy (CSWS) which promotes a "re-plumbing" of the Canterbury Plains to store and shift water from areas and times of surplus to areas of demand and current shortage, as shown in Figure 3. In particular the areas coloured yellow, orange, and red require movement of water between catchments to achieve the objectives sought by the CWMS.

5.2. The CWMS Strategic Framework discusses how a paradigm shift is needed in the approach to water management. It notes that:

"Regulatory action to deal with environmental problems will need to be complemented with incentive mechanisms that progressively drive efficiency in the use of water and responsible land management practices.

The key incentive mechanism will be the availability of reliable water from new storage and distribution infrastructure. However, this must not be

over-allocated for production purposes, as some water resources have been in the past, but instead used to achieve balanced outcomes:

- *restoring environmental flows to surface and ground water systems*
- *providing reliability of supply of water in exchange for investment in efficient irrigation systems and improved land management practices*
- *generating revenue to fund environmental restoration and ongoing ecological, recreational and cultural development*."

5.3. As an example of water movement between catchments the recently approved changes to the National Water Conservation (Rakaia River) Order 1988 allow the storage of water in Lake Coleridge which could be used to provide water to land on both the north side and south side of the Rakaia River. Other examples are described in the CSWS Stage IV report, including:

"A single new dam in the Lees Valley, replenished by water from the Ashley and Waimakariri rivers could provide sufficient storage to enable all foreseeable long-term water needs in the Selwyn and Waimakariri Districts to be met, along with much of the potential water needs in the Waipara catchment."

and

"Providing irrigation water needs in South Canterbury (from the Orari to the Waitaki Rivers) from the Waitaki Catchment."

5.4. Policy 4.52 contains a number of criteria that are likely to be inconsistent with the proposed shifting of water between catchments. That is because the movement of water between catchments is generally associated with major investment in infrastructure and therefore involves significant flows to justify the investment, as set out

in the quote from the CWMS in paragraph 5.2 and the examples in paragraph 5.3.

5.5. That is inconsistent with statements requiring no adverse effects in Policy 4.52. Therefore Policy 4.52 is very much of the form that says you can discharge water from one catchment to another providing that you don't create any of the effects that can realistically be expected to occur from such a discharge. That inconsistency is unhelpful and inappropriate and as such Policy 4.52 should be deleted.

5.6. In the Section 42A Report the policy has helpfully been modified by recognising that some adverse effects may occur provided that they are not more than negligible. Whilst that is a step in the right direction it is still too restrictive for major infrastructure projects. If the hearing panel wishes to keep such a policy, a more appropriate wording could be to describe the acceptable level of adverse effects as being "not more than minor" and to include a proviso, "unless mitigation is provided".

6. Policy 4.58 – Cumulative drawdown effects between groundwater abstraction bores (Dairy Holdings Ltd – submission point 298.10).

6.1. Policy 4.58 specifies that the direct cumulative interference effect from new groundwater takes on existing groundwater takes is minimised by limiting the drawdown of any existing bore within a 2 km radius to no more than 20% of the available drawdown. However such an approach is unnecessarily restrictive and promotes poor development of the groundwater resource.

6.2. Firstly the policy ignores one of the important provisos in Schedule 12 of the PLWRP which deals with Well Interface Effects, that the evaluation is based on adequately penetrating bore depths.

6.3. Secondly, there should be no absolute requirement to limit the drawdown interference to 20% of the available drawdown. This is because many bores can perform to full capacity utilising a lot less than the remaining 80% drawdown that this policy seeks to protect.

6.4. Therefore a more balanced policy would be worded as follows:

"The direct cumulative interference effect from new groundwater takes on existing groundwater takes as determined using the approach set out in Schedule 12 is minimised by limiting the drawdown of any existing bore within a 2 km radius to no more than 20% of the available drawdown, unless the effect is mitigated such that no more than minor adverse effects are experienced by existing users of adequately penetrating bores."

6.5. The Section 42A Report recommends including a reference to Schedule 12, which is a helpful improvement, but still specifies an absolute limit of no more than 20% of the available drawdown. On page 235 of the Section 42A Report the evaluation of submissions seems to suggest that the mitigation option is superfluous as the Policy sets out the extent of acceptable effects. However if no neighbouring bore owner experiences any problems from the drawdown interference effect greater than 20% then that too should be an acceptable effect. It is important to write that provision into the policy because rule 5.103 says not meeting the Schedule 12 criteria is a non-complying activity and if the policy is not changed then one of the two limbs of S104D is no longer available.

6.6. As currently worded, the limitation in Policy 4.58 could see groundwater abstraction being restricted when neighbouring bores are experiencing no adverse effects, which is an inefficient outcome. Accordingly, I still prefer the wording I have recommended in paragraph 6.4.

7. **Rule 5.102 non-complying status for abstractions outside of Groundwater Allocation Zones** (Federated Farmers – submission point 320.168, Fonterra – submission point 270.61, Beef and Lamb NZ – submission point 318.55, Deer Industry NZ – submission point 319.49, Horticulture NZ – submission point 326.61).

7.1. Rules 5.102 classifies the taking and use of groundwater where the point of abstraction is outside of a Groundwater Allocation Zone on the planning maps as a non-complying activity.

7.2. Groundwater Allocation Zones have been defined for all the major aquifers in Canterbury where the vast majority of groundwater abstractions are occurring as shown in the zoning maps in Figure 4, at the end of my evidence. However there are areas outside of these zones where groundwater abstraction can still occur such as in the valleys of the foothills and Banks Peninsula where alluvial strata fill the valley floor and or fractured basement rocks may provide permeable zones to support abstraction bores.

7.3. The use of groundwater outside of the established allocation zones is typically of a small scale with localised effects. I expect it is for that reason that groundwater allocation zones have not been established. Because they are areas of smaller scale and more localised groundwater abstractions which can adequately be managed by the other rules and policies and rules within the PLWRP.

