



NRRP Hearing stage 7

**OFFICER REPORT No. 7 Chapter 5 WQN2**

***ON***

**PROPOSED VARIATION 1 OF THE  
PROPOSED CANTERBURY NATURAL RESOURCES  
REGIONAL PLAN:**

**Chapter 5 – Water Quantity – Interference effects  
between bores**

**Prepared by Warwick Pascoe, Matt Smith and Anna Veltman**

**Matters to be heard**

- Section 5.5.8 Interference effects between groundwater abstractors – well interference;
- Issue WQN7 Interference effect between bores;
- Objective WQN7 Interference effects between bores;
- Policy WQN20 Managing the effects of interference between bores;
- Methods WQN20(a) – (d); and
- Schedule WQN10 Determination of well interference effects on adjacent bores

**Dates of hearing: 9 and 12 *March 2007*  
at ECan offices, 58 Kilmore Street in Christchurch**

This Section 42A report has been prepared by Warwick Pascoe, Matt Smith and Anna Veltman.

**Warwick Pascoe**

I am a director of ADAM Environmental Ltd (a mineral exploration and environmental consultancy), which I formed in July 2005. Prior to launching this company I was employed by Environment Canterbury in the Consents Section from February 1996. I had six years in that Section primarily auditing water permit and land use consent applications, and a further three years as a Team Leader (of the Discharge Team, and then one of the Water Teams). During this time I also spent two years co-ordinating the Water Quality and Quantity Portfolio Team that had input to the Council's Annual Plan and Long Term Financial Strategy, as well as representing the Consents Section on the in-house panel advising on the management and implementation of Canterbury's groundwater zones, and providing comment from a Consents perspective during the development of Chapter 5 of the Natural Resources Regional Plan.

My qualifications include Bachelor of Science and Honours degrees, both in geology from Victoria University of Wellington. I also have seven years experience as an exploration geologist working internationally.

**Matt Smith**

My name is Matthew Blair Smith. I hold the qualification of M.Sc (Engineering Geology) from the University of Canterbury. I am currently employed by Environment Canterbury as a Groundwater Hydrologist, a position I have held since November 2005. Previously I was employed by Glasson Potts Fowler Limited, an environmental planning and engineering firm, as their senior Hydrogeologist. I am a member of the New Zealand Hydrological Society and the International Association of Hydrogeologists.

I have worked, almost exclusively, in groundwater hydrology for the last 5 years. During this time I have been involved with assessments and testing of stream depletion; spring interference; and well interference; as well as aquifer definition and aquifer testing.

Previous work also involved assessing the potential impacts of storm water and land use on the groundwater environment, the design of infiltration systems as well as technical review of regional plans, and the representation of a number of applicants in resource consent proceedings.

**Anna Veltman**

I am a Senior Resource Management Planner with 8 years experience in water resource management at Environment Canterbury. During this period, I worked for the first four years in the Consents Section auditing resource consent applications for both ground and surface water, as well as some coastal activities. In the latter four years, I have been involved in the preparation of Chapter 5 of the proposed NRRP which addresses water quantity issues. I have a Masters in Ecological Agriculture (Wageningen, The Netherlands) and a Post Graduate Diploma in Resource and Environmental Planning (Waikato).

## • **Introduction**

### **Content of this report**

This officer report is one of a series considering submissions to Proposed Variation 1 (Chapters 4 to 8) to the Proposed Canterbury Natural Resources Regional Plan (NRRP). Submissions evaluated in this report are those that relate to the matters to be heard as listed on the cover of this report.

### **Purpose of this officer report**

This officer report has been prepared under Section 42A of the Resource Management Act:

1. to assist the Hearing Committee in making its recommendations to Environment Canterbury on the submissions and further submissions to Proposed Variation 1 to the Proposed NRRP;
2. to assist submitters and further submitters who requested to be heard, by providing, prior to the hearing, a staff evaluation of decisions requested in submissions.

The evaluations and recommendations presented in the report are based on the information available prior to the hearing, including that contained in the submissions and further submissions. In evaluating the submissions and further submissions, the matters considered include whether a decision requested:

1. falls within the functions of Environment Canterbury under the Resource Management Act 1991 (RMA);
2. will enhance the ability of the Proposed NRRP to achieve the purpose of the RMA;
3. will improve an objective so that it is a more appropriate way to achieve the purpose of the RMA;
4. will improve a policy, rule or other method so that it is more efficient and effective for achieving the relevant objectives;
5. will improve the plan in relation to such matters as its lawfulness, clarity, accuracy, effectiveness, coherence, integration, etc.

### **How to read this report**

This report is presented in four parts:

*Part 1: Briefing for Hearing Committee on the structure of OR 7 and main areas of changes being recommended*

This part provides a brief overview of the nature of interference effects between abstractions and the main areas of change being recommended.

### *Part 2: Index of submitters and further submitters*

The index tells you where to find the evaluation of your submission or further submission. Submissions are usually listed in numerical order, followed by further submissions (which are identified with the letter F before the further submission number). The page numbers next to your submission name indicate the pages in the officer report on which your name is listed under the provisions you have submitted on. The actual evaluation of your submissions is in the text immediately following each table.

### *Part 3: Officer's evaluation of submissions and recommendations*

This is the main part of the report. For each provision submitted on, Part 3 contains the following standard format:

- the name of the provision (shaded), prefaced by a coding number (see explanation of coding below).
- the summary of decisions requested by submitters on that provision set out in table format
- **Clarification:** only used where the summary of the decision requested shown in the table needs further elaboration/clarification.
- **Evaluation and reasons:** This part discusses the merits of submissions and includes reasons for accepting, accepting in part, or rejecting it
- **Recommendations:** This will identify for each submission whether it should be accepted, accepted in part, or rejected. Each recommendation heading includes a unique identifying number.
- **Amendment required:** will identify specifically the location and nature of any amendment being recommended in response to submissions on the provision.

All clarifications, evaluations and recommendations are prefaced by the submission number to which they relate.

Amendments recommended to Chapters 4-8 are identified in the following way:

- deletions are shown by the use of strikethrough e.g. ~~strikethrough~~
- additions are shown by underlining e.g. underlining

### *Part 4: The relevant parts of chapters 4-8 amended to show the recommendations in the officer report*

The amended plan is on coloured paper at the end of the report. It shows all the changes recommended in Part 3 to allow you to see the overall effect of the recommendations. Strikeouts and underlining are used to show the amendments. Footnotes are used to identify which recommendation number each amendment relates to.

## Explanation of coding numbers in the tables

Each set of submissions evaluated in this report is preceded by the name of the provision submitted on and a coding number. The coding number is a reference to where the provision is located in the Proposed NRRP. The formula for coding is generally as follows:

[Chapter number]-[page number] [line number] on which the provision begins.

For example, Policy WQN14(4) is coded 5-83 32, which indicates that this provision is located in Chapter 5, page 83, beginning on line 32.

When a submission was summarised and put onto our submission database, staff gave every decision requested its own number. Thus a submission with 55 separate decisions requested would have 55 entries in our database, one for each plan provision submitted on. These are numbered from 1 to 55 and the extra number comes after the actual submission number and looks like this: 103.55 where 103 is the submission number. This helps staff keep track of each decision requested and ensure that all decisions requested have been addressed.

## Abbreviations and symbols

BPO	best practicable option
CMA	Coastal Marine Area
CRPMS	Canterbury Regional Pest Management Strategy
CRPS	Canterbury Regional Policy Statement (26 June 1998)
HSNO	Hazardous Substances and New Organisms Act 1996
L&VMRP	Land & Vegetation Management Regional Plan
L/s	litres per second
LTCCP	Long-Term Council Community Plan
MALF	mean annual low flow
$\mu\text{g}/\text{m}^3$	micrograms per cubic metre
mg/kg	milligram per kilogram
$\text{mg}/\text{m}^3$	milligrams per cubic metre
$\text{m}^3/\text{day}$	cubic metres per day
MHWS	mean high water springs
NMTRP	Nelson-Marlborough Transitional Regional Plan
TRP	Canterbury Transitional Regional Plan
NRRP	Proposed Canterbury Natural Resources Regional Plan
NTCSA	Ngāi Tahu Claims Settlement Act 1998
ORRP	Opihi River Regional Plan
PCE	Parliamentary Commissioner for the Environment
RCEP	Regional Coastal Environment Plan
RLTS	Regional Land Transport Strategy
RMA	Resource Management Act 1991
WRRP	Waimakariri River Regional Plan
7DMALF	seven-day mean annual low flow
Original submitter/submission	these are submissions made directly on Variation 1, Chapters 4-8, after it was first notified.
Further submitter/submission	these are submission made in support of/opposition to specific original submissions

## **Withdrawn Submissions and Further Submissions**

Legal advice indicates that a further submission to a withdrawn original submission remains “live” and entitles the RMA Schedule 1 process. Therefore an evaluation and recommendation has been provided for these further submissions in the Officer Report.

## **Officer Reports May Include Technical Reports from Scientists**

Some of the matters raised by submitters may have required written technical advice to be obtained from scientists to aid in the evaluation of submissions. Technical reports received may be included within the Officer Report, generally as an appendix, and form part of the Officers Report. Submitters appearing at the hearing can respond to these technical reports as part of their evidence. At the start of a hearing stage, the scientist who wrote one of these reports will be present to give a brief explanation of its contents to the Hearing Committee, and to answer any questions that the Committee may have about the report.

## ***Part 1: Briefing for Hearing Committee on the structure of Officer Report WQN2 and main areas of changes being recommended***

This s42A officer report addresses submissions made on Section 5.5.8 of Chapter 5, and Schedule WQN10. These sections describe how interference effects between groundwater abstractions will be managed.

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

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

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

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

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

The issues, objectives, policies and methods are outlined in Section 5.5.8, while the detailed methodology for assessing interference effects is explained in Schedule WQN10, including examples.

### **Submissions and Recommended Amendments**

Outlined below in summary form are the main amendments being recommended in this report.

- (1) Include reference to Schedule WQN10 in Policy WQN20(2)(d), in the explanation and principal reasons for Policy WQN20, and in Method WQN20(c).
- (2) Amend Policies WQN20(1) and (2)(e)(ii), Schedule WQN10, and make a consequential change to Rule WQN19 to allow for the assessment of interference effects beyond two kilometres in some situations as such effects have now been observed in Canterbury aquifer tests.

- (3) Amend Policy WQN20(2)(e)(ii) and Schedule WQN10 to increase the cut-off of acceptable interference effects from 0.05m to 0.1m and in recognition that this is the magnitude of interference effects that can readily be observed in the field.
- (4) Amend Figure WQN13 of Schedule WQN10 so that it also illustrates the protected available drawdown in a well with a surface water pump.

## Part 2: Index of submitters and further submitters

*List of Submission numbers and the pages where they are*

Submitter	Sub No	Page Number(s)
AgResearch Ltd,	F1084:	3, 4, 7
Aqualinc Research Ltd,	649:	8, 23
Brook Farm Ltd,	404:	5, 9, 12, 13, 14, 15, 16, 17, 20, 22
Calder Stewart Industries Ltd,	631:	23
Canterbury Forest Industry Working Group,	F1043:	3, 4, 6, 7, 10, 12, 13, 14, 16, 17, 20, 21, 22
Canterbury Growers Society Ltd,	540:	6, 12, 14
Canterbury Pastoral Ltd,	648:	8, 23
Canterbury-Aoraki Conservation Board,	432:	3, 4, 7
Christchurch City Council,	476:	3, 4, 7, 14, 21, 22, 25, 26
Department of Corrections,	567:	4, 7
Eminence Investments Ltd,	F1052:	3, 4, 7, 22
Federated Farmers NZ Inc - Canterbury Provinces,	586:	3, 4, 6, 10, 12, 13, 14, 16, 17, 20, 21, 22
Federated Farmers of NZ (Inc),	F1074:	10, 22
Fish & Game New Zealand, Central S. Island, N. Canterbury & Nelson/ Marlborough,	470:	22
Fish & Game NZ, Central South Island, North Canty & Nelson/Marlborough Regions,	F1049:	22
Fonterra Co-Operative Group Ltd,	F1083:	3, 4, 7
Haka Valley Irrigation Society,	635:	5, 9, 10
Horticulture NZ (formerly NZ Vegetable & Potato Growers Federation Inc et al),	541:	6, 12, 14
Hugh Turnbull,	506:	3, 4, 6, 10, 12, 13, 14, 16, 17, 20, 21, 22
Irricon Consultants,	560:	17, 22, 23
Mackenzie Irrigation Company Ltd,	542:	8, 22
Ministry of Education,	568:	4
Mr Gingerbread Ltd,	549:	23
Ngai Tahu Ltd,	F1053:	3, 4, 7, 22
North Bank Land Owners Group,	289:	4, 6, 7, 10, 12, 13, 14, 15, 17, 20, 21, 22
Rosalie and Jules Snoyink,	F1033:	22
Selwyn Plantation Board Limited,	F1044:	3, 4, 6, 7, 10, 12, 13, 14, 16, 17, 20, 21, 23
South Island High Country Section, Federated Farmers NZ,	669:	3, 5, 6, 10, 12, 13, 14, 16, 17, 20, 21, 23
Southern Area NRRP Irrigation Interest Group,	617:	4, 9, 10
Synlait Investments,	645:	8, 23
University of Canterbury,	512:	4, 7
Upper Waitaki Branch Federated Farmers Of New Zealand Inc,	257:	3, 4, 6, 10, 12, 13, 14, 15, 17, 20, 21, 22
Valetta Holdings Ltd,	508:	17
Water Rights Trust Inc,	582:	4, 7, 21
Water Rights Trust,	F1020:	13
William J Stevens,	306:	3



## Part 3: Submission summary, submission clarification, evaluation and recommendation on Chapter 5 WQN2

### 5-114-2 Issue WQN7 Interference effects between bores

5-114-2	257.1880	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.785).
5-114-2	306.9	William J Stevens*	Amend Issue WQN3 to have compensation payable, or mitigation provided, to those whose existing bores are affected by new abstractions.
5-114-2	432.259	Canterbury-Aoraki Conservation Board*	Retain Issue WQN7.
	F1052.261	Eminence Investments Ltd.*	<i>Oppose</i>
	F1053.257	Ngai Tahu Ltd*	<i>Oppose</i>
	F1083.257	Fonterra Co-Operative Group Ltd (Fonterra)*	<i>Oppose</i>
	F1084.257	AgResearch Ltd*	<i>Oppose</i>
5-114-2	476.365	Christchurch City Council*	Retain Issue WQN7 as worded.
5-114-2	506.1873	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.785).
5-114-2	586.785	Federated Farmers NZ Inc - Canterbury Provinces*	Retain Issue WQN7.
	F1043.2272	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.2266	Selwyn Plantation Board Limited*	<i>Support</i>
5-114-2	669.1868	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.785).

### Evaluations and reasons

**306.9:** This submission seeks the protection of existing bores from the effects of new takes. It is suggested that compensation should be paid, or mitigation provided, to existing well owners who are affected by new groundwater takes.

As noted in section 1.12 of the Section 32 Report for Chapter 5, giving full protection to existing groundwater users, regardless of whether or not their bore(s) fully penetrates the aquifer, was one of the options considered when drafting Issue WQN7. However it was concluded that this would unduly constrain access to the groundwater resource by the wider community, and thus limit the community's reasonable expectation of gaining social and economic benefits from water that is available to allocate.

