11 January 2021 Landpro Reference: 18060

Otago Regional Council
Private Bag 1954
70 Stafford Street
Dunedin 9054

To whom it may concern

Re: Application by Matakanui Station Limited to take and use water from Neds Creek

Please find enclosed the above consent application for your consideration.

The applicant seeks to replace Deemed Permit 4006.V1 and Water Permit RM15.217.01, to take and use water from Neds Creek. The applicant is also seeking to authorise ancillary activities related to the taking and use of water.

The consent processing deposit has been paid by the applicant using Matakanui Station as a reference.

If you have any questions in relation to this application, please feel free to contact me directly, or Christina Bright.

Kind Regards

Zoe McCormack
Senior Planner

0800 023 318
13 Pinot Noir Drive
PO Box 302
Cromwell 9342
Central Otago, NZ
info@landpro.co.nz
landpro.co.nz

Form 1 – Application for Resource Consent

This application is made under Section 88 of the Resource Management Act 1991 (RMA).

The purpose of this Form 1 and the relevant activity form(s) is to provide applications with guidance on information that is required under the Resource Management Act 1991. Please note that these forms are to act as a guide only, and Otago Regional Council reserves the right to request additional information or to reject the application as incomplete under Section 88 of the RMA if the provisions of the fourth schedule of the RMA are not provided (refer to page 6 of this form, which details these requirements).

PLEASE NOTE: You must have Adobe Acrobat Reader installed onto your computer to use this editable version, which you can download for free from the Adobe website. This form cannot be filled in on your internet browser. REMEMBER to save the form to your computer after completing then attach and send via email along with the other relevant application forms/information to consents.applications@orc.govt.nz. The form can also be printed and completed manually.

1(a). Applicant's details:

- The full names or Company name or Trust (including full names of all Trustees) of the consent holder who will be responsible for the consent and any associated costs.
- A resource consent can only be held by a legal organisation or fully named individual(s). A legal organisation includes a registered limited company, incorporated group or registered trust. If the application is for a Trust, the full names of all Trustees are required. If the application is not for a limited company, incorporated group or rust, then you must use fully named individual(s).
- All invoices will be made out to and sent to the applicant.

Full name(s): _____

_____

OR

Registered company: Matakanui Station Ltd

_____

OR

Trust (include all Trustees full names) _____

_____

Postal address: 1524 Moutere-Disputed Spur Road, Omakau

_____ Post code: 9376

and

Physical address: (not a PO Box number) 1524 Moutere-Disputed Spur Road, Omakau

_____ Post code: 9376

Phone number: Business: _____ Private: 027 224 7511

Mobile: _____

Email address: info@matakanui.co.nz

Please provide a valid and clear email address. Otago Regional Council has adopted a paperless consenting process – therefore any correspondence including decision documents and consent (if granted) will be sent via email, unless you request a paper copy.

Please tick if you do not prefer contact by electronic means ☐

1(b). Key contact for applicant details (if applicable):

Only complete if the applicant consists of multiple parties (e.g. multiple consent holders, Trust etc). Please outline who the key contact for the consent will be, if granted:

Full name: _____

Phone number: Business: _____ Private: _____

Mobile: _____

Email address: _____

2. Consultant details (if applicable):

Contact person: Christina Bright

Company: Landpro

Phone number: Mobile: 027 380 0498 Business: 0800 023 318

Email address: christina@landpro.co.nz

3. Consents required in relation to this proposal:

Water

- [x] Take surface water
- [ ] Take groundwater
- [ ] Divert
- [x] Dam

Discharge onto or into:

- [ ] Land
- [ ] Water
- [ ] Air

Land use:

- [ ] Bore construction
- [ ] Bore alteration
- [ ] Activities in or on beds of lakes or rivers or floodbanks
- [ ] Disturbance of contaminated land

Coastal

- [ ] Activities in the coastal marine area (i.e. below mean high water spring tide)

Where you have indicated the type of consent that is required, you must complete the appropriate application form before your application can be processed. Application forms can be found on the Council's website: www.orc.govt.nz/consents/ready-to-apply-for-a-consent

4. For what purpose is/are the consent(s) required (e.g. gravel extraction, water for irrigation etc):

Take and use of surface water, and related ancillary activities.

5. Location of proposed activity:

Address: 1524 Moutere-Disputed Spur Road, Omakau

Legal description(s):

Map reference(s) (NZTM 2000): E 1321981 N 5004937

Please include location details on separate documentation if there are multiple sites or activities.

Note: Certificate(s) of Title less than three months old for the site to which this application relates are required.

6. Are there any current or expired Resource Consents relating to this proposal:

☑ Yes ☐ No

If yes, give consent number(s), description and expiry date(s):

4006.V1 and RM15.217.01, for take and use of surface water, both expiring 1 October 2021.

(a) Do you agree to your current consent automatically being surrendered should a replacement consent be issued?

☑ Yes ☐ No

(b) Has there been a previous application for this activity that was returned as incomplete?

☐ Yes ☑ No

(c) Have you lodged a pre-application with Council for this activity?

☑ Yes ☐ No

(d) Have you spoken to a Council staff member about this application prior to lodging this application?

☑ Yes ☐ No

If yes, please state name of staff member: Natasha Pritchard

7. What is the term of consent you are seeking and reason for this term:

35 years - refer to AEE for further detail.