7.4. Against this background it does not seem appropriate that groundwater abstractions from outside of the Groundwater Allocation Zone should be classified as non-complying activities. There is no indication of any particular limit, policy or objective that they do not comply with simply by being outside of a Zone.

7.5. In section 2.3 of the PLWRP it is noted that "Non-complying activities are generally inappropriate, though with a non-complying activity there may be an exceptional case when a resource consent is granted." It seems incorrect that groundwater abstractions in the foothills or Banks Peninsula are viewed as being "generally inappropriate" simply because they have not been included in the Groundwater Allocation Zone process.

7.6. Based on my understanding of the different activity states that could be applied Rule 5.102 should be changed from non-complying to discretionary. Similarly, Rule 5.103 should not apply to condition 1 of Rule 5.101.

7.7. The Section 42A Report recommends the deletion of Rule 5.102 because it is duplicated by Rule 5.103 but no change is proposed to Rule 5.103. These changes do not address the issues I have raised.

7.8. Somewhat surprisingly the Section 42A report states:

"The PLWRP identifies appropriate areas from where groundwater can be taken. It is considered appropriate that applications outside these zones are non-complying activities and subjected to a higher threshold of assessment given the critical nature of groundwater resource."

7.9. This would imply the plan suggests a farmer on Banks Peninsula should not take groundwater from the area that they farm because it has not been identified as a Groundwater Allocation Zone. To presume that it is inappropriate to have groundwater abstractions in Banks Peninsula is a particularly unhelpful approach to groundwater allocation and inconsistent with a number of abstractions that are already occurring in a very satisfactory and sustainable manner.

8. **Rule 5.104 Prohibited Status for Abstraction in Excess of Allocation Limits** (Synlait Milk Ltd – submission point 187.80, Synlait Farms Ltd – submission point 188.80, Horticulture NZ – submission point 326.62)

8.1. Rule 5.104 classifies new groundwater abstractions that are in excess of the allocation regimes specified in the sub-regional sections 6-15 as prohibited activities, meaning that no resource consent can be granted for such activities.

8.2. Such a classification may be appropriate if well defined allocation limits have been determined through a rigorous procedure that has gone through an appropriate consultation process and the hearing of technical evidence to establish the limits, but that is not the case for the groundwater allocation limits that appear in sections 6-15.

8.3. I expect that through the zone committee process and subsequent hearings that appropriate limits may be established and the appropriate classification of activities in relation to those limits can be defined within those sections.

8.4. By establishing a prohibited activity status in the more generally applied Rule 5.104 it creates two problems:

- A pre-determination of how activities related to those limits should be classified

- A restriction on abstractions based on the currently defined limits which in many cases are of an interim nature that have not been properly defined.

8.5. The basis for my concern about prohibited activity status relates to the groundwater allocation limit setting process, which is described in two ECan reports. "Groundwater Allocation Limits: Guidelines for the

Canterbury Region" report number U04/02 dated January 2004 and "Groundwater Allocation Limits: land-based recharge estimates" report number U04/97 dated September 2004. These reports describe a three tiered system for defining allocation limits:

- The first order allocation limits are based on 15% of average annual rainfall within the zone and may include seepage from intermittent streams.

- Second order allocation limits are based on 50% of annual land-surface recharge and may include seepage from intermittent streams.

- Third order allocation limits are based on site specific assessments of recharge within each zone, as might occur during the establishment and calibration of a numerical groundwater flow model for the groundwater allocation zone.

8.6. The groundwater flow allocation limits that are specified in sections 6-15 of the PLWRP have been determined by either the first or the second order approaches which are generic and arbitrary criteria. In report U04/02 they are described as "initial conservative groundwater allocation limits" and "it is intended that these allocation limits will be revised progressively using more detailed approaches." Similarly in report U04/97 the limits of land-based recharge analysis are described as being "all subject to change". Because they are recognised as being interim and preliminary estimates that have not gone through any detailed zone committee process and hearing process it seems inappropriate that they should be used to define a prohibited activity which section 2.3 of the PLWRP describes as "not appropriate in any circumstance".

8.7. My view is supported by a series of groundwater abstraction consent application hearings that were held in the Selwyn-Waimakariri and Rakaia-Selwyn groundwater allocation zones. The applications were for abstractions in excess of the limits specified in the Natural Resource Regional Plan (NRRP) which defined the applications as non-complying activities. The hearing commissioners determined that many of the applications could be granted by the use of consent conditions that allowed for implementation of an adaptive management regime. This allowed for use to be made of the variable nature of groundwater recharge so that more water could be abstracted in years with surplus recharge and higher groundwater levels, with a more restrictive regime during times of low recharge and low groundwater levels.

8.8. These adaptive management approaches to the management of abstractions would be prevented by the use of a prohibited activity status.

8.9. The section 32 summary report for the PLWRP notes that whilst the NRRP gave non-complying status to activities to take water in excess of the groundwater allocation limits the PLWRP changes this to a prohibited activity, “primarily in response to the freshwater NPS and the CRPS.” However whilst these documents require the establishment of limits and allocation regimes they do not require that applications over the limits must be classified as prohibited activities. Given the generic and preliminary basis for the limits that are currently in the PLWRP it would seem that a non-complying status, as utilised in the NRRP, would be a more appropriate water management approach. The tests that apply to the granting of consent for a non-complying activity should fulfil the requirements of the NPS and the CRPS.

8.10. A further element of uncertainty in understanding the allocation status of the Groundwater Allocation Zones is the estimates of how much of the allocated water in actually being used. Currently that is mostly determined by a theoretical estimate of the amount of consented water that might actually be used (such as the approaches defined in Schedules 10 and 13 of the PLWRP), which incorporates a degree of uncertainty. The current imposition of flow meters (required by both the PLWRP and the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010) will provide useful information in this regard but at the current time all we have is an uncertain estimate to determine whether or not the proposed limits are actually exceeded. Once again this uncertainty is, in my opinion, not consistent with the use of a prohibited activity criteria.