While the cost of the approach taken in Policy WQN20(2)(a) will largely be borne by existing groundwater users whose wells do not fully penetrate the aquifer, the impact is off-set to a degree by the fact that they have had access to, and have gained social and economic benefits from, relatively 'cheap' water for some time i.e. fully penetrating wells are deeper and more expensive to install and operate. Often the existing shallow wells are nearing the end of their operational life anyway, and needing to be replaced.

Therefore it is considered that requiring compensation from new water users to protect existing users who are limiting access to available groundwater would not be consistent with the promotion of sustainable management.

For this reason, the submission is rejected, and no amendment is required.

**257.1880, 432.259, F1052.261, F1053.257, F1083.257, F1084.257; 476.365, 506.1873, 586.785, F1043.2272, F1044.2266; 669.1868:** Submissions 257.1880, 432.259, 476.365, 506.1873, 586.785 and 669.1868 all support the retention of Issue WQN7, although none give reasons. Further submissions F1052.261, F1053.257, F1083.257 and F1084.257 all oppose 432.259 for reasons that are not specific to

the relief sought. Further submissions F1043.2272 and F1044.2266 both support 586.785 for the reasons stated in the original submission.

While none of the submissions or further submissions in support, or the further submissions in opposition, give reasons for their respective positions, it is recommended that Issue WQN7 be retained as worded, as it would appear to adequately describe the key issues associated with interference effects between bores.

For the above reason, 257.1880, 432.259, 476.365, 506.1873, 586.785, 669.1868, F1043.2272 and F1044.2266 in support are accepted, and F1052.261, F1053.257, F1083.257 and F1084.257 in opposition are rejected. Also 306.9 is rejected. No amendment is required.

#### **WQN2.1 Recommendation**

257.1880, 432.259, 476.365, 506.1873, 586.785, 669.1868, F1043.2272, F1044.2266: Accept

306.9, F1052.261, F1053.257, F1083.257, F1084.257: Reject

#### **Amendment**

Nil

#### **5-114-12 Objective WQN7 Interference effects between bores**

5-114-121	257.795	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.786).
5-114-121	289.1315	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.786).
5-114-121	432.260	Canterbury-Aoraki Conservation Board*	Retain Objective WQN7.
	F1052.262	Eminence Investments Ltd.*	<i>Oppose</i>
	F1053.258	Ngai Tahu Ltd*	<i>Oppose</i>
	F1083.258	Fonterra Co-Operative Group Ltd (Fonterra)*	<i>Oppose</i>
	F1084.258	AgResearch Ltd*	<i>Oppose</i>
5-114-121	476.366	Christchurch City Council*	Retain Objective WQN7 as worded.
5-114-121	506.785	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.786).
5-114-121	512.96	University of Canterbury*	Retain Objective WQN7 as worded.
5-114-121	567.24	Department of Corrections*	Retain Objective WQN7
5-114-121	568.44	Ministry of Education*	Retain Objective WQN7.
5-114-121	582.224	Water Rights Trust Inc*	Retain Objective WQN7.
	F1043.426	Canterbury Forest Industry Working Group.*	<i>Oppose</i>
	F1044.426	Selwyn Plantation Board Limited*	<i>Oppose</i>
5-114-121	586.786	Federated Farmers NZ Inc - Canterbury Provinces*	Retain Objective WQN7.
	F1043.2273	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.2267	Selwyn Plantation Board Limited*	<i>Support</i>
5-114-121	617.57	Southern Area NRRP Irrigation Interest	Retain Objective WQN7.

		Group*	
5-114-121	635.57	Haka Valley Irrigation Society*	Supports submission made by Southern Area NRRP Irrigation Interest Group. See submission point 617.57.
5-114-121	669.783	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.786).

### Evaluations and reasons

**257.795, 289.1315, 432.260, F1052.262, F1053.258, F1083.258, F1084.258; 476.366, 506.786, 512.96, 567.24, 568.44, 582.224, F1043.426, F1044.426; 586.786, F1043.2273, F1044.2267; 617.57, 635.57, 669.783:** All of the original submissions request that Objective WQN7 be retained, although only 568.44 gives a reason, being “sound management practice”. Submission 586.786 states “*Support but amend to also give recognition to FFNZ submission to Issue WQN7.*” As I have not been able to locate such a submission, it is unclear what is meant here.

Further submissions F1052.262, F1053.258, F1083.258, F1084.258 oppose 432.260, and F1043.426, F1044.426 oppose 582.224, all for reasons that are not specific to the relief sought. F1043.426 and F1044.426 both support 586.786, also for non-specific reasons.

While none of the submissions or further submissions in support, or the further submissions in opposition, give reasons for their respective positions, it is recommended that Objective WQN7 be retained as worded, as it is considered to be an appropriate objective in response to Issue WQN7. For this reason the submissions and further submissions in support are accepted, while the further submissions in opposition are rejected.

For the reasons set out above, 257.795, 289.1315, 432.260, 476.366, 506.786, 512.96, 567.24, 568.44, 582.224, 586.786, 617.57, 635.57, 669.783, F1043.2273 and F1044.2267 in support are accepted, while F1052.262, F1053.258, F1083.258, F1084.258, F1043.426 and F1044.426 in opposition are rejected. No amendment is required.

### WQN2.2 Recommendation

257.795, 289.1315, 432.260, 476.366, 506.786, 512.96, 567.24, 568.44, 582.224, 586.786, 617.57, 635.57, 669.783, F1043.2273, F1044.2267: Accept

F1043.426, F1044.426, F1052.262, F1053.258, F1083.258, F1084.258: Reject

### Amendment

Nil

5-114-123	404.18	Brook Farm Ltd*	Amend Objective WQN7 to provide for groundwater professionals to accurately implement the goals, and to address concerns that an interpolated water level may be significantly affected beyond the area associated with the activity.
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### Evaluations and reasons

**404.18:** This submission expresses a general concern that groundwater professionals may be unable to accurately implement the goals set by Objective WQN7, because of some of the methodologies and definitions in Policy WQN20. An example of a specific concern is noted as part of this submission in relation to the methodology for calculating minimum water levels that are factored into interference assessments carried out in accordance with Schedule WQN10.

While the submitter’s specific concerns will be evaluated in relation to Policy WQN20, it is considered that the general concern with Objective WQN7 is unfounded. It is also noted that no particular methodology for calculating minimum groundwater levels is specified in section 5.5.8 or Schedule WQN10, but rather Policy WQN20(2)(d) simply refers to ‘the level’ that is exceeded 80% of the time during the period of proposed water use. Therefore, groundwater professionals are free to calculate groundwater levels that meet this standard by any appropriate methodology.

As no specific amendments to this objective have been suggested, and it has previously been concluded that it represents an appropriate response to Issue WQN7, 404.18 is rejected. No amendment is required.

**WQN2.3 Recommendation**

404.18: Reject

**Amendment**

Nil

5-114-152	540.194	Canterbury Growers Society Ltd*	Amend Objective WQN7 by adding “ <u>and adequately maintained</u> ” at the end of the objective.
5-114-152	541.194	Horticulture NZ (formerly NZ Vegetable & Potato Growers Federation Inc et al)*	Amend Objective WQN7 by adding “ <u>and adequately maintained</u> ” at the end of the objective.

**Evaluations and reasons**

**540.194, 541.194:** These submissions both state their support for not protecting existing takes from bores that do not adequately penetrate the aquifer, however they note that bores and pumps also need to be adequately maintained to reduce the potential for interference. They therefore request that Objective WQN7 be amended accordingly.

While it is accepted that poorly maintained bores and pumps could result in interference effects from a neighbouring bore being exacerbated, it is considered that such factors do not need to be specifically mentioned in Objective WQN7 as they have already been built into the assessment methodology outlined in Policy WQN20 and Schedule WQN10.

Because the “protected available drawdown” of 80% is the same for all bores, any failure to adequately maintain a bore and/or pump will only affect that bore owner (i.e. they may not be able to take advantage of the whole of their available drawdown). This contrasts with the need to require all bores to adequately penetrate the aquifer, before they are eligible for full protection under Policy WQN20, as the available/protected drawdown split is based on this input (i.e. if Objective WQN7 did not require all bores to fully penetrate the aquifer the “available drawdown” for such inadequately penetrating bores might be reduced such that new users’ access to groundwater might be unreasonably restricted).

For the above reason 540.194 and 541.194 are rejected, and no amendment is required.

**WQN2.4 Recommendation**

540.194, 541.194: Reject

**Amendment**

Nil

**5-114-16 Explanation and principal reasons Objective WQN7**

5-114-16	257.797	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-16	289.1317	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-16	506.787	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-16	586.787	Federated Farmers NZ Inc - Canterbury Provinces*	Retain Explanation to Objective WQN7.
	F1043.2274	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.2268	Selwyn Plantation Board Limited*	<i>Support</i>
5-114-16	669.785	South Island High Country Section, Federated Farmers	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).

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### Evaluations and reasons

**257.797, 289.1317, 506.787, 586.787, F1043.2274, F1044.2268; 669.785:** All submissions, and the further submissions on 586.787, support the retention of the explanation and principle reasons for Objective WQN7, although no reasons are given. It is recommended that this section be retained as it adequately explains the purpose of, and main reasons for, the objective.

For the above reason, 257.797, 289.1317, 506.787, 586.787, 669.785, F1043.2274 and F1044.2268 are accepted. No amendment is required.

### WQN2.5 Recommendation

257.797, 289.1317, 506.787, 586.787, 669.785, F1043.2274, F1044.2268: Accept

### Amendment

Nil.

### 5-114-25 Policy WQN20 Managing the effects of interference between bores

5-114-251	432.261	Canterbury-Aoraki Conservation Board*	Retain Policy WQN20.
	F1052.263	Eminence Investments Ltd.*	<i>Oppose</i>
	F1053.259	Ngai Tahu Ltd*	<i>Oppose</i>
	F1083.259	Fonterra Co-Operative Group Ltd (Fonterra)*	<i>Oppose</i>
	F1084.259	AgResearch Ltd*	<i>Oppose</i>
5-114-251	476.367	Christchurch City Council*	Retain Policy WQN20 as worded.
5-114-251	512.97	University of Canterbury*	Retain Policy WQN20 as worded.
5-114-251	567.25	Department of Corrections*	Retain Policy WQN20.
5-114-251	582.225	Water Rights Trust Inc*	Retain Policy WQN20.
	F1043.427	Canterbury Forest Industry Working Group.*	<i>Oppose</i>
	F1044.427	Selwyn Plantation Board Limited*	<i>Oppose</i>

### Evaluations and reasons

**432.261, F1052.263, F1053.259, F1083.259, F1084.259; 476.367, 512.97, 567.25, 582.225, F1043.427, F1044.427:** All of the original submitters request the retention of Policy WQN20, although no reasons are given. Further submissions oppose 432.261 and 582.225 for reasons that are not specific to the relief sought. It is recommended that Policy WQN20 be retained, as it addresses the concerns outlined in Issue WQN7, and, when implemented, will meet Objective WQN7. Submissions have been made on each part of this policy, and these will be evaluated separately in this Officer's Report. As a result of the evaluation of these submissions, changes may be made to some parts of Policy WQN20.

For this reason, 432.261, 476.367, 512.97, 567.25 and 582.225 are accepted, and F1043.427, F1044.427, F1052.263, F1053.259, F1083.259, F1084.259 are rejected. No amendment is required.

### WQN2.6 Recommendation

432.261, 476.367, 512.97, 567.25, 582.225: Accept

F1043.427, F1044.427, F1052.263, F1053.259, F1083.259, F1084.259: Reject

### Amendment

Nil

5-114-252	289.23	North Bank Land Owners Group*	Amend Chapter 5 to ensure that groundwater abstractions from new bores must not impact on
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			existing, neighbouring bores.
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### Evaluations and reasons

**289.23:** This submitter requests that new groundwater takes do not impact on existing neighbouring bores. Providing absolute protection for all existing groundwater takes is considered to be inconsistent with the concept of promoting the sustainable management of the environment. Various options were considered as part of the Section 32 analysis for providing a “reasonable” level of protection for existing users (over and above that provided by Policy WQN14(10) in terms of priority), and it was decided that direct cumulative interference effects from new bores, and all other existing bores, should be limited to 20% of the available drawdown in an existing bore, as set out in Policy WQN20(1). This threshold was based on the modelling of various levels of protection, and it was concluded that it represented a reasonable level that would allow for further development of the groundwater resource in many parts of Canterbury, without unduly reducing the reliability of supply of existing users. As noted in Policy WQN20(2), this concept is taken further by treating existing bores that do not fully penetrate the aquifer as if they did, so that access to groundwater resources that are not fully allocated will not be unreasonably constrained, as discussed in relation to the evaluation of 306.9.

For this reason, 289.23 is rejected, and no amendment is required.

### WQN2.7 Recommendation

289.23: Reject

### Amendment

Nil

5-114-253	542.64	Mackenzie Irrigation Company Ltd*	Retain Policy WQN20, but amend to be much simpler and more realistic.
5-114-253	645.84	Synlait Investments*	Retain concept of Policy WQN20.
5-114-253	645.85	Synlait Investments*	Amend Policy WQN20 to rewrite to something much simpler and realistic.
5-114-253	648.83	Canterbury Pastoral Ltd*	Retain concept of Policy WQN20.
5-114-253	648.84	Canterbury Pastoral Ltd*	Amend Policy WQN20 to rewrite to something much simpler and realistic.
5-114-253	649.83	Aqualinc Research Ltd*	Retain concept of Policy WQN20.
5-114-253	649.84	Aqualinc Research Ltd*	Amend Policy WQN20 to rewrite to something much simpler and realistic.

### Evaluations and reasons

**542.64, 645.84, 645.85, 648.83, 648.84, 649.83, 649.84:** All of the submissions support the retention of the concept of Policy WQN20, but request that it be re-written “to something much simpler and realistic”. The submitters' main concern with this policy is that it relies on the application of Schedule WQN10, which is considered to be far too complicated, does not reflect actual pumping needs, makes too many assumptions and is too dependent on too many variables. No examples of these concerns are provided in any of the submissions.

While Policy WQN20 mistakenly does not refer to Schedule WQN10 (which should be corrected), it is correct that its application does rely on this schedule. Specific concerns regarding Schedule WQN10 will be evaluated as part of submissions on that schedule later in this Officers Report, and on the various clauses of Policy WQN20 that underpin it. However, as a general response to the concerns raised, it is considered that making the proposed methodology simpler would either lead to less realistic results (by not allowing for sufficient variables), or unreasonably penalising either existing well users (by not adequately protecting them, such as with a policy protecting a bores yield) or new well users (by requiring too high a level of protection for existing users, such as by setting a minimum bore separation distance). Also, once this policy is operative, assessments will be simpler in those situations addressed in Policy WQN20(2)(a) to (c).

With regard to the concern that the methodology does not reflect actual pumping needs, it is noted that, instead, it provides both existing and new abstractors with a predetermined level of protection, irrespective of pump rate. For existing users the level of protection is considered to be reasonable, while prospective new users are given certainty around which they can design their irrigation system, having first determined whether the level of protection affords an acceptable level of risk given the proposed water use.

However, aside from these generic concerns, it is considered important to make the link between Policy WQN20 and Schedule WQN10 explicit. For this reason, 542.64, 645.84, 645.85, 648.83, 648.84, 649.83 and 649.84 are accepted in part, to the extent that they support Policy WQN20 in concept and seek amendments that make it simpler. An amendment is required.