8. Territorial Local Authority in which activity is situated:

☐ Dunedin City Council
☐ Clutha District Council
☑ Central Otago District Council
☐ Queenstown Lakes District Council
☐ Waitaki District Council

9. Do you require any other resource consent from any local authority for this activity:

☐ Yes ☑ No

If yes, please give the date applied for or issued:

10. For the land on which the activity occurs, is the applicant (tick one):
If the applicant does not own the land to which this application relates, unconditional written approval from the land owner/affected party will be required.

- [x] The owner
- [ ] The lease holder
- [ ] The occupier
- [ ] Prospective purchaser

If the applicant is not the land owner, who is the owner of the land on which the activity occurs/is to occur:

Name of land owner: _____

Phone number: Mobile: _____ Business: _____

Email address: _____

11. Site visit from the Consents Team:

Consents staff are able to meet with you, visit your site and see what you are proposing to do. We find that this is beneficial to everyone involved. The cost of the visit will be included in the total cost of processing your consent. However, we find that applications that have an on-site visit are processed with less congestion and at a similar or lesser overall cost. Please let us know below if you would like us to come and see your site.

I would like a member of the Consents Team to visit my site:

- [x] Yes
- [ ] No

12. Processing Officer:

Due to high workloads or the complex nature of your application, it could be assigned to a consultant processing officer. Having your application assigned to an external officer should not greatly affect the processing costs. However, if you would like your application to be assigned to an internal officer then please advise. This may mean that your application enters a waiting line to be allocated and may not be processed straight away. If this is the case we will ask for a timeframe extension to cover the waiting time. There may be situations where we cannot accommodate this request but will let you know why this is.

I would like my application to only be processed by an internal staff member:

- [ ] Yes
- [x] No

13. How to pay:

A deposit **must** accompany this application (see **page 8** for amounts and ways to pay). The applicant will be invoiced for all costs incurred in processing this application that exceed the deposit.

If the required deposit does not accompany your application, staff will contact you on the email address provided on this form to request payment, and after 5 working days your application will returned as incomplete if no payment is made for the required deposit.

When paying online, please use the word '**Consent**' followed by the name of the applicant as a reference.

Method of payment:

[•] Online bank transfer	[ ] Cheque
[ ] Credit card	[ ] In person

Date of payment: 07/01/2021

Amount paid: $5,000

Payment reference: Matakanui Station

Please note: Your deposit may not cover the entire cost of processing your application. At the end of the application process you will be invoiced for any costs that exceed the deposit. Interim invoices may be sent out for applications, where appropriate.

Information regarding the average costs in processing various types of single non-notified consent applications can be found via the following link, scrolling down to "Costs to process the application": www.orc.govt.nz/consents/ready-to-apply-for-a-consent/fees-and-charges

Checklist

Before signing the declaration below, in order to provide a complete application have you remembered to:

- ☑ Fully complete this Form 1, including signed declaration
- ☑ Completed the necessary application forms relating to the activity
  Application forms can be found on Council's website via the following link:
  www.orc.govt.nz/consents/ready-to-apply-for-a-consent
- ☑ Payment of the required deposit (see page 8 for fees schedule)
- ☐ NA Written approvals from all potentially affected parties
  "Written Approval of an Affected Party" forms are available from Councils website
- ☑ An assessment of effects on the environment
- ☑ An assessment against the relevant objectives, policies and rules from Regional Council Plans, Regional Policy Statement (including proposed and partially operative versions), and relevant Regulations, National Policy Statements, National Environmental Standards and iwi management plans
- ☑ Site and location plans
- ☑ Certificate(s) of Title less than three months old for the site to which this application relates
  Certificates of Title can be obtained via the Land Information New Zealand website:
  www.linz.govt.nz

Declaration

I/we hereby certify that to the best of my/our knowledge and belief, the information given in this application is true and correct.

I/we undertake to pay all actual and reasonable application processing costs incurred by the Otago Regional Council.

Name(s): Christina Bright

Signature(s):* Christina Bright.
(or person authorised to sign on behalf of applicant)

* **Ensure you use the "fill and sign" function of Adobe Acrobat when signing this form. Either draw your signature or add an image. Council cannot accept typed signatures.**

Designation: Consultant
(e.g. owner, manager, consultant)

Date: 10/01/2021

Council can accept electronic lodgement of applications if sent to consents.applications@orc.govt.nz.

Alternatively, applications can be posted or delivered to:
Otago Regional Council
Private Bag 1954
70 Stafford Street
Dunedin 9054

Consultation

(consultation is not compulsory, but it can make a process easier and reduce costs)

Under Section 95E of the Resource Management Act 1991 (the Act), the Council will identify affected parties to an application and if the application is to be processed on a non-notified basis the unconditional written approval of affected parties will be required. Consultation with potentially affected parties and interested parties can be commenced prior to lodging the application.

Consultation may be required with the appropriate Tangata Whenua for the area. The address of the local Iwi office is: Aukaha, 258 Stuart Street, P O Box 446, Dunedin, Fax (03) 477-0072, Phone (03) 477-0071, Email info@aukaha.co.nz. If you are in the Clutha River area you may need to talk to Te Ao Marama Inc, Phone (03) 931 1242. If you require further advice, please contact the Otago Regional Council.

Good consultation practices include:

- Giving people sufficient information to understand your proposal and the likely effects it may have on them
- Allowing sufficient time for them to assess and respond to the information
- Considering and taking into account their responses

Written approval forms are available on Council's website.