8.11. As an alternative, the use of a non-complying activity status seems more appropriate given the nature of how the limits and allocation status have been defined. On that basis a consent could only be considered on its merits if it passes the threshold of either causing effects that are minor or the activity is not contrary to the objectives and policies of the relevant planning documents.

8.12. The non-complying status for abstraction in excess of the limits is supported by Policy 4.6 where the use of the phrase "*resource consents will **generally** not be granted*" (my emphasis) implies a non-complying rather than prohibited status and gives clear guidance to the expectations of the plan when considering any such consent applications.

8.13. The Section 42A Report recommends no changes to Rule 5.104 and therefore does not address my concerns. However with regard to Policy 4.6 (mentioned in paragraph 8.12 above) the section 42A Report

helpfully goes further and suggests an extra sentence is added at the end to say:

"New consents replacing expiring consents may be granted, but will likely be subjected to additional restrictions."

This approach is reasonable and is also consistent with Rule 5.104 being non-complying rather than prohibited.

9. **Policies 4.71 and 4.73 and Rule 5.107 condition 5 – Use of Transfers to Reduce Allocation** (Federated Farmers – submission point 320.64, 66, 173; Synlait Milk Ltd – submission point 187.49, 50, 81; Synlait Farms Ltd – submission point 188.49, 50, 81; Irrigation NZ – submission point 192.61; Silver Fern Farms – submission point 257.59; Dairy Holdings Ltd – submission point 298.14, 18; Dairy NZ – submission point 315.27).

9.1. Both Policy 4.71 and 4.73 refer to the reduction of water use in over-allocated catchments when a water permit is transferred. Condition 5 of Rule 5.107 specifies a schedule of how the claw-back in allocation shall be applied.

9.2. In general terms the transfer of allocated water for alternative uses at a different location and/or times should be encouraged as it increases the beneficial use that can be achieved from the allocated water. Policies 4.71 and 4.73 reflect this approach by including the following terms:

- Improvement in the efficiency of water use
- Encouragement of more effective storage and distribution of water
- Enable the transfer of water

9.3. However the inclusion of reductions in the allocation of water through the transfer process is not enabling or encouraging of the benefits described above in paragraph 9.2.

9.4. Even if a catchment is classified as “over-allocated”, it has reached that status on the basis of decisions on consent applications which determined that further allocations could be made. As part of the transfer process ECan still have the opportunity to assess the effects of the abstractions arising from the changes that are sought. If the allocations can be transferred to new locations without creating adverse effects at the new location then there seems no basis for not allowing this.

9.5. As noted earlier, the hearing panels for the recent consent hearing decisions in the Rakaia – Selwyn and Selwyn – Waimakariri Groundwater Allocation Zones were well aware that they were granting consents beyond the allocation zone limits that are currently being proposed for the PLWRP, but they put consent conditions in place to allow for the adaptive management of these abstractions. For a situation such as this, if transfers of these consents were to occur, it does not seem right for the PLWRP to undo this particular water management strategy that was deliberately put in place based on the site specific information that was presented to the hearing panel.

9.6. Furthermore, the proposed claw-back rates of 25% or 50% in condition 5 of Rule 5.107 seem completely arbitrary and without foundation. A smaller reduction is promoted for surface water takes that are shifted upstream and for groundwater takes that are shifted down the plains, even though this positioning has no effect on the overall allocation situation within the catchment or groundwater allocation zone. The Section 32 report explains the reason for this as

"The CWMS recognises that it is more efficient to use surface water in up-plains areas, where additional land surface recharge will tend to increase the amount of groundwater available for abstraction down plains. In some areas of the Canterbury Plains there is surface water applied in the lower plains area, with deep groundwater being abstracted in the upper plains area. This kind of water distribution can often be inefficient, both in terms of re-use of land surface recharge and the high costs of abstracting deep groundwater in upper plains areas."

9.7. Whilst this is a reasonable concept, there is no encouragement for it to occur by taking 25% of the allocation away from consent holders who may be considering such a transfer.

9.8. Furthermore, there is no indication in the plan that when water is transferred in those preferred directions that the resulting change will be used to initiate a revision of the allocation limit due to the increased groundwater recharge from inland surface sourced irrigation. Therefore as noted in paragraph 9.53 of Mr Willis's evidence for Fonterra, no change in the allocation status of the catchment or groundwater allocation zone is actually achieved by moving surface water abstractions up the catchment and groundwater abstractions down the catchment.

9.9. The prescription of a 25% or 50% claw back gives no consideration to the size of the allocation or the actual over-allocation situation. Such an approach is a major disincentive to the benefits that can be achieved by a transfer.

9.10. To more fully encourage the transfer of water permits and achieve the benefits listed in paragraph 9.2 above it would be preferable to delete all references to the over allocated catchment issue in Policies 4.71 and 4.73 and to delete condition 5 in Rule 5.107.

9.11. I agree with the Section 42A Report which says that over-allocation is an issue that the PLWRP should address, as described in Policy B6 of the NPS. But there is no suggestion in Policy B6 that the issue should be addressed as part of a transfer mechanism for water permits.

9.12. Policy 4.7 is an example of a policy that is already included in the PLWRP to deal with over-allocation. It appropriately focusses it as an issue that should be dealt with through the development of the sub-regional chapters 6-15. Policy 4.47(b) is also already in place to deal with replacement consents.