### WQN2.8 Recommendation

542.64, 645.84, 645.85, 648.83, 648.84, 649.83, 649.84: Accept in part

### Amendment

1) Amend Policy WQN20(2)(d) on page 5-115 as follows:

“...the “protected available drawdown” shall be determined as 80% of the drawdown available, as shown in Schedule WQN10, at a groundwater level that is exceeded...”

2) Amend the Explanation and principal reasons on page 5-115 at line 35 as follows:

“...result in a reduction in the protected available drawdown, as shown in Schedule WQN10, unless the effect is mitigated.”

3) Amend Method WQN20(c) on page 5-117 at line 23 as follows:

“...accordance with Policy WQN20 and Schedule WQN10.”

5-114-254	617.59	Southern Area NRRP Irrigation Interest Group*	Remove existing bores which inadequately penetrate aquifers from the protection of Policy WQN20.
5-114-254	635.59	Haka Valley Irrigation Society*	Supports submission made by Southern Area NRRP Irrigation Interest Group. See submission point 617.59.

### Evaluations and reasons

**617.59, 635.59:** Submission 617.59 requests that the protection afforded existing bores that do not adequately penetrate the aquifer by Policy WQN20 be removed as this is “inefficient” (with reference to the *Opiki Water Users v Manawatu/Wanganui Regional Council* decision). Submission 635.59 supports this request for reasons that are not specific to the relief sought.

As explained in the “Explanation and principal reasons” for Policy WQN20(2)(a), such bores are treated as if they are fully penetrating the aquifer. Therefore, they only receive the full protection of Policy WQN20(1) if they are subsequently deepened to the point where they do fully penetrate the aquifer. This is seen as a more reasonable approach for dealing with existing bores than, for example, removing all protection as per new (inadequately penetrating) bores installed six months after Policy WQN20 becomes operative (as per Policy WQN20(2)(b)).

For this reason' 617.59 and 635.59 are rejected, and no amendment is required.

### WQN2.9 Recommendation

617.59, 635.59: Reject

### Amendment

Nil

5-114-255	404.20	Brook Farm Ltd*	If the request to revise Schedule WQN10 (submission 404.21) is not accepted, reword Policy WQN20 so that policy and Schedule WQN10 are only used when there is significant information.
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### Evaluations and reasons

**404.20:** This submission requests that, should the request to revise Schedule WQN10 not be accepted, Policy WQN20 and Schedule WQN10 be amended so that they are only used in areas where there is a significant level of information, such as around Christchurch and Ellesmere. While it is acknowledged that the application of Schedule WQN10 in areas with limited information on aquifer parameters

(especially leakage) may result in the overestimation of cumulative interference effects, it should be recognised that it is primarily a screening tool (i.e. interference effects only need to be assessed further where the Schedule WQN10-based model highlights affected bores).

Therefore in areas with little information, where default inputs to the Schedule WQN10-based model give results not in their favour, applicants have the opportunity to provide accurate local information in the form of an aquifer test, local water level records and pump test results. Therefore it is considered inappropriate to limit the application of Policy WQN20 and Schedule WQN10 to only some parts of Canterbury, especially as this methodology is an advance over that used previously by ECan to audit interference effects. It is also noted that while some submitters have suggested amendments to aspects of Schedule WQN10, none have proposed an alternative, potentially better, methodology.

For this reason, 404.20 is rejected, and no amendment is required at this stage.

## WQN2.10 Recommendation

404.20: Reject

## Amendment

Nil

## 5-114-26 Policy WQN20(1)

5-114-26	257.798	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-26	289.1318	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-26	506.788	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-26	586.788	Federated Farmers NZ Inc - Canterbury Provinces*	Retain Policy WQN20(1).
	F1043.2275	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.2269	Selwyn Plantation Board Limited*	<i>Support</i>
	F1074.330	Federated Farmers of NZ (Inc)*	<i>Correction of original decision requested - submitter opposed Policy WQN20(1) because 2km is too large for small takes, say less than 20 litres per second. (Submitter mistakenly asked for (1) to be retained.)</i>
5-114-26	617.58	Southern Area NRRP Irrigation Interest Group*	Amend Policy WQN20(1) to remove the inconsistency between this policy and Policy WQN20(2)(e), regarding the exclusion of rules.
5-114-26	635.58	Haka Valley Irrigation Society*	Supports submission made by Southern Area NRRP Irrigation Interest Group. See submission point 617.58.
5-114-26	669.786	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).

## Submission Clarification

Submission 586.788 requested that Policy WQN20(1) be retained, although it is noted that the reason for the submission indicated a concern that interference effects from small (<20L/s) takes also had to be considered out to 2km. This was clarified in further submission F1074.330 which indicated that the original position was meant to be one of opposition to Policy WQN20(1), for the reason given in the original submission. Therefore, 586.788 has been evaluated as a submission in opposition to Policy

WQN20(1), as have those submissions and further submissions that support this submission for reasons that are not specific to the relief sought.

### Evaluations and reasons

**257.798, 289.1318, 506.788, 586.788, F1043.2275, F1044.2269, F1074.330; 669.786:** As explained above, these submissions are considered to all be opposed to Policy WQN20(1) because of the requirement for “small” (<20L/s) takes to assess interference effects out to 2km.

This concern is addressed to some extent by Policy WQN20(2)(e)(ii), which states that only those calculated interference effects from new takes that exceed 0.05m will be taken into account. Therefore the interference effects of a “small” take will only have to be considered out to the point where they drop below 0.05m (the point at which such effects can no longer be confidently measured in the field), which may well be less than 2km.

However, in some situations such as in a semi-confined aquifer of low transmissivity, theoretical interference effects from relatively small takes will extend further than has been observed in the field, or would realistically be expected, especially when calculated over 150 days (in accordance with Policy WQN20(2)(e)(ii)). Therefore, it would be reasonable either to raise the cut-off from 0.05m, or to build in greater flexibility within the policy to allow for the assessment of interference effects over a lesser distance, as is envisaged in Appendix 1 of “Guidelines for auditing assessments of well interference effects” (ECan technical report U03/7).

It is considered more practical to raise the cut-off, as this would result in more realistic outputs from the modelling of interference assessments, especially for “small” takes. For example, increasing the cut-off to 0.1m would allow for a doubling in the average rate of take over a set distance, which in the opinion of ECan groundwater scientists, would not significantly underestimate cumulative interference effects (i.e. it would still take 10 “small” takes each having an interference effect of 0.1m to cause a combined drawdown of one metre (refer to the Internal Memorandum prepared by Matt Smith, dated 24 January 2007, attached as Appendix I).

In time, it might be possible to determine an appropriate maximum radius within which to assess interference effects based on a function of transmissivity, leakage and pump rate, etc. However given the lateral heterogeneity (variability) of Canterbury’s aquifers, this would still only be a crude attempt to represent what actually happens in reality.

Therefore, where an assessment still appears to give unrealistic results, applicants would have the ability to use other criteria, based for example on parameters from a local aquifer test, having first had regard to Policy WQN20. Concerns with interference effects that could extend beyond 2km have been considered in the evaluation of submissions on Policy WQN20(2)(e), which has given rise to consequential amendments to Policy WQN20(1) in accordance with recommendation WQN2.16.

For the above reason, both the original and further submissions are accepted in part, and consequential amendments are required to Policy WQN20(2)(e)(ii), and the explanation and principal reasons for the policy, as well as to Schedule WQN10.

**617.58, 635.58:** These submissions seek an amendment to address the apparent inconsistency between Policy WQN20(1) and WQN20(2)(e)(i) in that the latter provision specifically excludes takes that are authorised by a permitted activity rule, while the former provision does not. In fact, there is no inconsistency, as the term “direct cumulative interference effect” used in Policy WQN20(1) is defined in Policy WQN20(2)(e)(i), hence the effect of permitted takes is also excluded from the former. Essentially Policy WQN(20)(2) clarifies Policy WQN20(1), hence the whole of the policy must be read together. For this reason, the submissions are rejected.

Therefore for the above reasons, 257.798, 289.1318, 506.788, 586.788, 669.786, F1043.2275, F1044.2269 and F1074.330 are accepted in part, and 617.58 and 635.58 are rejected. An amendment is required.

### WQN2.11 Recommendation

257.798, 289.1318, 506.788, 586.788, 669.786, F1043.2275, F1044.2269, F1074.330: Accept in part

617.58, 635.58: Reject

### Amendment

1) Amend Policy WQN20(2)(e)(ii) on page 5-115 as follows:

“...calculated interference effect on that bore of more than ~~0-050~~0.1 metres, when abstracting at either...”

2) Amend the explanation and principal reasons on page 5-116 at line 52 as follows:

“...abstracting is ~~0-050~~0.1 metres or more, this will be included in the direct...”

3) Amend Schedule WQN10 on page 5-259 at line 5 as follows:

“...effect on that bore of more than ~~0-050~~0.1 metres, when abstracting at either...”

#### 5-114-32 Policy WQN20(2)(a)

5-114-32	257.799	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-32	289.1319	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-32	404.12	Brook Farm Ltd*	Retain policy WQN20(2)(a) in particular the inclusion of references to the exclusion of inadequately penetrating wells in future interference effects analysis.
5-114-32	506.789	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-32	540.195	Canterbury Growers Society Ltd*	Amend Policy WQN20(2)(a) to read: " <u>where an existing bore inadequately penetrates an aquifer or is inadequately maintained ...</u> ".
5-114-32	541.195	Horticulture NZ (formerly NZ Vegetable & Potato Growers Federation Inc et al)*	Amend Policy WQN20(2)(a) to read: " <u>where an existing bore inadequately penetrates an aquifer or is inadequately maintained ...</u> ".
5-114-32	586.789	Federated Farmers NZ Inc - Canterbury Provinces*	Retain Policy WQN20(2)(a).
	F1043.2276	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.2270	Selwyn Plantation Board Limited*	<i>Support</i>
5-114-32	669.787	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).

#### Evaluations and reasons

**257.799, 289.1319, 404.12, 506.789, 586.789, F1043.2276, F1044.2270; 669.787:** All of the original submissions and the two further submissions support the retention of Policy WQN20(2)(a), although only 404.12 gives a reason (being support for the exclusion of inadequately penetrating bores from future interference effects analyses).

While there may be further discussion as to how an “inadequately penetrating bore” is defined as part of the evaluation of submissions on Policy WQN15, the principle of not providing full protection for existing bores, and no protection for new bores from six months after Policy WQN20 becomes operative, would appear to be accepted as there are no submissions opposing these measures. For this reason, the requests for the retention of Policy WQN20(2)(a) are accepted, and the original submissions and further submissions in support are therefore accepted. No amendment is required.

**540.195, 541.195:** Both of these submissions request that bores that are “inadequately maintained” be treated in the same way as those that are not fully penetrating the aquifer, in order to “reduce the potential for interference.” This request has been evaluated earlier in this report in relation to 540.194

and 541.194, where it was concluded that such factors have already been built into the assessment methodology outlined in Policy WQN20 and Schedule WQN10. For this reason, these submissions are rejected.

For the above reasons, 257.799, 289.1319, 404.12, 506.789, 586.789, 669.787, F1043.2276 and F1044.2270 are accepted, and 540.195 and 541.195 are rejected. No amendment is required.

#### WQN2.12 Recommendation

257.799, 289.1319, 404.12, 506.789, 586.789, 669.787, F1043.2276, F1044.2270: Accept

540.195, 541.195: Reject

#### Amendment

Nil

#### 5-114-36 Policy WQN20(2)(b)

5-114-36	257.800	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-36	289.1320	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-36	404.13	Brook Farm Ltd*	Retain policy WQN20(2)(b) in particular the inclusion of references to the exclusion of inadequately penetrating wells in future interference effects analysis.
5-114-36	506.790	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-36	586.790	Federated Farmers NZ Inc - Canterbury Provinces*	Delete Policy WQN20(2)(b).
	F1020.193	Water Rights Trust*	<i>Oppose</i>
	F1043.2277	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.2271	Selwyn Plantation Board Limited*	<i>Support</i>
5-114-36	669.788	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).

#### Evaluations and reasons

**257.800, 289.1320, 506.790, 586.790, F1020.193, F1043.2277, F1044.2271; 669.788:** The original submissions all request that Policy WQN20(2)(b) be deleted “because it is unclear”. Further submissions F1043.227 and F1044.2271 support 586.790 for reasons that are not specific to the relief sought, while F1020.193 opposes this submission on the grounds that this policy signals both bore permit applicants and well drillers that new bores need to adequately penetrate the aquifer.

It is considered that Policy WQN20(2)(a) is clear, especially when read in conjunction with the “explanation and principal reason” for the policy on page 5-116. Essentially this policy states that wells drilled six months after it becomes operative, and which do not fully penetrate the aquifer will not be protected from interference effects at all. While this will result in an increase in the cost of drilling new wells, it will ensure that the available groundwater use is accessed in a manner that maximizes its potential use without unduly limiting access for other future users. Failure to implement such a measure would result in the construction of further inadequately penetrating bores, which would exacerbate the existing situation (which is addressed by Policy WQN20(2)(a)). Therefore the submissions supporting the removal of this policy are rejected, while F1020.193 is accepted.

**404.13:** This submission requests that Policy WQN20(2)(b) be retained, as did 404.12 in respect of Policy WQN20(2)(a), namely so that inadequately penetrating wells can be excluded from future well

interference analyses to prevent them inhibiting further sustainable development of the groundwater resource. For the reasons stated above in relation to the submissions requesting the removal of this policy, 404.13 is accepted.

For the above reasons, 257.800, 289.1320, 506.790, 586.790, 669.788, F1043.2277 and F1044.2271 are rejected, while 404.13 and F1020.193 are accepted. No amendment is required.

### WQN2.13 Recommendation

257.800, 289.1320, 506.790, 586.790, 669.788, F1043.2277, F1044.2271: Reject

404.13, F1020.193: Accept

### Amendment

Nil

### 5-114-40 Policy WQN20(2)(c)

5-114-40	257.801	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-40	289.1321	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-40	404.14	Brook Farm Ltd*	Retain Policy WQN20(2)(c), in particular fast tracking of the consent process through leaving interference effects out of the assessment in certain situations.
5-114-40	506.791	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-40	540.196	Canterbury Growers Society Ltd*	Amend Policy WQN20(2)(c) to read: <u>"where application is made for renewal of an existing water permit the application will not consider interference between bores as per this policy if the same manner and volume as previously authorised is not exceeded. Such applications will need to meet other requirements in the plan."</u>
5-114-40	541.196	Horticulture NZ (formerly NZ Vegetable & Potato Growers Federation Inc et al)*	Amend Policy WQN20(2)(c) to read: <u>"where application is made for renewal of an existing water permit the application will not consider interference between bores as per this policy if the same manner and volume as previously authorised is not exceeded. Such applications will need to meet other requirements in the plan."</u>
5-114-40	586.791	Federated Farmers NZ Inc - Canterbury Provinces*	Amend Policy WQN20(2)(c) by replacing the word "new" with <u>"newly (by not more than 6 months)"</u> .
	F1043.2278	Canterbury Forest Industry Working Group.*	Support
	F1044.2272	Selwyn Plantation Board Limited*	Support
5-114-40	669.789	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-114-41	476.368	Christchurch City Council*	Amend Policy WQN20(2)(c) to read: <u>"...as previously authorised by a newly expired consent..."</u> or similar.

### Submission Clarification

Both 540.196 and 541.196 also state that it is not clear what is meant by "...a new expired consent,..." in Policy WQN20(2)(c).