Information Requirements

In order for any consent application to be processed efficiently in the minimum time and at minimum cost, it is critical that as much relevant information as possible is included with the application**.**

Resource Management Act 1991
FOURTH SCHEDULE – ASSESSMENT OF EFFECTS ON THE ENVIRONMENT
(Below are the provisions of the fourth schedule of the Act, which describes what must be in an application for resource consent, as amended in 2015)

1. Information must be specified in sufficient detail

Any information required by this schedule, including an assessment under clause 2(1)(f) or (g), must be specified in sufficient detail to satisfy the purpose for which it is required.

2. Information required in all applications

(1) An application for a resource consent for an activity (the **activity**) must include the following:
- (a) a description of the activity; and
- (b) a description of the site at which the activity is to occur; and
- (c) the full name and address of each owner or occupier of the site; and
- (d) a description of any other activities that are part of the proposal to which the application relates; and
- (e) a description of any other resource consents required for the proposal to which the application relates; and
- (f) an assessment of the activity against the matters set out in Part 2; and
- (g) an assessment of the activity against any relevant provisions of a document referred to in section 104(1)(b) *("document" includes regional and district plans, regulations*, *national policy statements, iwi plans*).

(2) The assessment under subclause (1)(g) must include an assessment of the activity against:
- (a) any relevant objectives, policies, or rules in a document; and
- (b) any relevant requirements, conditions, or permissions in any rules in a document; and
- (c) any other relevant requirements in a document (for example, in a national environmental standard or other regulations).

(3) An application must also include an assessment of the activity's effects on the environment that:
- (a) includes the information required by clause 6; and
- (b) addresses the matters specified in clause 7; and
- (c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

3. Additional information required in some applications

An application must also include any of the following that apply:

(1) if any permitted activity is part of the proposal to which the application relates, a description of the permitted activity that demonstrates that it complies with the requirements, conditions, and permissions for the permitted activity (so that a resource consent is not required for that activity under section 87A(1))

(2) if the application is affected by section 124 or 165ZH(1)(c) (which relate to existing resource consents), an assessment of the value of the investment of the existing consent holder (for the purposes of section 104(2A))

(3) if the activity is to occur in an area within the scope of a planning document prepared by a customary marine title group under section 85 of the Marine and Coastal Area (Takutai Moana) Act 2011, an assessment of the activity against any resource management matters set out in that planning document (for the purposes of section 104(2B).

4. (relates to subdivisions – *not included here as subdivisions are not within ORC's jurisdiction)*

5. Additional information required in application for reclamation

An application for a resource consent for reclamation must also include information to show the area to be reclaimed, including the following:

(1) the location of the area; and

(2) if practicable, the position of all new boundaries; and

(3) any part of the area to be set aside as an esplanade reserve or esplanade strip.

Assessment of environmental effects

6. Information required in assessment of environmental effects

(1) An assessment of the activity's effects on the environment must include the following information:

(a) if it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity

(b) an assessment of the actual or potential effect on the environment of the activity

(c) if the activity includes the use of hazardous substances and installations, an assessment of any risks to the environment that are likely to arise from such use

(d) if the activity includes the discharge of any contaminant, a description of:

(i) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and

(ii) any possible alternative methods of discharge, including discharge into any other receiving environment.

(e) a description of the mitigation measures (including safeguards and contingency plans where relevant) to be undertaken to help prevent or reduce the actual or potential effect

(f) identification of the persons affected by the activity, any consultation undertaken, and any response to the views of any person consulted

(g) if the scale and significance of the activity's effects are such that monitoring is required, a description of how and by whom the effects will be monitored if the activity is approved

(h) if the activity will, or is likely to, have adverse effects that are more than minor on the exercise of a protected customary right, a description of possible alternative locations or methods for the exercise of the activity (unless written approval for the activity is given by the protected customary rights group).

(2) A requirement to include information in the assessment of environmental effects is subject to the provisions of any policy statement or plan

(3) To avoid doubt, subclause (1)(f) obliges an applicant to report as to the persons identified as being affected by the proposal, but does not:

(a) oblige the applicant to consult any person; or

(b) create any ground for expecting that the applicant will consult any person.

7. Matters that must be addressed by assessment of environmental effects

(1) An assessment of the activity's effects on the environment must address the following matters:

(a) any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects

(b) any physical effect on the locality, including any landscape and visual effects

(c) any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity

(d) any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations

(e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants

(f) any risk to the neighbourhood, the wider community, or the environment through natural hazards or the use of hazardous substances or hazardous installations.

(2) The requirement to address a matter in the assessment of environmental effects is subject to the provisions of any policy statement or plan.

Set out below are details of the amounts payable for those activities to be funded by fees and charges, as authorised by s36(1) of the Resource Management Act 1991.

Resource Consent Application Fees (from 1 July 2020)

Note that the fees shown below are a **deposit** to be paid on lodgement of a consent application and applications for exemptions in respect of water metering devices. This deposit will not usually cover the full cost of processing the application, and further costs are incurred at the rate shown in the scale of charges. GST is included in all fees and charges.

If you wish to make a payment via internet banking, or online, the details are below. Please note the applicants name and 'consent application' should be used as reference when paying the deposit.

For ways to pay, visit: www.orc.govt.nz/consents/ready-to-apply-for-a-consent

Pre-Application Work
Fees payable for pre-application work carried out before a consent application is lodged with Council will be incurred at the rates shown in the scale of charges.