10. Policy 4.60, 4.63, 4.66 and the use of annual volumes (Synlait Milk Ltd – submission point 187.41, 43, 44; Synlait Farms Ltd – submission point 188.41, 43, 44; Dairy NZ – submission point 315.23)

10.1. All these policies promote the use of annual volumes to be specified in water permit conditions. Such volumes are appropriately used for the allocation of water from groundwater and from lakes or reservoirs as these source water bodies are predominately stored water. However annual volumes are not commonly used for allocation for run of river abstractions where allocation is typically based on the abstraction rate relative to the flow of water in the river. This difference between the allocation approach for flowing water or stored water bodies generally appears to be correctly set out in Schedule 13 of the PLWRP, although Schedule 9 (which is referenced in clause 1(b) of Schedule 13) lists a % of the annual volume to be included in the surface water allocation limit. That reference should be specifically identified as only being relevant for lakes of reservoirs and not for streams or rivers.

10.2. However the PLWRP also promotes the use of annual volumes as a means of ensuring the reasonable use of water. Schedule 10 sets out methods for specifying the annual volume required to meet irrigation demand for nine years out of ten.

10.3. In my opinion such an annual volume limit is a somewhat ineffective mechanism to achieve reasonable water use in that the limit:

- Specifies more water than is needed for 8 years out of 10
- Does not specify enough water for the driest year out of 10
- Only specifies the actual water required for 1 year in 10

10.4. It would seem to me that a more effective means to achieve reasonable use for irrigation is through the Farm Environment Plan process that is being promoted to manage nutrient applications, coupled with the use of Schedule 10 as a guideline (or a modified version of the Schedule as defined in the evidence of Mr McIndoe).

10.5. In particular, it seems unreasonable to restrict a run-of-river take based on an annual volume limit during times when the river has a sufficiently high flow and there is a legitimate requirement for irrigation to occur.

10.6. Therefore, in my opinion the approach to water allocation would be improved if:

- Policy 4.60 is re-worded to say:

"Any run-of-river abstraction of surface water or stream depleting groundwater <u>with direct, high, or moderate depletion</u> is subject to conditions specifying:"

and clause (b) in Policy 4.60 is deleted;

- The extent of Policy 4.63 is limited by the following insertion:

"Where existing abstractors from groundwater, lakes or storage reservoirs do not have …."

- Policy 4.66 is re-worded as follows:

"The rate <u>and</u> volume ~~and seasonal duration~~ for which water may be taken will be reasonable for the intended use."

The Section 42A Report addresses one of the modifications listed above for part of Policy 4.60 but the other short comings still need to be addressed.

10.7. To ensure there is no misunderstanding on this point it would be useful if Schedule 13 explicitly stated that annual volumes are not to be used for the allocation of run-of-river abstractions.

11. Rule 5.107, Condition 2 Reduction in Seasonal or Annual Volumes for Run of River Takes (Dairy Holdings NZ – submission point 298.18)

11.1. Similar to the discussion in Section 12 above, Condition 2 of Rule 5.107 requires that when a consent is transferred, the seasonal or annual volume must be less than or equal to the volume of take prior to the transfer. That is appropriate when the seasonal or annual volume is part of the allocation regime from the source water body as occurs for groundwater abstractions or may also be applied where a surface water body is dammed and/or water is stored. However for run of river abstractions the allocation of water is based on the average daily rate of abstraction within the limits in the source water body based on the flow measured at a particular monitoring point.

11.2. Whilst run of river takes may also have annual volumes incorporated in the consent conditions, in my experience of irrigation takes these are added to control the reasonable use of the water rather than the allocation from the surface water resource.

11.3. An example of the poor water management outcome that can occur from condition 2 of Rule 5.107 came about during consideration of a proposed partial transfer of an irrigation take and use consent on a river to another user at a location further downstream.

11.4. Consent A authorised the abstraction of 310 L/s subject to low flow restrictions in the river in a catchment that is not over-allocated. The water is used to irrigate 430 ha of pasture and it is deemed that a reasonable use of the water could result in a volume of up to 2,257,500 m^3 being abstracted each season. That volume can be achieved by pumping for 130 days at around 16 hours per day at the consented rate of 310 L/s.

11.5. Another farmer came to an arrangement with the holder of consent A to utilise 85 L/s of their consent to irrigate 155 ha at a different location. In order to avoid an increase in allocation from the surface waterway this would mean that consent A would reduce to 225 L/s.

11.6. The reasonable use limit for the new user of the 85 L/s was deemed to be a volume of 1,042,800 m^3 per season.

11.7. Therefore an ideal water management outcome from the transfer would be:

- Consent A to take 225 L/s subject to low river flow restrictions. An unchanged reasonable use volume of 2,257,500 m^3 per season to irrigate 430 ha. Using the same example as noted in paragraph

11.4, that volume can be achieved by pumping for 130 days at around 22 hours per day – i.e. a small change in the pumping pattern still allows the productive use of the allocated water over 430 ha.

- New consent to take 85 L/s subject to the same low river flow restriction. A reasonable use volume of 1,042,800 m^3 per season to irrigate 155 ha.

11.8. This approach does cause a larger seasonal volume to be abstracted from the river, however the in-stream environment is still protected by the low flow restrictions on each consent. Provided that the river flow is high enough then both abstractions should be allowed to occur to create a greater benefit in terms of increased productivity from the 310L/s that is able to be allocated.

11.9. As currently worded, condition 2 of Rule 5.107 would prevent that outcome being achieved. It could result in consent A having its reasonable use volume reduced to 1,214,700 m^3 which would correspond to a reduced irrigation area from 430 ha to around 230 ha. Such a reduction in annual volume:

- is not enabling of transfers,

- does not make the most efficient use of the 310 L/s that is allocated from the resource; and

- does not achieve any improvement to the allocation status for the river.

11.10. It is therefore important that the limitations imposed by condition 2 only apply to the allocation regimes applicable to the source water body and do not limit the reasonable use of water.