### Evaluations and reasons

**257.801, 289.1321, 404.14, 506.791, 540.196, 541.196, 586.791, F1043.2278, F1044.2272; 669.789, 476.368:** The original submissions all support the retention of Policy WQN20(2)(c), with some submitters requesting minor amendments associated with the phrase "...a new expired consent,...". While "new" should have been "newly", it is now considered that this phrase requires further clarification to make it clear that this section does not apply to replacement applications lodged after the expiry of the original consent.

In this regard, submission 586.791 (supported by further submissions F1043.2278 and F1044.2272) suggests that the phrase is amended to read: "...a *newly (but not more than six months) expired consent,...*", however this wording may result in consent holders concluding that they have six months after the expiry of their consent in which to lodge a replacement application, which runs contrary to Section 124 of the RMA.

Submission 476.368 also picked up on the need for a grammatical change in this policy, and suggested that the word "new" be replaced with "newly" (or similar). While this avoids the issue outlined above with respect to the amendment requested in 586.791, the potential for misunderstandings regarding replacement water permits remains.

Submissions 540.196 and 541.196 both request that the policy be amended as summarised above. Parts of this wording are considered to be an improvement over the existing wording, however the RMA talks about "replacement" consents rather than "renewals", while reference to Policies WQN14 and WN17 provide helpful guidance to consent applicants.

Submission 404.14 supports this policy because it allows for the "fast-tracking" of water permit applications in "certain situations".

Overall the submissions are supportive of Policy WQN20(2)(c), subject to minor clarification regarding the definition of replacement consent applications.

For the above reasons, 257.801, 289.1321, 404.14, 476.368, 506.791, 540.196, 541.196, 586.791, 669.789, F1043.2278 and F1044.2272 are accepted in part, and an amendment is required.

### WQN2.14 Recommendation

257.801, 289.1321, 404.14, 476.368, 506.791, 540.196, 541.196, 586.791, 669.789, F1043.2278, F1044.2272: Accept in part

### Amendment

Amend the wording of Policy WQN20(2)(c) on page 5-114 as follows:

"for applications for a where an application is made to replace an existing water permit prior to the expiry date to continue to take groundwater in the same manner and volume as previously authorised by a new expired consent, interference effects between bores as per..."

### 5-115-2 Policy WQN20(2)(d)

5-115-2	257.802	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-115-2	289.1322	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-115-2	404.2	Brook Farm Ltd*	Amend Policy WQN20(2)(d) so that the potential available drawdown is based on a floating level proportional to available drawdown rather than being based on groundwater levels that are exceeded 80% of the time.
5-115-2	404.15	Brook Farm Ltd*	Amend Policy WQN20(2)(d) to ensure the

			method, particularly the 80% water level, if used is constrained to areas where there is sufficient data available to make accurate prediction on what the water level could be over the consent life.
5-115-2	404.19	Brook Farm Ltd*	Amend Policy WQN20 by replacing the 80% available head with an option to bypass the protected available drawdown on a floating level proportional to available drawdown that is actually exploited in a particular area.
5-115-2	506.792	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-115-2	586.792	Federated Farmers NZ Inc - Canterbury Provinces*	Retain Policy WQN20(2)(d).
	F1043.2279	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.2273	Selwyn Plantation Board Limited*	<i>Support</i>
5-115-2	669.790	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).

#### Evaluations and reasons

**257.802, 289.1322, 506.792, 586.792, F1043.2279, F1044.2273; 669.790:** All of the original submissions support the retention of Policy WQN20(2)(d), although no reasons are given. Further submissions F1043.2279 and F1044.2273 both support 586.792 for reasons that are not specific to the relief sought. It is considered that this policy is consistent with Objective WQN7, and sets a reasonable level of protection for existing groundwater users that complements Policy WQN20(1). For this reason, the submissions and further submissions in support are accepted, and no amendment is required.

**404.2, 404.15, 404.19:** These submissions all request an amendment to Policy WQN20(2)(d) to replace the “across the board” requirement that 80% of the available drawdown in a well be protected from new interference effects. The submitter points out that in some aquifers this level of protection is unjustified, and does not represent an efficient use of the resource. As an alternative, it is suggested that the “protected available drawdown” figure (as per Policy WQN20(2)(d)) be based on a floating level proportional to available drawdown in the aquifer being targeted, and that the methodology proposed in Policy WQN20 and Schedule WQN10 be restricted to areas where sufficient data is available to ensure accurate results.

It is considered that this alternative proposal is unworkable as an “across the board” screening tool, because, in many parts of Canterbury, there is insufficient information to determine an appropriate level of protected available drawdown on a well-by-well basis. However, where an applicant is able to obtain sufficient information to determine a more appropriate level of available drawdown to protect (through an aquifer test for instance), they could include it as part of their assessment of effects on the environment (AEE). After having regard to Policy WQN20, a decision-maker could also take into account any additional information provided in the AEE in their decision-making (in accordance with Section 104(c) of the RMA), and such an application could be granted, possibly even non-notified.

Restricting the use of the methodology to areas with a high level of information such as Christchurch and Ellesmere is also seen as impractical given the lack of an alternative screening tool, as discussed in the evaluation of submission 404.20 earlier in this officer report. It is also noted that protecting 80% of the available drawdown ties in with giving bore owners a reliability of supply close to that proposed in Policy WQN14(7), as explained in the explanation and principal reasons for the policy.

For this reason, these submissions are rejected, and no amendment is required.

For the reasons set out above, 257.802, 289.1322, 506.792, 586.792, 669.790, F1043.2279 and F1044.2273 are accepted, and 404.2, 404.15 and 404.19 are rejected. No amendment is required.

**WQN2.15 Recommendation**

257.802, 289.1322, 506.792, 586.792, 669.790, F1043.2279, F1044.2273: Accept

404.2, 404.15, 404.19: Reject

**Amendment**

Nil

**5-115-6 Policy WQN20(2)(e)**

5-115-6	404.16	Brook Farm Ltd*	Amend Policy WQN20(2)(e) to provide the ability for groundwater professionals to accurately implement the goals set by Objective WQN7. Also ensure no double counting of the existing cumulative effects in the water levels.
5-115-6	560.6	Irricon Consultants.*	Amend Policy WQN20(2)(e) to use the existing method of assessing well interference effects.
5-115-12	257.1865	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.793).
5-115-12	289.2402	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.793).
5-115-12	506.1871	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.793).
5-115-12	508.4	Valetta Holdings Ltd*	Amend Policy WQN20(c) to assess the effects of a new take on existing wells as follows: <ul style="list-style-type: none"> <li><input type="checkbox"/> Make the initial assessment over a radius of 2km.</li> <li><input type="checkbox"/> If the pumping effect on neighbouring bores at that distance is more than 0.05 metres, add another 1km.</li> <li><input type="checkbox"/> If the effect is still greater than 0.05 metres, add another 1km, and so on until the effect is less than 0.05 metres.</li> </ul> Limit this provision to new applications only.
	F1076.717	Horticulture NZ (formerly NZ Vegetable & Potato Growers Federation)*	<i>Oppose</i>
	F1043.4254	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.4232	Selwyn Plantation Board Limited*	<i>Support</i>
5-115-12	586.793	Federated Farmers NZ Inc - Canterbury Provinces*	Amend Policy WQN18(2)(a) to be consistent with Policy WQN8(1&2).
5-115-12	669.1853	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586.793).

**Submission Clarification**

Further submissions F1043.4254 and F1044.4232 appear in the SODR as being in support of 508.4, however they are actually in support of 586.793. It is also noted that generic submissions 289.1323 and 506.793 in support of 586.793 are missing from the SODR.

## Evaluations and reasons

**257.1865, 289.2402, 506.1871, 586.793, F1043.4254, F1044.4232; 669.1853:** The original submissions all support this policy, but request that clause (2)(e)(ii) be amended: "...to be consistent with (sic) submission on Policy WQN8(1 & 2)". Further submissions F1043.4254 and F1044.4232 both support 586.793 for reasons that are not specific to the relief sought.

The submission points on Policy WQN8 (586.637 to 643) oppose the use of the 150-day estimate of stream depletion because it is based on a model which they claim overestimates stream depletion.

It is assumed that the concerns expressed in 586.793 relate to the consideration of interference effects over 150 days, i.e. that they overestimate interference as it is claimed that stream depletion is overestimated over this period of time. The choice of 150 days in both Policy WQN8 and WQN20 relates to the results of irrigation surveys, which have shown that irrigation commonly commences in October and typically continues for more than 150 days into the following March and April (refer to page 5-91 of the Section 32 Report on Chapter 5). Therefore, it is considered reasonable to continue using 150 days in Policy WQN20(2)(e)(ii).

However, while not raised explicitly in 586.793, the use of 150 days could potentially underestimate interference effects for non-irrigation takes that typically operate for much longer periods of time such as those for non-seasonal industrial or commercial uses. Mr Matt Smith, ECan hydrogeologist, considers that assessing interference effects over 150 days will show around 90% of the effect that would occur from 365 days pumping. Therefore, it is reasonable to assess interference from non-seasonal industrial and community supply takes over 150 days as well (refer to the Internal Memorandum prepared by Matt Smith, dated 24 January 2007, attached as Appendix I).

For the above reasons, the original submissions and further submissions in support are rejected. No amendment is required.

**404.16:** The submitter is concerned that cumulative adverse effects are counted twice as part of the new methodology, once in the calculation of existing water levels that are exceeded 80% of the time during the period of proposed water use (i.e. these may include the effects of some, or even all, existing abstractions), and a second time when direct cumulative interference is calculated when running the Schedule WQN10-based model.

There is no double-counting of cumulative interference effects in the methodology described in Policy WQN20 and Schedule WQN10, which doesn't specify how groundwater levels, that are exceeded 80% of the time during the period of proposed water use, are to be calculated. Double-counting only occurs when the modelling of potential interference effects in accordance with these plan provisions is based on a groundwater level data-set from which historical interference has not been removed.

While ECan itself does not currently possess such a data-set (which would involve an enormous amount of work), applicants (or their consultants) can re-analyse the groundwater levels in their local area and produce a data-set free from historical interference. Their method of analysis could then be audited by Consents staff to determine whether it is valid, without ECan having to possess its own dataset.

Alternatively, groundwater consultancies and other concerned parties could pool their expertise to create such a regional dataset, or could petition ECan through the Annual Plan process to do so.

For this reason, the submission is rejected, and no amendment is required.

**560.6:** This submission requests that the "existing method" (i.e. that used before Chapter 5 was notified) of assessing well interference effects be used at this stage, because there is insufficient data to provide accurate values for the water level that is exceeded 80% of the time, and those that are available are unduly influenced by existing interference effects (potentially resulting in the "double-counting" of interference effects).

While the methodology proposed in Policy WQN20 and Schedule WQN10 may give quite conservative results in some situations, it has been shown that the method used pre-NRRP provided a much greater level of protection to existing users, potentially significantly limiting new development in some areas (refer to Section 6, page 12 of David Scott's Internal Note dated 21 April 2004, referenced in the Section 32 analysis for Chapter 5). The old method was also only able to take account of cumulative interference effects in a very limited way by assuming that these were reflected in the lowest water level data. Therefore because the new methodology more realistically represents direct cumulative adverse effects (albeit conservatively), and allows for the inclusion of other variables such as leakage, screen and pump length, partial penetration and interpolated water levels (by an appropriate method), etc. as well as setting

a more reasonable level of protection of existing well users, it is considered to represent the best available method, subject to possible refinement through the evaluation of submissions.

It is also noted that, as the number of aquifer tests and water level monitoring sites increase around the region, model inputs, and therefore outputs, will improve over time.

In terms of the concern with the double counting of cumulative interference effects, this has been responded to in the evaluation of 404.16 above, therefore this submission is rejected.

**508.4, F1076.717:** Submission 508.4 has requested an amendment to this policy so that interference effects from new takes are assessed beyond 2km when the drawdown exceeds 0.05m because: “well interference does not just cease at a mythical line on a map”. It is further suggested that the assessment extends out in 1km increments when the modelled drawdown exceeds 0.05m at 2km, 3km etc. Further submission F1076.717 is opposed to this amendment as it would: “...extend the scope considerably and needs to be based on science that could justify it.”

At the time Policy WQN20 was drafted ECan groundwater scientists had not personally observed interference effects extending beyond 2km within Canterbury, hence that distance was adopted as an appropriate figure for most takes. Since that time interference effects have been observed out to 2.5 to 3km in semi-confined aquifers, and concerns have been raised that in some circumstances they could extend even further. Therefore it would be appropriate to grant the relief requested in principle, however the proposed method of applying it is not recommended. This is because when modeling interference effects greater than 0.05m over 150 days, in some circumstances these may extend much further than has been observed in the field, or is realistic even in theory. The same is true even when the 0.05m cut-off is increased to 0.1m, as proposed in recommendation WQN2.11. For example interference effects from a 4.5L/s take from an aquifer with a transmissivity of 5,000m<sup>2</sup> (a measure of how well an aquifer transmits water) and storativity of 0.001 (a unit-less measure of how well an aquifer releases water) would extend out to 5km over 150 days before dropping below the proposed 0.1m cut-off (refer to the Internal Memorandum prepared by Matt Smith, dated 24 January 2007, attached as Appendix I).

As interference from takes that extend beyond 2km are likely to be relatively uncommon, it is considered best to amend the policy to require an assessment out to a maximum of 2km as the default position, except for when the best available technical information indicates otherwise. While this introduces some uncertainty into the process, there are too many variables that affect interference effects to propose a simple “sliding scale” as suggested.

Consequential amendments are also required to Policy WQN20(1) and condition 7 of Rule WQN19.

For the reasons set out above, 508.4 is accepted in part, and an amendment is required. Submissions 257.1865, 289.2402, 404.16, 506.1871, 560.6, 586.793, 669.1853, F1043.4254, F1044.4232 and F1076.717 are rejected.

#### **WQN2.16 Recommendation**

508.4: Accept in part

257.1865, 289.2402, 404.16, 506.1871, 560.6, 586.793, 669.1853, F1043.4254, F1044.4232, F1076.717: Reject

#### **Amendment**

1) Amend Policy WQN20(2)(e)(ii) on page 5-115 as follows:

“...that are located within two kilometres of the bore, or such greater distance as determined by the application of the best available technical information, and have a calculated interference...”

2) On page 5-115 amend the Explanation and principal reasons for Policy WQN20(2)(e)(ii) at line 53 as follows:

“...effect. In some situations interference effects may extend beyond two kilometres, in which case it will be appropriate to require the assessment to take this into account, utilising the best available technical information, such as might be derived from nearby aquifer tests and water level monitoring. While some abstractions may occur for longer on average than the 150 day period stated in this policy, it is considered that 90% of interference effects occur within this period, hence it is unnecessary to require an assessment over a longer period of time.”

3) Amend Schedule WQN10 on page 5-259 at line four as follows:

“that are located within two kilometres of the bore, or such greater distance as determined by the application of the best available technical information, and have a calculated interference...”

4) As a consequence of the above changes, on page 5-114 amend Policy WQN20(1) as follows:

“...with an existing authorisation that is within two kilometres, or such greater distance as determined by the application of the best available technical information, unless the effect is mitigated.”

5) As a further consequence, on page 5-141 amend condition 7 of Rule WQN19 at line B21 as follows:

“on any neighbouring bore within two kilometres, or such greater distance as determined by the application of the best available technical information, that, together with all other...”