Publicly Notified Applications: [3]	**$**
First application	5,000.00

Non-Notified Applications and Limited Notification Applications: [3]	**$**
First application (except those below)	1,750
Multiple Applications [1]	2,300
Variation to Conditions – s127	1,750
Administrative Variation – s127	1,750

Fixed Fees	**$**
Exemptions from water metering regulations	400
Bores	600

Hearings	Per Note 2 below
Payment for Commissioner request – s100A	Per Note 4 below

Objections	
Payment for Commissioner request – s357AB	Per Note 4 below

Transfer of Consent Holder and Certificates Deposits:	**$**
Transfer of permits and consents	200
Priority Table	200
Section 417 Certificate	500
Certificate of Compliance	1,750
All Other Costs As per Scale of Charges	

Scale of Charges:	**$**
Staff time per hour:	
• Management	190
• Team Leader/Principle	170
• Senior Technical	135
• Technical	115
• Field staff	115
• Administration	85

Disbursements	Actual
Additional site notice	Actual
Advertisements	Actual
Vehicle use per kilometre	0.70
Travel and accommodation	Actual
Testing charges	Actual
Consultants	Actual
Commissioners	Actual
Photocopying and printing	Actual

Councillor Hearing fees per hour:	**$**
• Chairperson	$100
• Member	$80
• Expenses	Actual

Notes:

1. For additional permits in respect of the same site, activity, applicant, time of application, and closely related effect as the first application.

2. The deposit payable shall be 90% of the cost of a hearing as calculated by Council in accordance with information contained in the application file and using the scale of charges. The amount payable will be due at least 10 working days before the commencement of the hearing. If the amount is not paid by the due date, then the Council reserves the right under S36(7) of the Resource Management Act to stop processing the application. This may include cancellation of the hearing.

   Should a hearing be cancelled or postponed due to the non-payment of the charge, the applicant will be invoiced for any costs that arise from that cancellation or postponement.

   Following completion of the hearing process, any shortfall in the recovery of hearing costs will be invoiced, or any over recovery will be refunded to the applicant.

3. Where actual and reasonable costs are less than the deposit paid, a refund will be given.

4. Where an applicant requests under s100A (for a consent hearing) or under s357AB (for the hearing of an objection) an independent commissioner(s); the applicant will be required to pay any increase in cost of having the commissioner(s).

   Where a submitter(s) requests under s100A an independent commissioner(s) any increase in cost that is in addition to what the applicant would have paid shall be paid by the submitter. If there is more than one submitter who has made such request the costs shall be evenly shared.

Review of consent conditions

Following the granting of a consent, a subsequent review of consent conditions may be carried out at either the request of the consent holder, or as authorised under Section 128, as a requirement of Council. Costs incurred in undertaking reviews requested by the consent holder will be payable by the consent holder at the rates shown in the Scale of Charges above.

Reviews initiated by Council will not be charged to consent holders.

Compliance Monitoring Charges

Compliance charges may also be applied to any granted consent(s). These can be found via Council's website at: https://www.orc.govt.nz/media/8679/annual-plan-2020-21_digital.pdf

Resource Consent Application Form 4

To take and use surface water

This application is made under Section 88 of the Resource Management Act 1991.

1. Note to applicants

The purpose of this form is to provide applicants with guidance on information that is required for your application under the Resource Management Act 1991. This form acts as a guide only and Otago Regional Council reserves the right to request additional information.

Please ensure that you fully complete this form **as well as** a fully completed resource consent application form (form 1) in support of your application, **and** preparation of an **Assessment of Environmental Effects** in terms of the Fourth Schedule of the Resource Management Act 1991. Failure to do so may result in Council rejecting your application, requesting further information, or publicly notifying your application, leading to delays in the processing of your application and potential increases in processing costs.

Please also note that Proposed Plan Change 7 (Water Permits) was publicly notified for submissions on 18 March 2020 and has immediate legal effect. PPC7 provides an interim regulatory framework for the assessment of applications to renew:

- *deemed permits expiring in 2021; and*
- *any other water permits expiring prior to 31 December 2025, the date by which the new Regional Land and Water Plan (LWRP) is expected to be operative.*

The plan change also establishes a requirement for short duration consents for all new water permits granted under the operative Water Plan rules.

Please ensure that your resource consent application is also made in accordance with the plan change. Failure to do this may result in Council rejecting your application, requesting further information, or publicly notifying your application.

Acceptance of your application for processing does not constitute a guarantee that water allocation is available.

2. General

2.1 This application is for (please tick any applicable box):

☐ A new surface water take

☑ An application to replace a current Water Permit

Water permit number: RM15.127.01 *Expiry date:* 1 October 2021

☑ An application to replace a Deemed Permit / Mining Privilege

Deemed permit number: 4006.V1 *Expiry date:* 1 October 2021

2.2 A lapse period of 5 is sought. Provide reasons in application attached.

Note: This is the timeframe within which the consent must be given effect to. The default timeframe is 5 years after the date of commencement of the consent unless stated otherwise.

2.3 A consent term of 35 is sought. Provide reasons in application attached.

Note: This is the timeframe from the date of commencement of the consent which the consent will expire.