12. Conclusion

12.1. The changes proposed in my evidence are intended to help improve the water management approach described in the PLWRP in a way that is more consistent with the RMA, the NPS for Freshwater Management, the CRPS and is closer to achieving the desired outcome of the Canterbury Water Management Strategy which is:

"To enable present and future generations to gain the greatest social, economic, recreational, and cultural benefits from our water resources within an environmentally sustainable framework."

12.2. The specific proposed wording changes to the Policies and Rules I have commented on are to be presented in the legal submissions of the Canterbury Primary Sector Policy Group.

Appendix A

Figures referred to in the evidence of Peter Callander

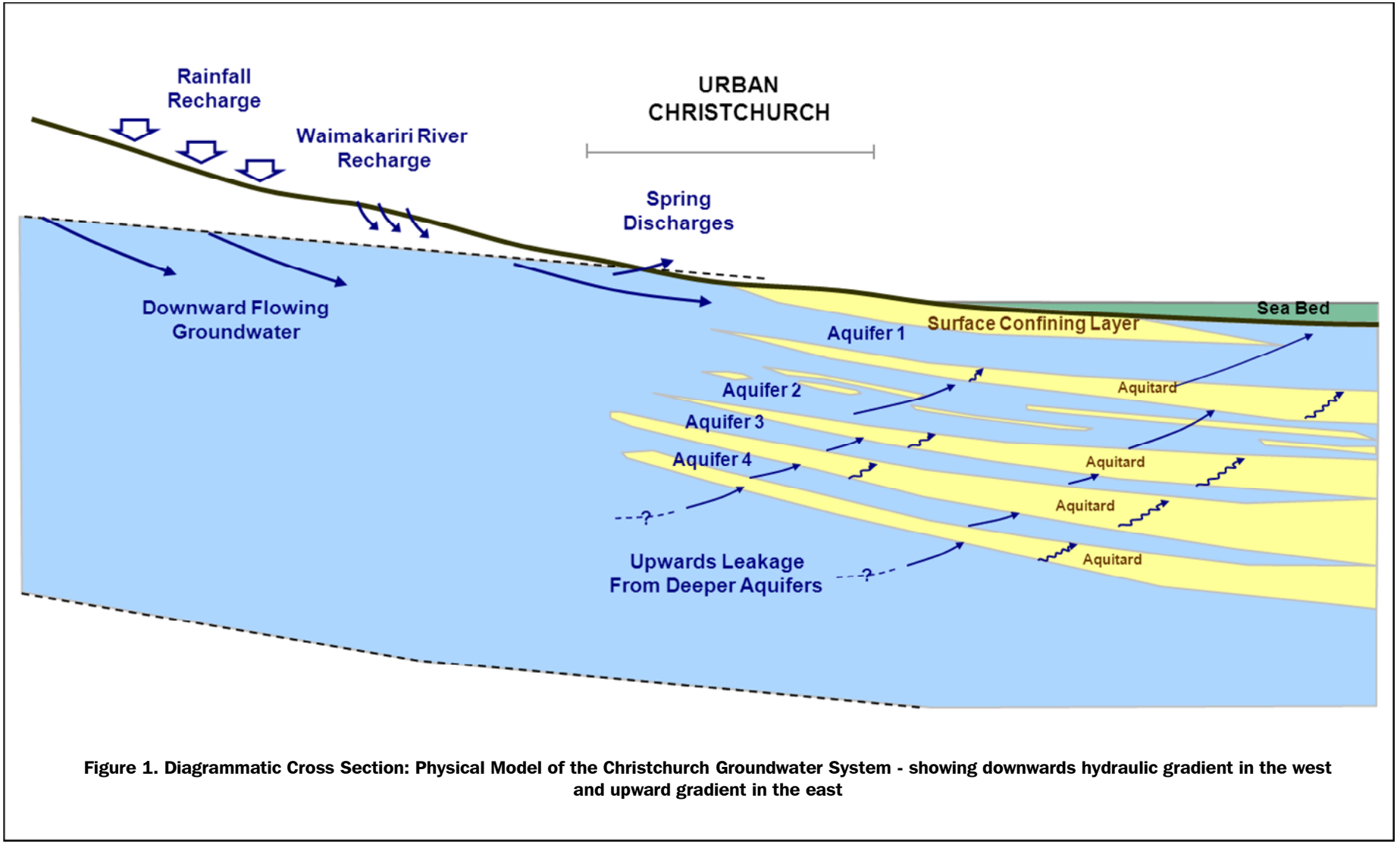

Figure 1. Diagrammatic Cross Section: Physical Model of the Christchurch Groundwater System - showing downwards hydraulic gradient in the west and upward gradient in the east