**5-115-18 Policy WQN20(2)(f)**

5-115-18	257.803	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-115-18	289.1324	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-115-18	404.17	Brook Farm Ltd*	Amend Policy WQN20(2)(f) to provide the ability for groundwater professionals to accurately implement the goals set by Objective WQN7.
5-115-18	506.794	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-115-18	586.794	Federated Farmers NZ Inc - Canterbury Provinces*	Retain Policy WQN20(2)(f).
	F1043.2280	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.2274	Selwyn Plantation Board Limited*	<i>Support</i>
5-115-18	669.791	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).

**Evaluations and reasons**

**257.803, 289.1324, 506.794, 586.794, F1043.2280, F1044.2274; 669.791:** The original submissions request that Policy WQN20(2)(f) be retained, although no reasons are given. Further submissions F1043.2280 and F1044.2274 support this request for reasons that are not specific to the relief sought. As this clause is considered to accurately describe “bores with an existing authorisation” for the purposes of implementing Policy WQN20(1), the submissions and further submissions are all accepted.

**404.17:** This submission requests that Policy WQN20(2)(f) be amended because of general concerns with some of the methodology and definitions in the policy. As no specific concerns with this clause are mentioned in the submission it is rejected, and no amendment is required.

For the above reasons, 257.803, 289.1324, 506.794, 586.794, 669.791, F1043.2280 and F1044.2274 are accepted, while 404.17 is rejected. No amendment is required.

**WQN2.17 Recommendation**

257.803, 289.1324, 506.794, 586.794, 669.791, F1043.2280, F1044.2274: Accept

404.17: Reject

**Amendment**

Nil

**5-117-8 Methods for Policy WQN20**

5-117-8	257.804	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-117-8	289.1325	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-117-8	506.795	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-117-8	582.226	Water Rights Trust Inc*	Retain Methods WQN(a) - (d).
	F1043.428	Canterbury Forest Industry Working Group.*	<i>Oppose</i>
	F1044.428	Selwyn Plantation Board Limited*	<i>Oppose</i>
5-117-8	586.795	Federated Farmers NZ Inc - Canterbury Provinces*	Retain all Methods WQN20.
	F1043.2281	Canterbury Forest Industry Working Group.*	<i>Support</i>
	F1044.2275	Selwyn Plantation Board Limited*	<i>Support</i>
5-117-8	669.792	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).

**Evaluations and reasons**

**257.804, 289.1325, 506.795, 582.226, F1043.428, F1044.428; 586.795, F1043.2281, F1044.2275; 669.792:** All of the original submissions request that all Methods WQN20 be retained, although no reasons are given. Submission 586.795 is supported for reasons that are not specific to the relief sought by F1043.2281 and F1044.2275, while 582.226 is opposed by further submissions F1043.428 and F1044.428, also for non-specific reasons.

As there are no submitters requesting that these methods be amended or deleted, and they are considered appropriate to implement Policy WQN20, the submissions and further submissions in support are accepted, and the further submissions opposing 582.226 are rejected.

For this reason, 257.804, 289.1325, 506.795, 582.226, 586.795 and 669.792, and further submissions F1043.2281 and F1044.2275 are accepted, while further submissions F1043.428 and F1044.428 are rejected. No amendment is required.

**WQN2.18 Recommendation**

257.804, 289.1325, 506.795, 582.226, 586.795, 669.792, F1043.2281, F1044.2275: Accept

F1043.428, F1044.428: Reject

**Amendment**

Nil

**5-118-1 Figure WQN7: Illustration of adequate and inadequate penetration of the aquifer and of bore interface**

5-118-1	476.482	Christchurch City Council*	Retain Figure WQN7 as worded.
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## Evaluations and reasons

**476.482:** Submission 476.482 requests that Figure WQN7 be retained as worded, although no reason is given. As this figure is considered to provide a useful illustration of adequate and inadequate penetration of an aquifer as per Policy WQN20(2)(a) and (b), and of well interference effects as per Policy WQN20(1) and (2)(c) to (e), the submission is accepted. No amendment is required.

For the above reason, 476.482 is accepted, and no amendment is required.

## WQN2.19 Recommendation

476.482: Accept

## Amendment

Nil

## 5-258-1 Schedule WQN10: Determination of well interference effects on adjacent bores

5-258-1	257.1208	Upper Waitaki Branch Federated Farmers Of New Zealand Inc*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-258-1	289.1729	North Bank Land Owners Group*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-258-1	404.21	Brook Farm Ltd*	Revise Schedule WQN10 to allow for the fact the data needed to operate this schedule effectively is insufficient. Alternatively reword Schedule WQN10 and Policy WQN20 (refer 404.20) so that they are only used in areas where a significant level of information is present.
5-258-1	470.219	Fish & Game New Zealand, Central S. Island, N. Canterbury & Nelson/ Marlborough*	Retain Schedule WQN10
	F1033.654	Rosalie and Jules Snoyink*	<i>Support</i>
	F1052.658	Eminence Investments Ltd.*	<i>Oppose</i>
	F1053.654	Ngai Tahu Ltd*	<i>Oppose</i>
5-258-1	476.468	Christchurch City Council*	Retain Schedule WQN10 as worded.
5-258-1	476.469	Christchurch City Council*	Retain Schedule WQN10 as worded.
5-258-1	506.1199	Hugh Turnbull*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-258-1	542.65	Mackenzie Irrigation Company Ltd*	Delete Schedule WQN10.
5-258-1	560.5	Irricon Consultants.*	Add an additional text in Schedule WQN10 as follows: "In circumstances where >20% of the available drawdown has been allocated this may remain acceptable if evidence is provided that sufficient water is available in the subject well to enable abstraction at the allocated rate".
	F1049.546	Fish & Game NZ, Central South Island, North Canty & Nelson/Marlborough Regions*	<i>Oppose</i>
	F1074.530	Federated Farmers of NZ (Inc)*	<i>Support</i>
5-258-1	586.1199	Federated Farmers NZ Inc - Canterbury Provinces*	Amend Schedule WQN10 so that the distance of 2 kilometres does not apply for small takes (less than 20 litres per second) and introduce a sliding scale for small takes.
	F1043.2685	Canterbury Forest Industry Working Group.*	<i>Support</i>

	F1044.2678	Selwyn Plantation Board Limited*	<i>Support</i>
5-258-1	631.31	Calder Stewart Industries Ltd*	Clarify the method used to calculate drawdown effects.
5-258-1	645.100	Synlait Investments*	Delete Schedule WQN10.
5-258-1	648.99	Canterbury Pastoral Ltd*	Delete Schedule WQN10.
5-258-1	649.99	Aqualinc Research Ltd*	Delete Schedule WQN10.
5-258-1	669.1196	South Island High Country Section, Federated Farmers NZ*	Supports submission from Federated Farmers NZ Inc, Canterbury Provinces (refer 586).
5-258-18	549.12	Mr Gingerbread Ltd*	Amend Schedule WQN10 so that the 80% drawdown protection is not required for neighbouring bores when these are small takes or for domestic use.
5-258-21	560.4	Irricon Consultants.*	Amend the reference to <i>Figure WQN12</i> in the fourth paragraph of Schedule WQN10 to " <i>Figure WQN13</i> ".

### Submission Clarification

Submission 631.31 actually requested that Schedule WQN10 be “re-evaluated” rather than “clarified”.

### Evaluations and reasons

**257.1208, 289.1729, 506.1199, 586.1199, F1043.2685, F1044.2678; 669.1196:** All of the original submissions seek an amendment to the schedule so that “small” takes (<20L/s) do not have to assess interference effects out to 2km, which is considered to be too great a distance for abstractions of this magnitude. Further submissions F1043.2685 and F1044.2678 both support 586.1199 for reasons that are not specific to the relief sought.

As an alternative to the methodology outlined in Schedule WQN10, these submissions recommend that a sliding scale be introduced: “...depending on the size of take and the volume of the source water contributing to the take.” This issue has been evaluated as part of submissions on Policy WQN20(1), where it was concluded that there was some validity to the concern. While it is considered that a sliding scale approach to abstractions of different magnitudes would be inconsistent with Objective WQN7 and Policy WQN20(2)(e)(ii) (as the drawdown magnitude used to define the cut-off distance would likely contradict the definition of significant drawdowns, i.e. >0.1m), recommendation WQN2.11 is that both Policy WQN20 and Schedule WQN10 be amended. It is considered that these submissions also support this recommendation, therefore they are accepted in part and an amendment is required.

**404.21:** This submission requests that the schedule be “significantly revised” because it cannot accurately calculate direct cumulative interference in semi-confined and leaky confined aquifers without a “scientifically determined transmissivity, storativity and leakage values”. Alternatively, the submitter requests that the schedule be “...re-worded so that it is only used in areas where a significant level of information is present (e.g. Christchurch, Ellesmere, etc.)”.

These issues have previously been evaluated in respect of submission 404.20 on Policy WQN20, where it was concluded that the Schedule WQN10-based model represents the best available regional method for screening interference effects from new groundwater takes. Where affected bores are highlighted by this method, applicants have an opportunity to provide more information, which could include aquifer test results or written approvals, or amend their application (e.g. reduce the abstraction rate, relocate the take to a different bore, propose a trigger level, etc.). Therefore the submission is rejected, and no amendment is required.

**470.219, F1033.654, F1052.658, F1053.654; 476.468, 476.469:** Submission 470.219 requests that this schedule be retained, although no reasons are given. The submission is supported by F1033.654 and opposed by F1052.658 and F1053.654, all for reasons that are not specific to the relief sought. Submissions 476.468 and 476.469 both request that the schedule be retained as it is considered to contain useful calculations for determining interference effects on bores, and Figure WQN13 is especially helpful to explain the concept of 80% protected available drawdown.

As Schedule WQN10 is considered to represent the best available regional method for screening interference effects from new groundwater takes (subject to the minor amendments recommended elsewhere in this officer report), the original submission and further submission in support are accepted. The further submissions in opposition are rejected, and no amendment is required.

**542.65, 645.100, 648.99, 649.99:** These submissions all request that the schedule be deleted for the following reasons:

(a) it is an “unnecessary methodology specified in great detail” (542.65);

(b) “the methodology is ineffective and unwarranted, does not apply in all situations, does not properly take into account the actual effect on neighbouring bores, requires too many assumptions and relies on policies and rules that are also unwarranted and inappropriate” (645.100, 648.99, 649.99).

With regard to the methodology being unnecessary and unwarranted, this is rejected as clearly there is a need to respond to those matters listed in Issue WQN7. The same applies to related policies and rules. Submitters opposed to this methodology have either requested that ECan go back to the methodology used prior to Chapter 5 being notified, amend the proposed methodology, or delete it. However, no one has proposed an alternative methodology that addresses the issues and meets Objective WQN7, hence it is concluded that Schedule WQN10 should not be deleted, although amendments have been recommended to improve it.

It is acknowledged that Schedule WQN10 does specify the methodology “in great detail”, however that simply reflects the complicated nature of assessing cumulative interference effects in highly utilised heterogeneous aquifers across the whole of Canterbury. Being specific should also assist in ensuring consistency in the application of the methodology.

As for the other technical concerns with the methodology listed in (b) above, it is acknowledged that Schedule WQN10 does contain a number of assumptions, and will not accurately represent actual interference effects in all situations. However, it is considered to represent the best available methodology for the initial screening of interference effects that errs on the conservative side.

For the above reasons, these submissions are all rejected, and no amendment is required.

**560.5, F1049.546, F1074.530:** This submission requests that the schedule be amended as suggested in the SODR above to address the concern that protecting 80% of the available drawdown may be “prohibitively excessive in areas where typical self-induced drawdown is considerably less than what is being protected”. Examples of such areas are given as deeper semi to fully-confined aquifers with high transmissivity and /or leakage that have significant head, where (it is claimed) it would not be the most efficient use of the resource to prevent further development.

This submission is opposed by F1049.546 due to a concern that the proposed amendment could “promote an over-allocated resource that cannot be addressed without a plan change (or consent expiry)”. The submission is supported by F1074.530 for the reasons given in the original submission.

The concern regarding the protection of 80% of the available drawdown has been evaluated in relation to submissions on Policy WQN20(2)(d), where it was concluded that it is reasonable to provide this level of protection as a default position. This is consistent with the reliability of supply proposed for groundwater abstractors set in Policy WQN14(7), while not preventing applicants from making a case for a lower level of protection based on local information (such as from an aquifer test and water level monitoring data, and/or evidence to show how much drawdown is actually needed in, for example, domestic wells).

Therefore, the original submission and further submission in support are rejected, while the further submission in opposition is accepted. No amendment is required.

**631.31:** This submitter requests that the methodology in the schedule be re-evaluated because “there appears to be a double accounting of drawdown effects that is unnecessarily conservative [which] could result in unnecessary restrictions on groundwater usage”. This concern has been evaluated in relation to submissions on Policy WQN20(2)(e), where it was concluded that any “double counting” of cumulative interference effects does not form part of the policy, and the lowest water level data used in the Schedule WQN10-based model should ideally be filtered to remove the direct effects of abstraction. It is also noted that, even without such filtering, the magnitude of any double counting will vary, and will not necessarily always be significant. Therefore this submission is rejected, and no amendment is required.

**549.12:** This submission opposes the use of the method in the schedule to the extent that it requires the protection of 80% of the available drawdown for small takes, such as for domestic use. It is assumed that this is because such small takes are not considered to need such a high level of protection. Submissions on the use of the 80% figure have been evaluated in relation to submissions on Policy WQN20(2)(d) earlier in this OR. However, it is also noted that while small takes such as those for domestic use do not usually require large drawdowns, the energy required to pump water from increasingly greater depths due to interference effects also needs to be taken into account. For this reason, it is considered that

protecting 80% of the available drawdown is still a reasonable default position, as applicants have the opportunity to provide further information or written approvals as an indication that a lower level of protection is appropriate in their area. For this reason, the submission is rejected, and no amendment is required.

**560.4:** This submission requests that the reference to Figure WQN12 in the schedule on page 5-258 at line 21 be amended to Figure WQN13. This submission is accepted so that this error can be corrected, and an amendment is required. A consequential amendment is also required in Figure WQN7, which also mistakenly refers to Figure WQN12.

For the above reasons, 470.219, 476.468, 476.469, 560.4, F1033.654 and F1049.546 are all accepted, and 257.1208, 289.1729, 506.1199, 586.1199, 669.1196, F1043.2685 and F1044.2678 are accepted in part. Submissions 404.21, 542.65, 549.12, 560.5, 631.31, 645.100, 648.99, 649.99, F1052.658, F1053.654 and F1074.530 are rejected. An amendment is required.

**WQN2.20 Recommendation**

470.219, 476.468, 476.469, 560.4, F1033.654, F1049.546: Accept

257.1208, 289.1729, 506.1199, 586.1199, 669.1196, F1043.2685, F1044.2678: Accept in part

404.21, 542.65, 549.12, 560.5, 631.31, 645.100, 648.99, 649.99, F1052.658, F1053.654, F1074.530: Reject

**Amendment**

Amend lines 20/21 on page 5-258 as follows:

“...installation details (see Figure WQN123).”

A consequential amendment is required to Figure WQN7 on page 5-118 at lines 11/12 after Scenario 2 as follows:

“...drawdown (see Figure WQN123).