Please also note:

- *Proposed Plan Change 7 (Water Permits) establishes a requirement for short duration consents of no more than six years in accordance with Policies 10A.2.1 and 10A.2.2.*
- *If your application is for the replacement of a deemed permit or the take and use of surface water[1] that is the replacement of a take and use authorised by an existing water permit expiring prior to 31 December 2025, if the consent term sought in your application exceeds six years it will be considered as a non-complying activity in accordance with Proposed Plan Change 7 (Water Permits).*

2.4 Provide a map or coloured aerial photograph which outlines the following details (as applicable):

- ☑ The location of the existing and proposed point(s) of take and all associated infrastructure (including water races and point of discharge and re-takes)
- ☑ The location of the water measuring device(s) or system(s)
- ☑ The total property area boundary
- ☑ The area(s) to be irrigated (if relevant) by water applied for under this application
- ☐ The area of the community supply (if relevant)
- ☐ Distances to any discharge activities
- ☑ Other surface water bodies and wetlands, and distances from the point of take(s) to them
- ☐ The coastline and the distance to it (if relevant)
- ☐ The location of any dairy shed(s)
- ☐ The location of any known recreational activities, other water takes, areas of significance to iwi and areas where food is obtained from the water body.

2.5 Does the take hold a s417 certificate to confirm access of supply? If yes, please attach a copy.

- ☐ Yes
- ☑ No

[1] (including groundwater considered as surface water under policy 6.4.1A (a), (b) and (c)) of the operative Water Plan

3. Volume and rates of take applied for

3.1 Quantity and rate of take

Note: 1,000 litres = 1 cubic metre

a. Maximum rate of take: Various - refer to AEE. litres per second

b. Maximum monthly volume: cubic metres per month

c. Maximum annual volume: cubic metres per year

*Note: Some deemed permits refer to hourly/weekly rates. Water permits are issued in litres per second, m^3 per month and m^3 per year. Should you wish to seek hourly or weekly rates **in addition** to those listed on the form, please provide this information including justification for any variances.*

3.2 Frequency of take

Note both the maximum and estimated average take.

	Average	Maximum
How many hours per day?		24
How many days per week?		7
How many weeks per month?		4

3.3 In your application describe the timing of your take, including which months of the year you expect to take water in both an average year and a dry year, and what part of the day the water take will generally occur.

3.4 In your application describe whether the take is from re-charge or is an augmented take, along with whether your activity provides re-charge back into the catchment.

3.5 In your application provide details of all takes and discharges (re-take / biowash).

3.6 If your application is to replace a deemed permit or an existing consent expiring prior to 31 December 2025, provide calculations in accordance with Schedule 10A.4 of Proposed Plan Change 7 (Water Permits) demonstrating whether:

The volume of water taken is no more than the average maximum of the daily volume limit, or monthly volume limit, or annual volume limit (whichever one or more are applicable) recorded during the period 1 July 2012 – 30 June 2017; and

The rate of take is no more than the average maximum rate of take limit recorded during the period 1 July 2012 – 30 June 2017

3.7 Storage

3.7.1 Do you intend to store your water before subsequent use?

- [x] Yes
- [ ] No

3.7.2 If yes, what/how much storage will be provided?

30,000 m^3 This is for private water right - refer AEE for other storage details.

3.7.3 In your application outline the type of storage facilities that are proposed.

Note: You may need a building consent and/or additional resource consents for the construction of storage facilities. If the reservoir is in a water body or captures catchment runoff, you may require resource consents for damming and associated activities.

4. Point(s) of take description

4.1 What are the GPS coordinates of the point(s) you propose to take water from?

Note: if there are more than two points of take, please provide these details on a separate sheet.

Point 1: NZTM 2000 E: 1321981 N: 5004937

Point 2: NZTM 2000 E: N:

4.2 Please provide photographs of the proposed point(s) of take [x]

4.3 What is the name of the water body/ies from which the proposed take(s) is/are to occur? *Note: if the water body is unnamed please note this and note the water body it flows into.*

Neds Creek

4.4 If the take is from a river, stream, spring, drain or modified water body, in your application please provide a full description of the water course, including:

- [x] The average channel width and depth at various locations including at the point of take and upstream and downstream of the point of take.
- [x] Average flow water velocity including source of flow data and any changes to flow velocity above and below the point of take.
- [x] Any flow gauging of the water body. A flow gauging report with photographs of the site and methodology to be attached.
- [x] Bed of the water body at the point of take and upstream and downstream of the point of take.

Please also answer the following:

4.4.1 What type of water body will the take/s occur from?

- [x] River
- [ ] Stream
- [ ] Modified water body
- [ ] Spring
- [ ] Drain

4.4.2 Is the water course perennial (flows all year round) or ephemeral?

- [x] Perennial
- [ ] Ephemeral

4.5 If the take is from a lake, pond or wetland please answer the following:

- [ ] Lake
- [ ] Pond
- [ ] Wetland

4.5.1 If the take is from a wetland, is the wetland classed as a Regionally Significant Wetland identified in Schedule 9 of the Regional Plan: Water for Otago?

- [ ] Yes (list the name and provide an assessment of effects on the wetland)

- [ ] No

4.5.2 Has the wetland been formed by artificial means?

- [ ] Artificial
- [ ] Natural

4.5.3 What is the surface area of the lake/pond/wetland?

4.5.4 How deep is the lake/pond/wetland?

4.5.5 Does the lake/pond/wetland have an outlet? i.e. does water flow out of it?

- [ ] Yes
- [ ] No

4.5.6 What is the main source of water that fills the lake/pond/wetland?

- ☐ Groundwater
- ☐ Springs
- ☐ Runoff from surrounding land
- ☐ Direct rainfall
- ☐ Stream/river (list name) [ ]
- ☐ Other (provide details) [ ]

5. Historical water use

5.1 Water abstracted over at least the last 5 years

Note: if you are applying to replace an existing water permit for primary allocation, or an existing deemed permit or mining privilege you must provide evidence of the amount of water abstracted under that permit for at least the last five years.