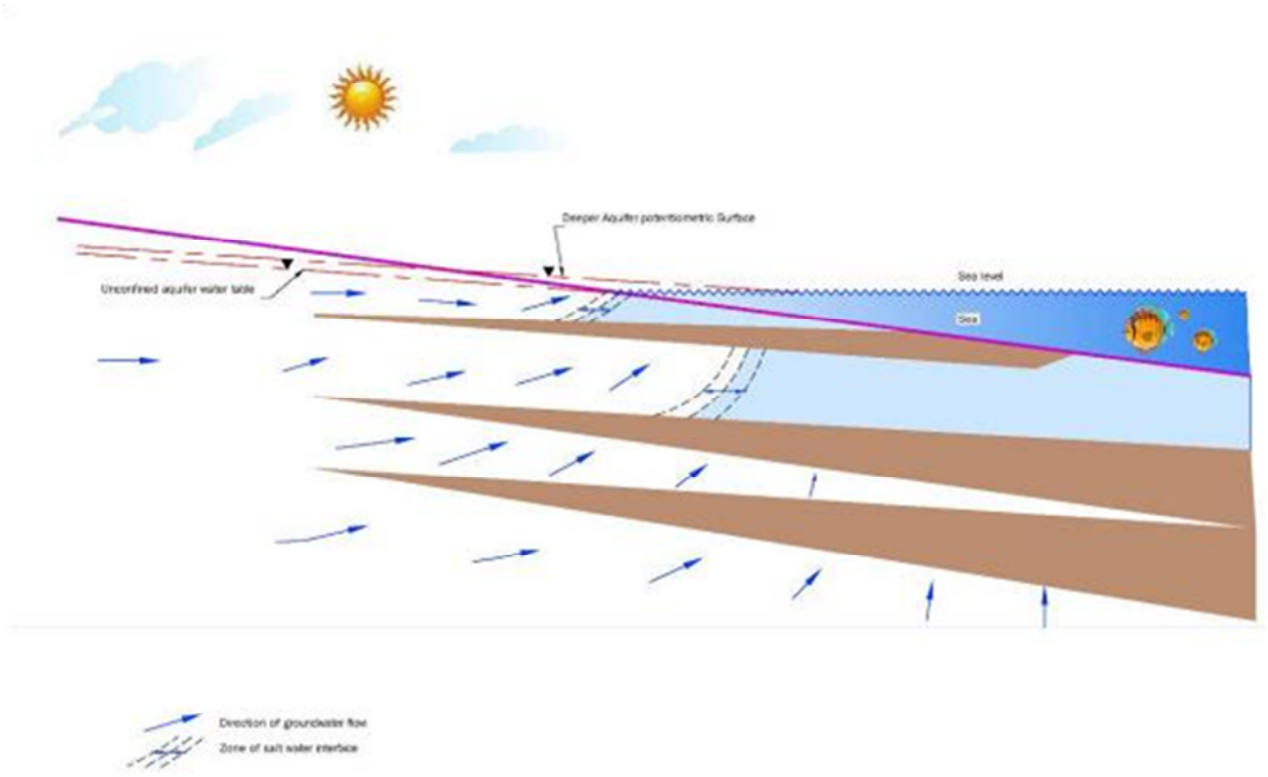

Figure 2: Schematic Diagram of Sea Water Interface

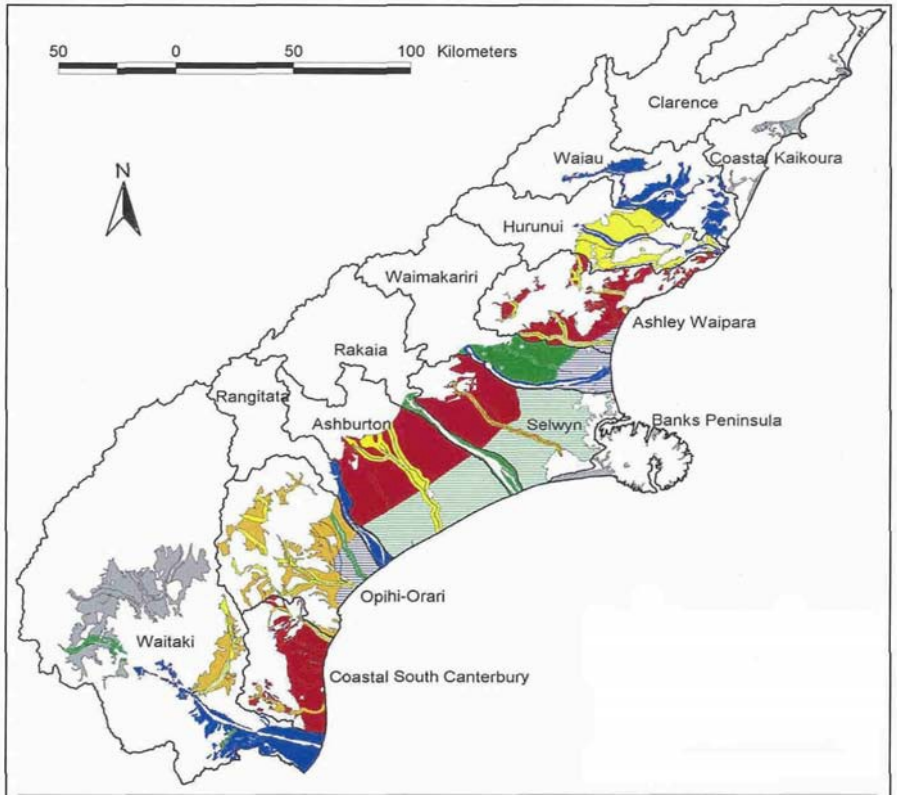

Figure 3: Summary Map of Supply and Demand Situation in Canterbury
(Source: Stage 1 Canterbury Strategic Water Study)

Legend
Striped blue - Demand can be reliably met from groundwater**.**
Striped green - Demand can be reliably met from groundwater with the proviso that there is some plains irrigation which enhances recharge.
Blue - Demand can be reliably met from run of river supply.
Green - Unreliable run of river. Supply/demand ratio in worst irrigation season >1. Minimal storage needed.
Yellow - Supply/demand ration in worse case year >1. Moderate storage needed. Require river flows outside irrigation season to fully replenish storage.
Orange - Average annual supply/demand rate >1. Storage possible but less likely. Large storage required which would not fully replenish every year.
Red - Average annual supply demand ratio <1. No amount of storage replenished from within the zone can provide for the demand.
Grey - There is insufficient data to compare with demand.