**5-258-22 Figure WQN13: Illustration showing the protected available drawdown in a well**

5-258-22	476.489	Christchurch City Council*	Amend Figure WQN13 to produce companion figure allowing for use of a surface mounted pump.
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**Evaluations and reasons**

**476.489:** This submission requests that Schedule WQN10 be amended to include a “companion figure” to Figure WQN13 that illustrates the protected available drawdown in a bore with a surface pump. Such a figure would look very much like Figure WQN13, but without the pump above the screen, which may or may not be present. While these differences are minor, they are also significant when assessing interference effects on shallow bores. Therefore, it is agreed that it would be helpful to amend Figure WQN13 so that it applies to bores with surface and submersible pumps. This is considered to be a better option than adding an additional figure.

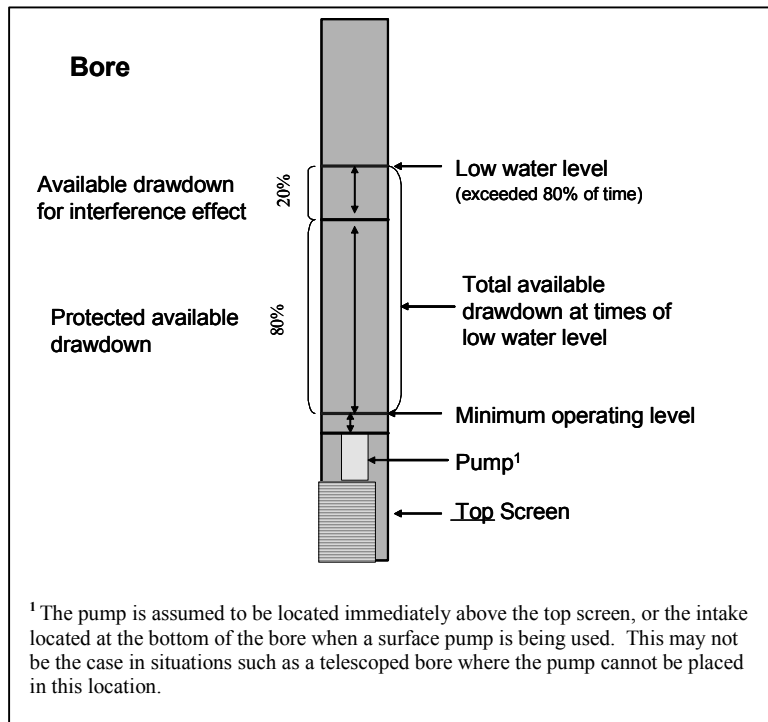
For the above reasons, 476.489 is accepted in part, and an amendment is required.

**WQN2.21 Recommendation**

476.489: Accept in part

**Amendment**

Amend Schedule WQN10 at line 23 by revising Figure WQN13 as shown below:



**5-259-20 Table WQN25: Example of effects of groundwater abstraction on neighbouring bores**

5-259-20	476.518	Christchurch City Council*	Amend Table WQN25 to include an explanation of terms, check equation, and include reference to note 2.
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**Evaluations and reasons**

**476.518:** The submitter requests that Table WQN25 be amended because note 2 has an equation that “does not look correct” and which requires a better explanation of terms and assumptions. It is also noted that there is no reference to note 2 in the table.

The submitter is correct that the reference to note 2 is missing, and it is agreed that the terms and assumptions used in the equation could be explained better. Therefore the submission is accepted, and an amendment is required.

**WQN2.22 Recommendation**

476.518: Accept

**Amendment**

1) Amend Table WQN25 on page 5-259 as follows:

At line 21, column A, line 11, make the following amendment:

“Multiwell 150 days drawdown <sup>Note 32</sup>”

2) At line 23: ~~2 Equation  $\Phi = \kappa Qw1.7$  is used to determine the drawdown in a well at any given pump rate. To determine  $\kappa$ , a yield and drawdown for the well is needed. For wells with no information, an average value for the area is assumed.~~

3) As a consequence make the following amendment:

“At line 26: “~~32~~ ‘Multiwell to determine a...’”

## Appendix 1



14 February 2007

Ref : NRRP/2002/V1/NOT/HEA/8C

### MEMORANDUM

FROM : MATT SMITH

TO : PLANNING SECTION

CC

SUBJECT : ISSUE WQN7 INTERFERENCE EFFECTS BETWEEN BORES

#### Introduction

Only minor changes to the policy WQN20 and schedule WQN10 need to be considered.

In many cases entirely effects-based well interference assessments are not workable. For example 10 wells inducing 10 cm can reduce a well's water level by a metre, thus 10 cm might be considered significant. However a well pumping at 10 L/s would theoretically (using Theis, a T of 3500 m<sup>2</sup>/day and default confined storativity) induce a 10 cm drawdown over 8 km away after 150 days. Effects of this magnitude cannot be measured or observed in practise, nor predicted with any reliability in a real aquifer system.

As distance between wells increases, the variability of an aquifer's parameters also increases dramatically. In addition large pumping times and distances tend to invalidate assumptions (therefore accuracy and certainty) used by analytical drawdown models, which are by far the most convenient methods of estimating drawdown.

The present WQN10 assessments carried out represent precautionary estimates of well interference and only flag an activity for further investigation if the criteria are not met.

#### Submissions:

##### ***Submission that Calcmins are based on very limited data.***

Policy WQN20 makes no reference to the Calcmin calculation, nor does it specify a method for minimum water level calculation to be used in a Schedule WQN10 assessment. The policy does, however, state that the water level used shall be the level that is exceeded 80% of the time. The explanation of policy WQN20 goes on to say "...at a groundwater level that is exceeded 80% of the time during the period of proposed water use."

Calcmin calculations will be less accurate for some aquifer systems, however the method of calculating them is not stipulated anywhere in the proposed plan. *No change to the proposed plan is required because it is appropriate for the calculation to be undertaken afresh for each application.*

##### ***"Double-counting" of cumulative interference effects given that these are already built into the water level data.***

Double counting can occur – the minimum water level in a well should decrease as development increases until a new equilibrium is reached. The water levels will be a combination of regional-cumulative drawdown and local direct well interference.

The NRRP does not specify how these minimum water levels are or should be calculated. The method of calculation should ideally take direct interference into account, whilst leaving the increased regional lowering due to abstraction development.

*Recommendation: Those minimum water levels are calculated as per the NRRP (80% minimum water level over the period of pumping).*

***Protecting 80% of the available drawdown is too conservative in areas with high transmissivity and leakage***

The protection of 80% for high performance wells or low pump rates could be excessive, however, high efficiency wells should not be penalised by allowing lower operating levels.

Presently areas containing aquifers of high transmissivity and leakage will have relatively small drawdown effects modelled under WQN10, thus more wells and/or higher pumping rates can be and, in some areas have, already been accommodated.

Low pumping rates do not require high drawdowns to meet small yields. However, the energy required to pump will increase inline with reduction in water levels. Whilst an activity only becomes non-complying if Schedule WQN10 is not met, a consent could still be granted if it can be demonstrated that neighbouring wells will not be adversely affected.

***Assessing interference effects out to 2 km for all takes, regardless of size, is unreasonable***

If a take is small it will likely not exceed the 0.05 m cut off, in which case the 2km is a reasonable maximum. Adjusting the cut-off upward would relax the criteria for small takes while still including large ones. For example increasing the cut off to 0.1 m would allow for a doubling in average take rate for the same cut-off distance (Attachment 1).

There are concerns from some ECan groundwater staff that drawdowns could potentially occur at distances greater than 2 km from a pumping bore. These drawdowns may be significant in terms of cumulative drawdown effects.

The concept of a sliding scale could be introduced. Effects-based interference cannot readily be introduced as the drawdown magnitude used to define the cut-off distance would likely contradict the definition of significant drawdowns of neighbouring bores. A drawdown level that may be considered a significant contributor to cumulative interference could lead to an unrealistically large area of consideration, if this level was used to determine the extent of significant drawdown.

A maximum radius based on a function of transmissivity and pumping rate could be introduced however more work is required before a recommendation can be made.

Spatial variability in aquifer conductivities greatly complicates estimates of cumulative drawdown and limits the use of analytical models (with any accuracy) over distances greater than 2 km.

*Recommend increasing the cut-off for interference effects to 0.1 m, and assessing interference effects beyond 2km where indicated by the available information.*

**Policy WQN20 – Well interference**

There are two implementation problems with Policy WQN20 (2)(e)(ii):

Policy WQN20 (2)(e)(ii) ...when abstracting at either the authorised rate of abstraction over 150 days to deliver their seasonal volume, or pumping at the authorised maximum instantaneous rate over seven continuous days, whichever is the greater;

1) I note also that there are many cases where a bore has a high instantaneous rate consented, however the daily volume is restricted. Thus the assumed pumping schedule of 7 days at maximum instantaneous rate will grossly over calculate the volume of water abstracted, and an unrealistic amount of drawdown will be estimated by a Schedule WQN10 analysis.

*Recommend rewording to: .....when abstracting at either the authorised rate of abstraction over 150 days to deliver their seasonal volume, or pumping at the authorised maximum average daily over seven continuous days, whichever is the greater.*

2) Non irrigation bores often have annual volume, which will be taken over an entire year, and by following Policy WQN20 (2)(e)(ii) the 150 day rate can be calculated to be significantly higher than the actual rate taken, and can even exceed the maximum instantaneous rate, resulting in over calculation of the volume of water abstracted over 150 days and an unrealistic amount of drawdown will be estimated by a Schedule WQN10 analysis

*Recommend adding: ..... In the case of non-irrigation bores the 150 day rate shall be the maximum average daily rate or rate of abstraction over 150 days to deliver their annual volume whichever is the lesser.*

The 150 day assessment should be retained as greatest cumulative effects will occur when all wells (as considered by the Schedule WQN10 analysis) are pumping, considering all abstraction types pumping over 365 days is not logical, as irrigation bores have seasonal pumping schedules only. Additionally, drawdown models are non-steady state (drawdown will keep increasing with time) so there is not justification for even a 365 day limit i.e. in theory the time considered should be duration of consent, which is neither practical nor realistic.

Retaining the 150 day period could potentially cause problems in industrial areas, however, a 150 day drawdown will include the majority of a 365 day theoretical drawdown (at maximum abstraction rate and assuming no recharge). For example the Theis (1935) model drawdown from a 25 L/s take in an aquifer with a T of 2000 m<sup>2</sup>/day and S of 0.0001 is shown in Table 1. The majority of drawdown occurs in the first 150 days and as a comparison using a time of 365 days induces only another 6 cm of drawdown in this case (at all distances considered by table 1).

**Table 1 Theis drawdown at 150 days vs. 365 days**

Radius	Drawdown (m)		% of 365 day drawdown
	150 days	365 days	
10	1.55	1.63	0.95
50	1.27	1.35	0.94
100	1.15	1.23	0.94
200	1.03	1.11	0.93
500	0.88	0.95	0.92
600	0.85	0.92	0.92
700	0.82	0.90	0.91
800	0.80	0.87	0.91
1000	0.76	0.83	0.91
1500	0.69	0.76	0.90

## **Schedule WQN10; Determination of well interference effects on neighbouring bores**

*Recommendations:*

*Minor corrections to figure to include the case of surface pumps (Attachment 2)*

Available drawdown is defined as the depth of water above the operating level of a pump assumed to be sitting just above the well screen, or the operating level of a surface pump with an intake close to the bottom of the well.

### **Conclusion**

The existing method represents a robust mechanism accepted by and large by reviewers and submitters of the proposed plan.

An additional test to further measure the impacts on neighbouring wells could be derived in order to assess the impact of pumping bores which do not meet the WQN10 criteria. This test could operate as a tool outside of the plan, as individual cases will need to be considered and as this test may need to evolve rapidly with as the understanding of well interference and performance improves.

Attached:

- 1 Consequence of proposed Interference cut-off change.
- 2 Proposed Figure WQN13

## Well interference memo Attachment 1

### Consequence of proposed Interference cut-off change.

The drawdown curves modelled from a groundwater take flatten rapidly with distance, and if this cut-off is too low, small takes are required to consider unrealistic distances for well interference. Conversely if this cut off level is too high the amount of interference due to “minimal” drawdown may cumulatively become significant and adversely effect neighbouring bore performance.

Under the currently proposed method the minimum drawdown down is 0.05 m

The 0.05 m limit is considered to be conservative, however, it tends to penalise small takes by the resulting large area of interference to be considered.

An adjustment of this cut-off to 0.10 m is therefore proposed to ease the WQN10 criteria. The effect of changing the cut-off from the present level of 0.05 m is that some small takes will not have to consider the effects of all bores within 2km. This change will ease the WQN10 criteria for small takes whilst retaining a level precaution for larger takes.

0.1 m represents the minimum change that can be easily observed, and attributed to interference. For example an air pressure variation of 1 kPa will result in a water level change of approximately 0.1 m in a barometrically efficient aquifer (as a comparison 1 hPa is the expected diurnal change in New Zealand)

The adoption of 0.1 means that at least 10 “minimal” takes will be require to impact any bore by 1m.

In areas of high T and leakage between aquifers the minimum rates of take can increase significantly, without subjecting neighbouring bores to significant increased risk.

### ***The degree of easing under WQN10***

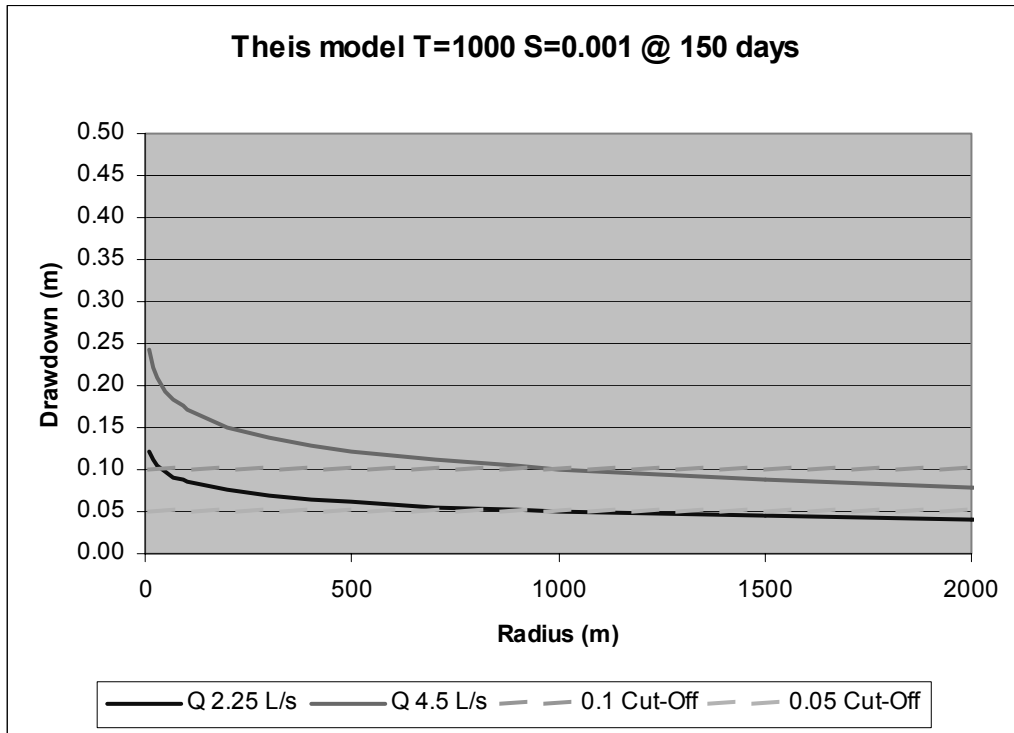
For example a take that previously required the consideration of neighbouring bores out to a distance of 1000 m could now double its rate of take while retaining the same radius of wells to be considered for well interference. Table 1 shows the changes in maximum take