The following usage evidence is provided in support of this application:

- ☑ Water metering records, attached to this application with historical water use summarised and assessed
- ☐ Water metering records sent to Council electronically or recorded on file by Council with historical water use summarised and assessed
- ☐ Detail on alternative water use information, attached to this application

5.2 In your application please analyse and assess the historical volumes and pattern of water use based on the water use evidence. If your application is to replace a deemed permit or an existing consent expiring prior to 31 December 2025 please ensure this is also undertaken in accordance with Schedule 10A.4 of Proposed Plan Change 7 (Water Permits).

5.3 Provide a summary of your analysis below: Refer to AEE. Alternative method provided.

a. Average maximum rate of take: [ ] litres per second
b. Average maximum daily volume: [ ] cubic metres per day
c. Average maximum monthly volume: [ ] cubic metres per month
d. Average maximum annual volume: [ ] cubic metres per year

5.4 For which years have these rates and volumes been recorded? 2013 - 2021

6. Water use and management

6.1 For what purpose(s) will the water be used?

- [x] Stock water and/or dairy shed use
- [x] Irrigation (provide detail of irrigation use in your application attached)
- [ ] Community supply
- [ ] Commercial/industrial

Other

6.2 Will the water take be managed as part of an existing water allocation committee or water management group?

- [x] Yes (name of committee of group): Chatto Creek Catchment Water Management Group
- [ ] No

6.3 If yes, have you described how the allocation committee/management group operates in your application?

- [x] Yes
- [ ] No

6.4 In your application describe any water rationing regime that operates in the catchment.

6.5 Will the take applied for be operated in accordance with the rationing regime you have described in question 6.4?

- [x] Yes
- [ ] No

6.6 Will you or others "re-take" water from your take (i.e. via a water race)? If yes, please provide details of such re-takes in your application.

- [x] Yes
- [ ] No

7. Measuring and reporting

7.1 In your application describe the type of water metering system that is installed or proposed to be installed.

Note: If currently installed provide proof of installation or note if proof has already been provided to Council.

7.2 Provide information in your application demonstrating that the installation of the measuring device or system shall be undertaken in accordance with Council guidelines.

Note: If the installation is not able to meet these guidelines, you need to fill out and attach to this application form a Non-Standard Installation Form for Water Measuring Devices, available on our website or through the environmental services unit of the Council.

☑ Tick if completed

☐ Tick if completing a Non-Standard Installation Form for Water Measuring Devices

7.3 Is your water measuring device or system installed or proposed to be installed at the point(s) of take?

Note: The council considers the point of take to be within a 100 metre radius of the physical take point. If your answer is No, you need to apply for a Water Measuring Exemption (WEX) by filling out Application Form 24 – Application for Exemption to use a device or system near the location from which water is taken. A fully completed Form 24 should be lodged at the same time as this application to enable dual processing.

☑ Yes

☐ No – complete an Application Form 24 – Application for Exemption

8. Location and Efficiency of Water Use

8.1 Provide details of point/area of use (include legal description(s) and grid references).

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

8.2 Provide a description of any existing works/infrastructure in place, including value, in your application.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

8.3 Provide a description of proposed works/infrastructure to give effect to consent sought, including value of investment, in your application.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

8.4 Provide an assessment of the proposed use against the Aqualinc report for reasonable water requirements[2].

☑ Completed

☐ Not Completed (provide details of alternative assessment and justification for that)

8.5 If you propose to use water to irrigate land, please outline:

a. How many hectares of land will be irrigated?

b. What is the soil type(s) of the land being irrigated?

c. What will you be irrigating (i.e. crop, pasture etc in ha)?

d. What is the target application rate (mm/day and mm/year)?

e. Will the total land area under irrigation exceed that irrigated in the 2017-2018 irrigation season?

8.6 What type of irrigation system is proposed to be used or is currently being used?

☐ K-line

☑ Centre pivot

☐ Travelling irrigator

☑ Border-dyke/flood irrigation

☑ Other – provide details Hard hose guns

[2] *"Guidelines for reasonable irrigation water requirements in the Otago Region", Aqualinc, 2017. Note that while this document provides a basis for assessing efficiency of use, other matters may be applicable.*

8.7 Do you have any water distribution infrastructure in place (for example pipes, storage tanks, open races etc.)?

☑ Yes

☐ No

If yes, in your application please describe the type of infrastructure in place and how you intend to ensure that it is maintained in good working order (e.g. do you intend to have a maintenance or leak detection programme, will the scheme be managed by an external company).

Note: For deemed permits please ensure you have the right to convey water under s417 of the Resource Management Act if that conveyance crosses another party's property, prior to the expiry of the deemed permit.

8.8 Do you intend to install any water distribution infrastructure (for example pipes, storage tanks, open races etc.)?

☑ Yes

☐ No

If yes, in your application please describe the type of infrastructure to be installed and how you intend to ensure that it is maintained in good working order (e.g. do you intend to have a maintenance or leak detection programme, will the scheme be managed by an external company).

Note: For deemed permits please ensure you have the right to convey water under s417 of the Resource Management Act if that conveyance crosses another party's property, prior to the expiry of the deemed permit.