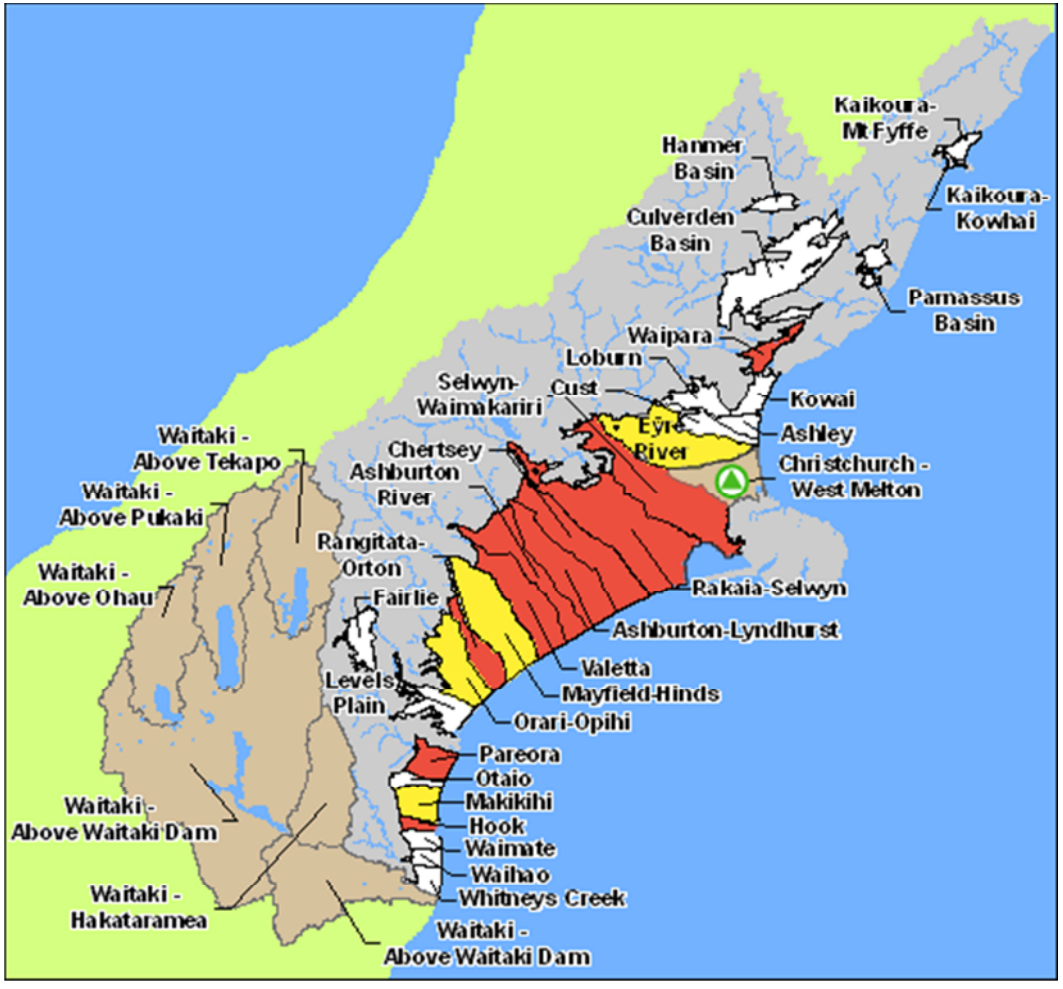

Figure 4: Groundwater allocation zones (grey shading shows area outside of zones)

Appendix B

Curricula Vitae of Peter Callander

Curriculum Vitae – Peter Callander

Expertise

- Investigation, assessment and management of water resources
- Environmental effects in soils and water arising from land use and discharge activities
- Characterisation of contaminants in soil, surface water and groundwater
- Assessments of water availability and water allocation

Nationality

New Zealander

Qualifications

B.Sc. (Geology), 1982 University of Auckland
M.Sc. (Engineering Geology), 1984 University of Waterloo, Canada
University of Waterloo Graduate Scholarship 1982 (for outstanding academic credentials).

Relevant Training

Certificate of Proficiency in Master of Engineering Course:
Mathematical Analysis of Groundwater Resources, 1991 University of Canterbury.
Contaminated Sites course: From Contamination to Remediation: Bridging the Gap 1994.
Risk Based Corrective Action (RBCA) 1998.
Making Good Decisions – A Training, Assessment and Certification Programme for Resource Management Act Decision-makers. 2008. Recertification course 2012.

Personal Affiliations

- New Zealand Hydrological Society
- New Zealand Water and Wastes Association
- National Ground Water Association (USA)

Employment Record

1996 – Present
Director
Pattle Delamore Partners Ltd, Christchurch, New Zealand.

1991 – 1996

Senior Hydrogeologist
Pattle Delamore Partners Ltd, Christchurch, New Zealand.

1989 – 1991
Groundwater Group Leader
Canterbury Regional Council, Christchurch, New Zealand.

1984 – 1989
Hydrogeologist
Canterbury Regional Council (formerly North Canterbury Catchment Board and Regional Water Board), Christchurch, New Zealand.

1982 – 1984
Research and Teaching Assistant
University of Waterloo, Ontario, Canada.

1981 - 1982
Contract Geologist
CRA Exploration Pty Ltd, Reefton

Examples of Project Experience

ENVIRONMENTAL ASSESSMENTS

Canterbury Regional Council: Preliminary assessment of environmental concerns associated with effluent disposal from unsewered townships throughout the Canterbury Region.

Canterbury Waste Services Ltd: Hydrogeologic evaluation of the Canterbury region to select and evaluate potential sites for a new regional landfill. Detailed evaluation of the Kate Valley site.

Christchurch City Council: Assessment of options for stormwater disposal via ground soakage throughout Christchurch City.

Christchurch International Airport Limited: Investigations and advice on groundwater abstraction and ground contamination issues, involving stormwater discharges, fuels storage and solid waste disposal facilities.

Christchurch Polytechnic: Presentation of lectures on environmental site assessments and evaluations.

Fuelquip Services Limited: Development of soil sampling protocols to be used during removal of underground storage tanks. Presentation at training course for Fuelquip staff.

Horizons Regional Council: Independent Hearing Commissioner for consent applications related to wastewater discharges to land and surface waterways.

March Mining Ltd: Soil sampling and assessment of mercury residues in soils and water near a gold recovery operation.