T (m <sup>2</sup> /day)	200	700	1000	2000	3000	5000
S	0.001	0.001	0.001	0.001	0.001	0.001
Q L/s for 0.10 dd	0.70	1.86	2.50	4.47	6.19	9.8
Q L/s for 0.05 dd	0.35	0.93	1.25	2.23	3.09	4.8

**Table 2 maximum rates of take to meet interference cut-off at 1000 m**

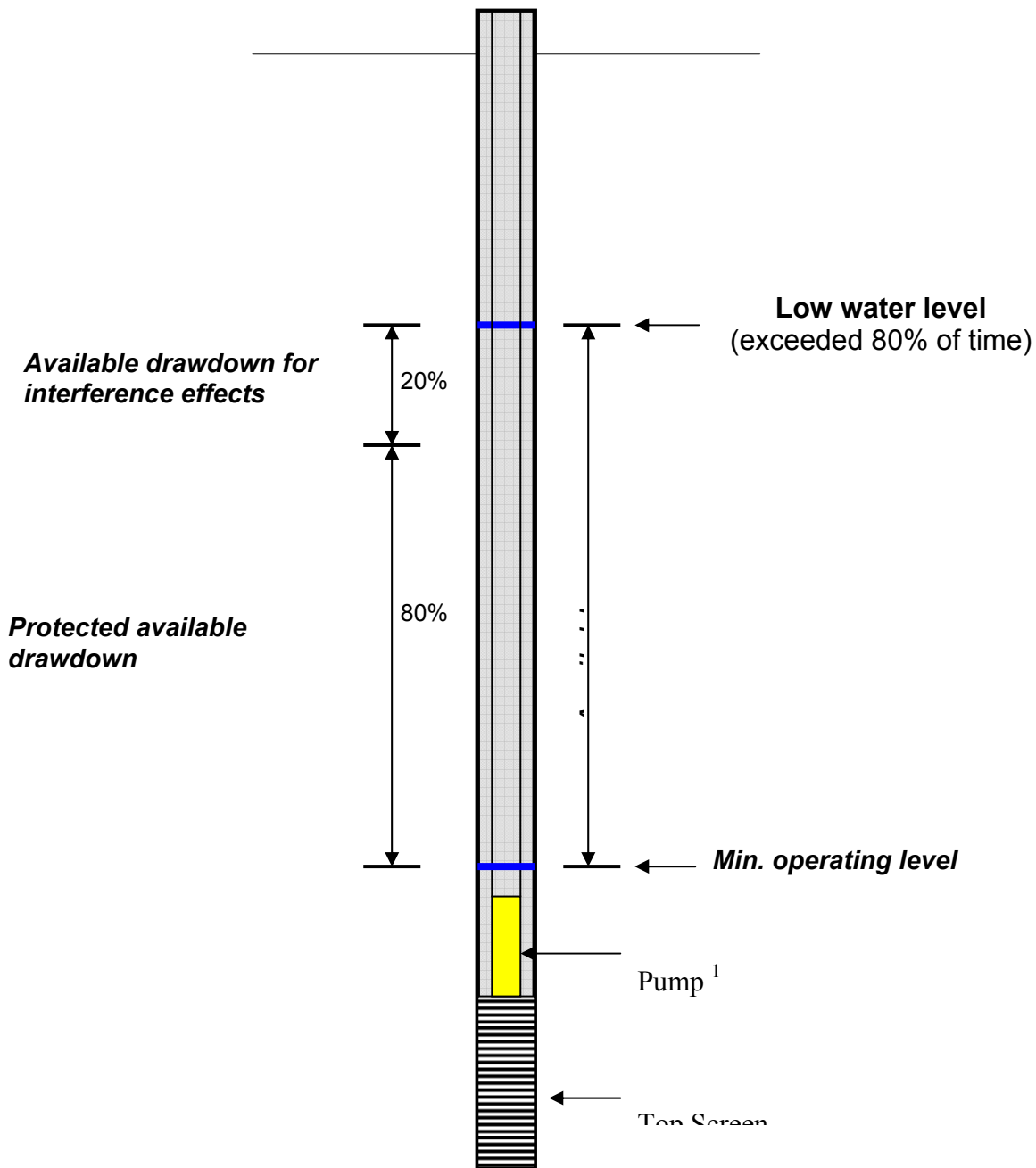
Looking at the highlighted example more closely; Figure 1 shows the drawdown curves for a take using the Theis(1935) drawdown model with a simulated 150 day abstraction, a transmissivity (T) of 1000 m<sup>2</sup>/day and a storativity (S) of 0.001.

Under the present cut-off the maximum rate of take is an average of 2.25 L/s (195 m<sup>3</sup>/day) over 150 days. Under the proposed cut-off this increases to 4.5 L/s (389 m<sup>3</sup>/day). Additionally under the present cut-off a take of 4.5 L/s would have exceeded 0.05 out to 5 km which is an overly conservative distance to consider for a take of this size.



**Figure 1 Drawdown curves for the highlighted table 1 example**

Well interference memo Attachment 2 – Figure WQN13



<sup>1</sup> The pump is assumed to be located immediately above the top screen (or the intake located at the bottom of the bore when a surface pump is being used). This may not be the case in situations such as a telescoped bore where the pump cannot be placed in this location.

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

This summary includes all parts of Chapter 5 covered by Officer Report 7 Water Quantity WQN2, as listed under “Matters to be heard” where consequential amendments have been recommended in Officer Report 7 WQN2.

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

<b>Parts of chapter showing changes</b>	<b>Page number in Notified version</b>	<b>Page number in this summary document</b>
Policy WQN20(1)	5-114	5-126
Policy WQN20(2)(c)	5-114	5-127
Policy WQN20(2)(d)	5-115	5-127
Policy WQN20(2)(e)(ii)	5-115	5-127
Explanation and principal reasons	5-115 and 116	5-128 and 129
Method WQN20(a) Information and promotion	5-117	5-129
Method WQN20(c) Resource consents	5-117	5-130
Figure WQN7: Illustration of adequate and inadequate penetration of the aquifer and of bore interference	5-118	5-131
Rule WQN19 Taking of water from groundwater within an allocation block for a groundwater allocated zone, listed in Schedule WQN3, or determined using Schedule WQN4 (restricted discretionary activity)	5-141	5-154
Schedule WQN10: Determination of well interference effects on adjacent bores	5-258	5-280
Figure WQN13: Illustration showing the protected available drawdown in a well	5-258 and 259	5-280 and 281
Table WQN25: Example of effects of groundwater abstraction on neighbouring bores	5- 259	5- 281 and 282

### 5.5.8 Interference effects between groundwater abstractors – well interference

#### Issue WQN7 Interference effects between bores

- (1) Abstraction from a bore or bores can adversely affect the yield of a neighbouring bore depending on the separation distance and abstraction rate.
- (2) Existing bores that inadequately penetrate an aquifer can be adversely affected due to the drawdown of the groundwater level or pressure created by pumping from new or deeper bores.
- (3) In some areas the number and concentration of bores is such that interference effects cause groundwater levels or pressures to fluctuate over a greater range so that bore yields decline.

#### Objective WQN7 Interference effects between bores

Ensure that groundwater abstractions from new bores, in conjunction with all other abstraction from existing bores, do not significantly affect the yield from neighbouring bores that are adequately penetrating the aquifer.

#### Explanation and principal reasons

The installation and operation of bores can have local adverse effects on the environment and on other groundwater abstractors. Objective WQN7 seeks to ensure that abstractions from neighbouring bores do not have significant localised effect on other groundwater abstractors. This is to ensure that abstractions do not reduce local groundwater levels or pressures, so that existing groundwater users cannot have access to a reliable supply of groundwater providing that existing bores are adequately penetrating the same aquifer. It does, however, allow a degree of effect on neighbouring bores. Additionally, this effect shall be determined as if the existing bore is adequately penetrating the aquifer.

#### Policy WQN20 Managing the effects of interference between bores

- (1) To limit interference effects between bores. Where a new bore is proposed to be installed and used, the direct cumulative interference effects should be limited to no more than 20% of the available drawdown in any other bore with an existing authorisation that is within two kilometres, or such greater distance as determined by the application of the best available technical information,<sup>112</sup> unless the effect is mitigated.
- (2) For the purposes of this policy:
  - (a) where an existing bore inadequately penetrates an aquifer (see Policy WQN15), the direct cumulative interference effects of abstracting from the new bore and all other bores will be assessed as if the existing bore is adequately penetrating the aquifer;
  - (b) notwithstanding Policy WQN20(2)(a) above, where a new bore is installed six months or more following this policy becoming operative, and the bore inadequately penetrates the aquifer, the yield from the bore shall not be protected under this policy;

<sup>112</sup> WQN2.16

- (c) ~~for applications for a~~ **where an application is made to replace an existing water permit prior to the expiry date to continue to take groundwater in the same manner and volume as previously authorised by a new expired consent<sup>113</sup>, interference effects between bores as per this policy need not be considered, but such applications will need to meet all the other requirements of the plan including policies WQN14 and WQN17;**
- (d) the “protected available drawdown” shall be determined as 80% of the drawdown available, as shown in Schedule WQN10,<sup>114</sup> at a groundwater level that is exceeded 80% of the time during the period of proposed water use, having taken into account individual bore and pump installation details;
- (e) the “direct cumulative interference effect” on a bore shall be the combined interference of abstractions from all bores (including the new bore):
- (i) that are authorised to take groundwater for abstractive purposes via a resource consent (but excluding those that are authorised to take groundwater through an operative permitted activity rule); and
  - (ii) that are located within two kilometres of the bore, or such greater distance as determined by the application of the best available technical information,<sup>115</sup> and have a calculated interference effect on that bore of more than 0.050.1<sup>116</sup> metres, when abstracting at either the authorised rate of abstraction over 150 days to deliver their seasonal volume, or pumping at the authorised maximum instantaneous rate over seven continuous days, whichever is the greater; and
- (f) “bores with an existing authorisation” will include:
- (i) bores used for the taking of groundwater for which there are existing water permits, either through an operative permitted activity rule or a resource consent for the taking of groundwater for any abstractive use; and
  - (ii) bores used for which no water permit to take groundwater is required, but which are intended to be used for water level observations and/or water quality monitoring.

### Explanation and principal reasons

Policy WQN20 requires that any new bore be located so that the abstraction from it does not cause any significant interference with abstractions from neighbouring bores, provided the neighbouring bores penetrate to an adequate depth that allows effective access to the resource. The necessary separation to achieve this will vary depending on rates of abstraction and the nature of the groundwater resource. The potential effect will need to be assessed when a bore permit is lodged, and again when the application to take groundwater is lodged.

<sup>113</sup> WQN2.14

<sup>114</sup> WQN2.8

<sup>115</sup> WQN2.16

<sup>116</sup> WQN2.11

The extent of the direct cumulative interference effect on any neighbouring bore should not result in a reduction in the protected available drawdown, as shown in Schedule WQN10,<sup>117</sup> unless the effect is mitigated. This level of protection is set so that on average 80% of the time a bore will be able to yield the flow possible when utilising all of the protected available drawdown. Thus, if the design flow rate required by the bore owner is close to the flow that is possible from that individual well, given its own well properties and the protected available drawdown, then the bore owner will have a reliability of supply close to that proposed in Policy WQN14(7) for groundwater abstractors.

Mitigation that may be considered acceptable, may include, for example, varying the proposed abstraction rate so that the direct cumulative interference effect falls below the threshold of no more than 20% of the available drawdown in any other bore with an existing authorisation that is within two kilometres. Alternatively, where the written permission of the owner of the neighbouring bore is provided, this will be considered an acceptable means of demonstrating mitigation and the absence of adverse effect. Also, the setting of a trigger groundwater level when abstraction will reduce or cease, may form acceptable mitigation.

Policy WQN20(a) provides for the situation where existing bores that do not adequately penetrate the aquifer may be affected by a new abstraction from a bore that does adequately penetrate the aquifer. In this situation, the effect shall be assessed as if the existing bore is set at a depth that is adequately penetrating the aquifer. The same protected available drawdown limit shall apply but it will be calculated as if the existing bore was drilled to an adequate penetration depth. This would then allow the existing bore to be deepened at a later date and not suffer interference effects. Figure WQN7 provides further explanation of the policy. A neighbouring bore owner proposing a new abstraction that could interfere with the reliability of that existing bore, may advise the owner of the existing bore of this effect so that they are aware that they may need to consider deepening their bore.

Policy WQN20(b) specifically excludes new bores that do not adequately penetrate the aquifer from being provided protection from well interference effects. This is because these bores will be limited in obtaining a reliable supply of groundwater by their own depth. If provided the same level of protection as bores adequately penetrating the aquifer, these bores will then limit the opportunity of other potential groundwater users of accessing the resource in the area, as the well interference effects would likely quickly exceed the threshold set out in the policy.

Policy WQN20(c) provides for the situation where existing activities for the taking of groundwater which are expiring may be replaced when taking in the same manner and volume as previously authorised without being subject to the provisions of Policy WQN20, subject to meeting the requirements of the plan. This is to be consistent with Policy WQN14(10) where water permits issued for a particular allocation block of water shall retain that existing priority and may be replaced with the same priority.

Policy WQN20(d), WQN20(e) and WQN20(f) define the terms used, namely “protected available drawdown”, “direct cumulative interference effect” and “bores with an existing authorisation”.

The first definition (WQN20(d)) specifies the extent to which the available drawdown in an individual bore will be protected by this policy. It takes into account individual bore and pump installation details such as well depth, depth to the top of screen or screen length, pump length and manufacturers’ recommended minimum cut-off water level. By protecting a set level of available drawdown, as opposed to yield, for example, all bore owners will be offered the same level of protection, irrespective of whether they have an efficient or inefficient bore. Because of the nature of the hydraulics of individual bores, a bore may be operated in a way that uses all the available drawdown to achieve the desired abstraction rate, that is, it is pumped to its maximum limits so that any interference will affect the available drawdown, and therefore, yield. Thus, if the whole of the available drawdown or abstraction rate

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<sup>117</sup> **WQN2.8**

achieved by operating bores in this way is protected, this will limit other potential resource users from accessing the resource, even though water may be available for allocation. This will ensure that individual wells with poor hydraulic properties will not be overly protected.

In order to improve access to the available resource, the available drawdown that is to be protected is determined to be 80% of the drawdown available at a groundwater level that is exceeded 80% of the time during the period of proposed water use. By specifying “protected available drawdown” in terms of that which is exceeded 80% of the time during the period of proposed water use, it reflects the same level as that set for reliability of supply in Policy WQN14(7) for setting allocation limits, having assumed seasonal use for irrigation purposes. If the proposed period of water use is daily (i.e. 365 days of the year), however, the level that is exceeded 80% of the time will be different.

Policy WQN20(e) defines the interference effect that is to be taken into account in terms of the policy. The areal extent of the cone of depression around a pumping well will be influenced by aquifer parameters (transmissivity, storativity, and aquitard leakiness) and the abstraction rate. Given these, where the drawdown from the cone of depression from bores abstracting is 0.050.1<sup>118</sup> metres or more, this will be included in the direct cumulative interference effect. In some situations interference effects may extend beyond two kilometres, in which case it will be appropriate to require the assessment to take this into account, utilising the best available technical information, such as might be derived from nearby aquifer tests and water level monitoring. While some abstractions may occur for longer on average than the 150 day period stated in this policy, it is considered that 90% of interference effects occur within this period, hence it is unnecessary to require an assessment over a longer period of time.<sup>119</sup>

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

## Methods

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

### Method WQN20(a) Information and promotion

Environment Canterbury will produce information and make that information available via media such as pamphlets and newsletters to landcare groups, Federated Farmers, water users<sup>120</sup> groups, industry and other agencies to provide:

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

### Method WQN20(b) Regional rules

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

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<sup>118</sup> WQN2.11

<sup>119</sup> WQN2.16

<sup>120</sup> WQN1.27

### **Method WQN20(c) Resource consents**

Resource consents for the taking of groundwater shall only be granted where they are in accordance with Policy WQN20 and Schedule WQN10<sup>121</sup>.