8.9 If you propose to use water for stock and/or dairy shed use – please answer the following:

Note: The Council considers the following values as efficient use of water for stock:

Sheep	*5 litres per day per head*
Beef cattle	*45 litres per day per head*
Dairy cows	*70 litres per day per head*
Deer	*15 litres per day per head*
Dairy shed use	*50 litres per day per head*

8.9.1 What type of animal and numbers of stock will be supplied with water for drinking?

Sheep

Number: 21,000 Water required: 5 litres/head/day

Beef cattle

Number: 1,100 Water required: 45 litres/head/day

Dairy cows
Number: ☐ Water required: ☐ litres/head/day

Other
Number: ☐ Water required: ☐ litres/head/day

8.9.2 How much water do you require for your dairy shed?

☐ litres/head/day

8.9.3 If you are seeking more water for stock and/or dairy shed use than that recommended by the Council please state why this is in your application.

Note: please provide the source of any data provided. Also include details of stock water transportation if relevant.

8.10 If you propose to use water for industrial use – in your application state what type of industry will be using the water and how will the water be used.

8.11 If you propose to use water for community/domestic supply – please answer the following:

a. For households, the number of households to be supplied: ☐

b. For camping grounds, the maximum number of visitors and staff per year: ☐

c. For schools, the maximum number of students and staff per year: ☐

d. For motel units, the number and expected occupancy: ☐

e. Other uses (please describe): ☐
☐

8.12 For all uses, demonstrate in your application how have you calculated the amount of water you need?

Note: Please note that the Council will only grant volumes that have been assessed as efficient, and will assess the volumes sought for efficiency, taking into consideration the local climate, soils, and crop type.

☑ Tick if completed.

8.13 In your application please describe any other sources of water available for the property. How much water is available and what it is used for.

8.14 In your application please describe any measures you are proposing to minimise wastage of water and maximise its efficient use.

9. Assessment of Environmental Effects

Note: Pursuant to Schedule 4 of the Resource Management Act, 1991, there are a number of matters that must be addressed by an assessment of environmental effects. These matters are listed in Form 1, with additional or specific matters relating to water permits are listed below.

9.1 Assess effects on surface and/or ground water hydrology.

☑ Yes (attached to application)
☐ No (please outline reasons why this has not been provided in your application)

9.2 Provide an independent ecological assessment/instream assessment of the water body and any connected waterbodies. It is recommended that all takes not from the main stem of a catchment have this assessment carried out.

Note: if your application is to replace a deemed permit or an existing consent expiring prior to 31 December 2025 and the duration sought is more than six years, this assessment is required to be carried out to satisfy Policy 10A.2.3(a) in Proposed Plan Change 7 (Water Permits).

☑ Yes (attached to application)

☐ No (please outline reasons why an independent ecological assessment has not been undertaken in your application)

9.3 Assess any physical effect on the locality, including any landscape and visual effect.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

9.4 Assess any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity of the point of take.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

9.5 Does the taking of water from the water body cause it to dry up during summer or does the water body naturally dry up downstream of the take?

☐ Yes

☑ No

If Yes, your application should explain approximately how far downstream from your this occurs and in approximately which month in a wet year, average year and dry year this happens.

Note: Please discuss and attach any evidence to the application (e.g. photographs of water body downstream):

9.6 Assess effects on cultural values.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

9.7 Assess any effect on other water users or other human use values.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

9.8 Describe any positive effects from the take.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

9.9 Outline the mitigation you propose in your application. This should include a consideration of the following:

☑ Proposing any existing residual flow, minimum flow, or take cessation condition

☑ A new residual flow

☐ Fish screening on water intakes

☑ Measures for management where there are low flows

☑ Flow sharing measures

☑ Whether base flow is necessary to maintain the water race

☑ Any other applicable measures

9.10 Outline if your instantaneous abstraction rate (litres per second) will be reduced by increasing the length of time over which water is taken.

☐ Yes (attached to application)

☑ No

9.11 Provide a description of any possible alternative water sources or methods for undertaking the activity and why these alternatives have not been selected.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

10. Consultation

10.1 Include evidence of any consultation undertaken for this application.

Refer to Consultation section in the AEE.

10.2 Identify persons affected by this application.

10.3 Which persons approval have been provided to the application (attach copies of approvals)?

*Note: This **may** include (but not be limited to) consultation with adjoining landowners, other consent holders in the immediate area such as downstream permit holders, iwi (e.g. Te Rūnanga O Ngāi Tahu, Aukaha, Te Ao Marama Inc.), government departments/ministries (e.g. DOC), territorial authorities and recreational associations. To reduce costs and processing times, we recommended that written approval is obtained and submitted with the application for parties which may be affected. Such approval must be unconditional to avoid notification.*

11. Statutory Assessment

Please note that in accordance with Schedule 4 of the RMA, you are also be required to provide an assessment against the relevant provisions of the following documents (if relevant):

☑ National Policy Statement for Freshwater Management.

☐ National Policy Statement for Renewable Electricity Generation.

☑ Resource Management (Measurement and Reporting of Water Takes) Regulations 2010.

☑ National Environmental Standard for Sources of Human Drinking Water.

☐ New Zealand Coastal Policy Statement.

- [x] Operative Regional Policy Statement 1998, Proposed Regional Policy Statement and Partially Operative Regional Policy Statement 2019.

- [x] Regional Plan: Water for Otago (including description of permitted activities and compliance with permitted activity standards; identification of Regionally Significant Wetlands and associated valves).

- [x] Proposed Plan Change 7 (Water Permits).

- [x] Kai Tahu ki Otago Natural Resource Management Plan 2005.

- [x] Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008 (for takes from the south side of the Clutha River/Mata-Au)

- [x] Any other relevant plan, proposed plan and any other relevant regulations.