Marlborough Water Augmentation Group: Pre-feasibility and feasibility assessment for community irrigation scheme for a command area of 12,000 ha supplied by a piped pressurised water scheme sourced from the Wairau River.

Ministry of Health: Identification of environmental issues associated with the illegal use of a house for production of narcotics. Recommendations for remedial clean-up measures.

Mobil Oil NZ Ltd: Hydrogeological investigation for new service stations, underground storage tank sites and bulk fuel storage depots.

Selwyn District Council: Review of Paparua Stock Water Race System and identification of future rationalise options including potential to be used to artificially recharge aquifers in the Christchurch-West Melton area.

Shell New Zealand Ltd: Investigation of product leakages and their environmental effects on groundwater and surface waterways at various sites throughout the South Island.

TrustPower Ltd: Assessment of groundwater issues related to consenting for Matahina Dam, proposed Wairau Valley Hydro-Electric Power Scheme, and Wahapo power scheme.

Waimakariri Irrigation Ltd: Environmental management and consenting of a 12 m^3/s irrigation and stock water supply scheme with a 40,000 ha command area sourced from the Waimakariri River with provision for artificial recharge of aquifers and power generation opportunity.

Wanganui District Council: Evaluation of groundwater impacts arising from increased use of ground soakage for stormwater disposal, including effects on sewer infiltration.

CONTAMINATED SITES

New Zealand Army: Investigation of leachate plume associated with a camp landfill.

New Zealand Defence Force: Hydrogeological assessment of potential contaminant migration from Woodbourne airbase to downgradient farmer's property in relation to a compensation claim, which was successfully refuted through the presentation of evidence in the High Court.

New Zealand Defence Force: Environmental clean-up of underground storage tank structures and munitions disposal area.

New Zealand Rail Limited: Assessment and clean up of a diesel spillage at Ruru on the West Coast. The spillage affected soils and a stream which drained into Lake Brunner.

Selwyn District Council: Assessment of environmental effects and groundwater monitoring at landfills. Procurement of passive discharge consents.
Tasman District Council: Evaluation of remediation for former Fruit growers Chemical Corporation contaminated site at Mapua. Member of expert peer review panel reviewing the remedial works at the site.
Transit New Zealand Ltd: Assessment of issues and risks to Transit arising from a prolonged petrol spillage at Caltex Hokitika which had migrated beneath the State Highway corridor.
West Coast Regional Council: Environmental site assessments, soil and water sampling, and recommendations for site management at 10 timber treatment sites where Boron, CCA or PCP treatments had been used.

GROUNDWATER INVESTIGATIONS

Christchurch City Council: Investigation, design and contract supervision of water supply wells and assessment of environmental effects.

Christchurch International Rowing Centre Charitable Trust: Hydrogeologic investigation of McLeans Island area to assess feasibility of constructing an international rowing course and its effect on surrounding spring fed water ways.
Environment Bay of Plenty: Resource assessment and identification of water allocation options for surface water abstractions in the Galatea Basin and in the Paengaroa area.
Hanmer Springs Thermal Reserve: Assessment of sustainable abstraction limit for geothermal production bore and recommendations for a monitoring programme to determine effects from groundwater abstraction.
Horizons Regional Council: Independent Hearing Commissioner for consent applications for groundwater abstractions and provision of advice on water allocation issues.
Manawatu District Council: Technical review and recommendations for remedial works on water supply infiltration gallery in Oroua River.
Marlborough District Council: Overview of aquifer characteristics to assess relative risks for well yields and water quality at the MDC water supply wells, with a particular focus on the Renwick town supply and the occurrence of elevated nitrate concentrations.
Waimakariri District Council: Design recommendations and testing for deep water supply wells for public reticulation.

EXAMPLES OF PUBLICATIONS AND CONFERENCE PAPERS

Callander PF., Lough, HK and Steffens CC, 2011; "Monitoring and Management of Sea Water Intrusion risks in New Zealand Groundwater", 50th Jubilee New Zealand Hydrological Society Conference 2011, Wellington.

Callander P., 2008; "Security of Groundwater Supplies and Problems Proving it", New Zealand Water and Waste Association Annual Conference and Expo, Christchurch.

Callander P., Thorley, M., Lough, H., Williams, H. Kinimonth, M. and Henderson B., 2005; "Groundwater Flow Modelling for Groundwater Quality Assessment in Christchurch City", New Zealand Water and Waste Association Annual Conference and Expo, Auckland.

Callander P. and Fox, K., 2002; "Natural Causes of Arsenic Contamination in Alluvial Aquifers", New Zealand Water and Waste Association Annual Conference and Expo, Christchurch.

Callander, P. and Hunt, B., 1999; "Assessment of Stream Depletion Effects Caused by Groundwater Abstraction"; International Union of Geology and Geophysics, Birmingham.

Callander P.F., Watts, R and Oliver, T., 1999; "Sustainable Management of Christchurch's Waterways and Wetlands Using Stormwater Soakage Disposal"; Impacts on Urban Growth on Surface Water and Groundwater Quality; IAHS publication No. 259; pp 365-372.

Callander P.F., 1994; "Assessment of Groundwater Contamination Arising from Solid Wastes"; Solid Waste in the Pacific: Common Issues - Common Solutions; Waste Management Institute New Zealand Incorporated; Christchurch, New Zealand, November 1994.

Bidwell V.J., Callander P.F. and Moore C.R., 1991; "An Application of Time-Series Analysis to Groundwater Investigation and Management in Central Canterbury"; Journal of Hydrology New Zealand; Vol 30, No. 1, pp 16-36.

Broadbent M. and P.F. Callander, 1991; "A Resistivity Survey Near Waimakariri River, Canterbury Plains, to Improve Understanding of Local Groundwater Flow and of the Capabilities of the Survey Method"; New Zealand Journal of Geology and Geophysics; Vol. 34, No. 4, pp 441-453.