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

When considering the duration of any resource consent, Environment Canterbury will set the duration of the resource consent for as long as is consistent with the purpose of the RMA, and shall have particular regard to the matters set out in Section 1.3.5 and to the guidelines for consent duration set out in Sections 5.8 and 5.9.<sup>122</sup>

### **Method WQN20(d) Compliance and enforcement**

Environment Canterbury will:

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

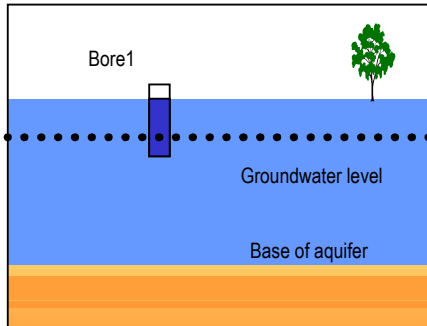
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<sup>121</sup> **WQN2.8**

<sup>122</sup> **GEN1.102, WQN1.7, WQN1.16, WQN1.140**

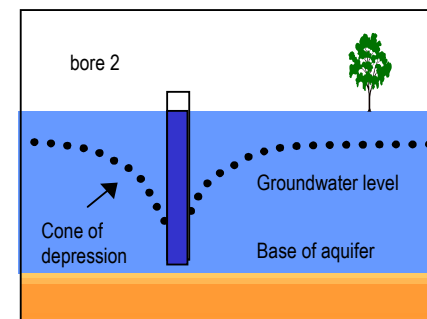
**Figure WQN7: Illustration of adequate and inadequate penetration of the aquifer and of bore interference**

In scenario 1 bore 1 does not penetrate the aquifer adequately; a large part of the resource is unavailable to the well when groundwater levels fall naturally or due to increasing demand.



Scenario 1

In scenario 2 bore 2 penetrates adequately to the base of the aquifer so that access to groundwater is maximised (providing depth of aquifer is known).

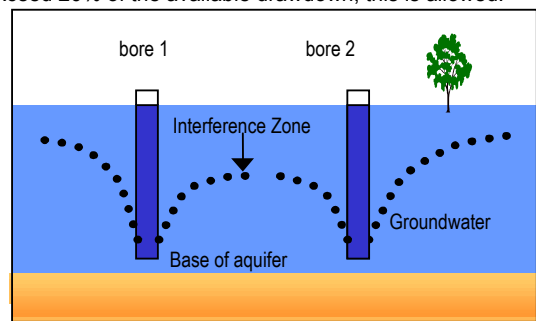


Cone of depression: When groundwater is abstracted from a bore, it causes a drawdown of the groundwater level (or a drop in water pressure) around that bore and in the shape of a cone. This "cone of depression" is centred on the bore and extends outward from it in all directions with the magnitude of the drawdown reducing with increasing distance from the bore.

In scenario 3 Policy WQN20(1) provides for new bore 2 to abstract providing the interference on existing bore 1 is limited to no more than 20% of the available drawdown (see Figure WQN123<sup>123</sup>).

This assumes that there is an existing deep bore and a new deep bore to be located nearby. Both bores penetrate the aquifer adequately.

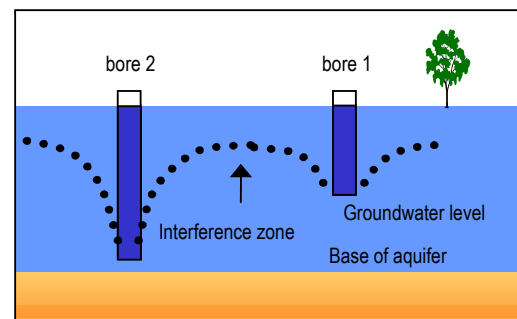
The cone of depression of the new bore overlaps or interferes with the cone of depression of the existing bore and reduces that bore's ability to abstract water. Providing this does not exceed 20% of the available drawdown, this is allowed.



Scenario 3

In scenario 4 Policy WQN20(2) (a) recognises that there will be occasions when the existing bore (bore 1) will not adequately penetrate the aquifer. In this situation, the effect of the new bore will be assessed as if the bore is at the adequate penetration depth. If at a later time the existing bore is deepened, its actual interference effect should be no more than 20% of the available drawdown.

Scenario 4



<sup>123</sup> WQN2.20

## Rule WQN19 Taking of water from groundwater within an allocation block for a groundwater allocation zone, listed in Schedule WQN3, or determined using Schedule WQN4 - restricted discretionary activity

Activity	Conditions	Restriction of discretion	Cross ref.
<p>1. The taking of water from groundwater that is wholly from a groundwater allocation zone for which an allocation block is set in Schedule WQN3 or can be determined using Schedule WQN4 that:</p> <p>(a) is not permitted by rules WQN13, WQN15 or WQN17, and is not authorised by a resource consent under rules WQN14, WQN16 and WQN18 that:</p> <p>(i) in combination with all other takes that are to be counted as part of the allocation block, is:</p> <p>(1) <u>within</u> the allocation block limit provided in Schedule WQN3 or determined using Schedule WQN4; or</p> <p>(2) <u>in excess</u> of the allocation block limit provided in Schedule WQN3 or determined using Schedule WQN4, but is an existing take that was lawfully established prior to 1 January 2001 that has not expired for more than six months;</p> <p>is a <b>restricted discretionary activity</b> provided the activity complies with the conditions in this rule.</p> <p>2. Where condition 1 is not complied with, the activity is a <b>restricted discretionary activity</b> under Rule WQN20 or a <b>non-complying activity</b> under rules WQN21, WQN22 or WQN23.</p> <p>3. Where any of conditions 2 – 8 are not complied with, the activity is a <b>non-complying activity</b> under Rule WQN23.</p>	<p>1. The take shall not have a stream depletion effect that, in accordance with Schedule WQN7, is to be counted in a surface water allocation block.</p> <p>2. The take from each bore shall only occur from within one aquifer.</p> <p>3. The bore(s) from which the groundwater is to be taken shall have been lawfully established.</p> <p>4. The bore from which the water is taken shall comply with Rule WQL36 or Rule WQL38.</p> <p>5. Where a take is from within a groundwater allocation zone listed in Schedule WQN3, the take shall be reduced and cease in accordance with Schedule WQN3 during times of water restrictions.</p> <p>6. Monitoring of the water take shall be carried out as set out in Schedule WQN13.</p> <p>7. The take shall not have an interference effect on any neighbouring bore within two kilometres <u>or such greater distance as determined by the application of the best available technical information</u>, that, together with all other direct cumulative interference effects, is in excess of 20% of the available drawdown, determined as per Schedule WQN10, except where the take is an existing activity and there is no increase in the abstraction rate proposed.</p> <p>8. For new takes commencing after 1 January, 2002, from the first confined aquifer between the Ashley/Rakahuri and Rakaia rivers within 1.5 kilometres of the coastal marine area, no pumping shall be allowed.</p>	<p>Environment Canterbury has restricted its discretion to the following matters:</p> <ol style="list-style-type: none"> <li>1. The abstraction rate (and its reasonableness given the intended use of this water).</li> <li>2. The depth at which water is to be taken.</li> <li>3. The stream depletion effect including any effects on wetlands, and on values of significance to Ngāi Tahu.</li> <li>4. The interference effect on neighbouring bores.</li> <li>5. The risk of contamination of groundwater due to abstraction and the extent to which water levels/pressure gradients will be affected.</li> <li>6. Location and method of water-measuring and recording device(s) to be used.</li> <li>7. The need for and provision of backflow prevention and ongoing monitoring.</li> <li>8. Consent holders responsibility for monitoring including the provision of information to Environment Canterbury at specified times.</li> <li>9. Review of conditions of consent and the timing and purpose of the review.</li> <li>10. Financial Contributions as specified in Part 5.10 of this Chapter.</li> </ol>	<p>Policies WQN8, WQN9, WQN10, WQN11, WQN12, WQN14, WQN16, WQN17, WQN18, WQN19 and WQN20.</p>
<p><b>Resource consent information requirements</b></p> <p>Any application for resource consent under this rule must meet the information requirements set out in 5.7.2 and 5.7.3.2.</p>			
<p><b>Notification and service</b></p> <p>In accordance with s.94D(2) RMA 1991, an application for resource consent required by this rule does not need to be notified, and in accordance with s.94D(3) RMA 1991, notice of such an application does not need to be served on those persons identified under s.94(1) of that Act.</p>			
<p><b>Where rule applies</b></p> <p>This rule applies everywhere in the Canterbury Region excluding the Coastal Marine Area.</p>			

<sup>125</sup> WQN2.16

### Schedule WQN10: Determination of well interference effects on adjacent bores

Where an existing bore **adequately penetrates an aquifer**, the existing bore should not have its **protected available drawdown** reduced due to the **direct cumulative interference** effects from other bores, unless the effect is mitigated.

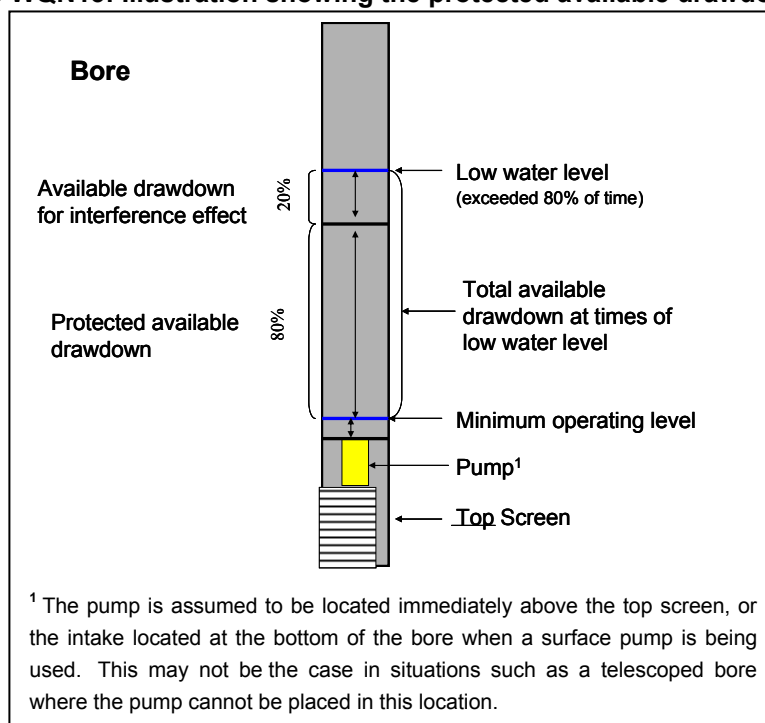
For a bore to **adequately penetrate the aquifer**, an adequate penetration depth shall be determined as follows:

- (a) where the aquifer is included in Schedule WQN 3, the depth specified in the schedule; or
- (b) for aquifers where the depth is not specified in Schedule WQN3:
  - (i) either a depth below the calculated minimum water level, or below the level to which 50% of bores penetrating the aquifer are already established at 1 January, 2002, whichever is the deeper; or
  - (ii) a depth determined by the application of the best available technical information and/or advice to be an adequate penetration depth.

Where an existing bore **inadequately** penetrates an aquifer, the interference effect of a new bore will be assessed as if the existing bore is also adequately penetrating.

The **protected available drawdown** shall be determined as 80% of the drawdown available at a groundwater level that is exceeded 80% of the time during the period of proposed water use, having taken into account individual bore and pump installation details (see Figure WQN12<sup>3</sup>).<sup>149</sup>

Figure WQN13: Illustration showing the protected available drawdown in a well<sup>150</sup>



<sup>149</sup> WQN2.20

<sup>150</sup> WQN2.21

The **direct cumulative interference effect** on a bore shall be the combined interference of abstracting from all bores (including the new bore):

- (a) that are authorised to take groundwater for abstractive purposes via a resource consent (but excluding those that are authorised to take groundwater through an operative permitted activity rule); and
- (b) that are located within two kilometres of the bore, or such greater distance as determined by the application of the best available technical information,<sup>151</sup> and have a calculated interference effect on that bore of more than ~~0.05~~0.1<sup>152</sup> metres, when abstracting at either the authorised rate of abstraction over 150 days to deliver their seasonal allocation, or pumping at the authorised maximum instantaneous rate over 7 continuous days, whichever is the greater.

“Bores with an existing authorisation” will include:

- (a) bores used for the taking of groundwater for which there are existing water permits, either through an operative permitted activity rule or a resource consent for the taking of groundwater for any abstractive use; and
- (b) bores used for which no water permit to take groundwater is required, but which are intended to be used for water level observations and water quality monitoring.

In the example below, an assessment of the effects upon three neighbouring wells is demonstrated. A mean well depth of 48m has been assumed, to apply to well A, which does not adequately penetrate the aquifer. A minimum water level that is exceeded 80% of the time is also estimated for each well, and used to determine the “protected available drawdown” of each well (based on well parameters).

**Table WQN25: Example of effects of groundwater abstraction on neighbouring bores**

	Well A	Well B	Well C	
Use	Irrigation	Irrigation	Irrigation	
Actual depth (m)	42	59.8	62.5	
Minimum adopted depth (m) <sup>Note<sup>1</sup></sup>	48	59.8	62.5	
Screen top (m)	45	57.8	59.5	
Estimated water level cut-off (m)	43	57.8	57.5	
Low water level (m) (exceeded 80% of the time)	-35	-36.3	-27.7	
Total available drawdown (m)	8	21.5	29.8	
Protected available drawdown (m)	6.4	17.2	23.84	
Available drawdown for interference effects (m)	1.6	4.3	5.96	
Multiwell 150 days drawdown <sup>Note <sup>32</sup>153</sup>	Without new take (m)	1.3	0.78	0.67
	Additional drawdown from new take (m)	0.47	0.5	0.58
	Combined drawdown (m)	1.77	1.28	1.25
Does drawdown exceed available drawdown?	Yes	No	No	

1 Minimum adopted depth is the depth of adequate penetration determined for this aquifer, being 48m.

<sup>151</sup> **WQN2.16**

<sup>152</sup> **WQN2.11**

<sup>153</sup> **WQN2.22**

~~2 Equation  $\Phi = \kappa Qw$ 1.7 is used to determine drawdown in a well at any given pump rate. To determine  $\kappa$ , a yield and drawdown for the well is needed. For wells with no information, an average value for the area is assumed.~~<sup>154</sup>

~~32~~<sup>155</sup> 'Multiwell' to determine a Hunt (2003) based cumulative drawdown effect. A 10-day pumping period at Q max and 150 day pumping period to deliver a seasonal volume for surrounding bores was modelled, and the greatest drawdown selected (in this case, 150 days).

This example indicates that Well A would be potentially affected, with the calculated drawdown exceeding the available drawdown for interference effects. Wells B and C have adequate available drawdown remaining to allow the potential new take.

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<sup>154</sup> WQN2.22

<sup>155</sup> WQN2.22