2 Application To Dam Water

Otago Regional Council

This form is to be used for applications seeking to dam water within a watercourse, or outside a watercourse where natural runoff will be captured.

(For Office Use Only)

Consent No.: _____

Job No: _____

PLEASE READ THIS PAGE BEFORE COMPLETING THE APPLICATION FORM

A number of resource consents may be required for the construction of a dam and the impoundment of water behind it. This schedule addresses the requirements for a water permit to dam water only.

Depending on the location of your dam structure, and if the dam structure is existing or new, you may not need to fill out all parts of this schedule.

Please note that additional permits may be required when damming water. These include:

- a water permit to take surface water or groundwater, should the dam impound water for which no consent is held to be taken (see Schedule 4 or 5), and
- a water permit to divert water, if flows are to be diverted during construction (see Schedule 3).
- a discharge permit to discharge water from a dam (see Schedule 7),
- a land use consent to disturb the bed of a watercourse and erect a dam structure in the bed of a watercourse, should construction activities occur in the bed of a watercourse (see Schedule 10C), and
- a discharge permit to discharge contaminants to water during dam construction (see Schedule 7) and
- a building consent for the dam structure *Please note that dam structures and dam modifications require a building consent under the Building Act (2004). The Otago Regional Council currently issue building consents for dams. You will need to apply to Council directly for a building consent. Application Forms are available on our website under 'Dams, their safety and building consents'"*

In order for any consent application to be processed efficiently in the minimum time and at minimum cost, it is critical that as much relevant information as possible is included with the application.

Form 1 and Schedule 2, when properly completed, may provide an adequate "Assessment of Effects on the Environment" (AEE) where the adverse effects of the dam proposal are not significant. The required detail for an AEE should reflect the scale and significance of the potential adverse effects the proposed dam may have on the environment. If the size of the proposed dam or scale of its potential effects is significant, a report by a professional advisor in support of your application may be required.

Guidance to answering the questions appear at the end of this schedule: "Notes to provide Guidance on Completing Schedule 2". Details of the information required in an AEE are included in the Fourth Schedule of the Resource Management Act 1991 appended to Form 1: Resource Consent Application.

If all the necessary information is not supplied with the application then Otago Regional Council may return your application, request further information or decline your application. This will lead to delays in the processing of your application and may increase processing costs.

If the effects of your proposal are considered to be minor and written approvals are gained from all parties that may be adversely affected by it, then your application(s) will proceed under non-notified consent provisions. If you are unable to supply the necessary written approvals from the affected parties, or if the effects of the proposal are more than minor, then Council must limited notify or fully notify the application. Such applications take longer to be processed than non-notified applications and may incur additional processing costs. Details of consultation required are presented in this document.

PART A: Description of the Proposed Damming and Associated Activities

A.1 Is the application to dam water:

☒ a new consent, or

☐ to replace an existing consent? _____ (consent number)

A.2 Please Indicate what provisions of Permitted Activity Rule 12.3.2.1 of the Regional Plan: Water for Otago, cannot be met by the proposed damming activity:

☐ The size of the catchment upstream of the dam is greater than 50 hectares in area.

*Size of catchment upstream of dam:*_____

☐ The water immediately upstream of the dam is more than 3 metres deep.

*Maximum water depth behind dam:*_____

☒ The volume stored by the dam is more than 20,000 cubic metres.

Maximum volume able to be stored behind dam: Various

☐ A lawful take will be adversely affected by the dam.

*Name whose take will be affected, and water permit number if known:*_____

☐ A wetland identified in schedule 9 of the Regional Plan: Water or any wetland higher than 800 metres above sea level will be adversely affected by the dam.

please name/describe wetland: _____

☐ The dam will cause either flooding, erosion, land instability, sedimentation or damage of another person's property.

Name which effect above, and whose property (if relevant): _____

A.3 Purpose for damming water: (Tick as appropriate)

☒ Irrigation

☒ Water harvesting / storage

☒ Stock water

☐ Domestic water supply

☐ Stormwater treatment

☐ Hydro-electric power generation

☐ Ornamental (specify): _____

☐ Other (specify): _____

A.4 Other Resource Consents required

A.4.1 (a) Do you hold a water permit or deemed permit / mining privilege to take the water that is dammed?

☒ Yes *(permit number):* RM15.127.01 & 4006.V1 *(go to Question A.4.2)*

☐ No *(go to question A.4.1(b))*

☐ Not applicable *(specify why):* _____

(b) Do you comply with the Permitted Activity Rules 12.1.2 or 12.2.2 of the Regional Plan: Water?

❑ Yes *(no resource consent to take water is required)*

❑ No *(a water permit may be required, see Schedule 4 or 5)*

A.4.2 (a) Do you intend on discharging water from the dam into water (i.e. not to a pipe or race, but into a natural watercourse).

☒ Yes *(please specify how):* bywashes - see AEE *(go to Question A.4.2(b))*

❑ No *(go to Question A.4.3)*

❑ Not applicable *(specify why):* _____

(b) Do you hold a Discharge Permit to discharge water to water from the dam?

❑ Yes *(permit number):* _____ *(go to Question A.4.3)*

☒ No *(go to Question A.4.3)*

A.4.3 (a) Do you propose to construct a new dam in a watercourse?

❑ Yes *(go to Question A.4.3(b))*

☒ No *(go to Part B)*

(b) For the associated bed disturbance, if consent to dam water is needed you will be unable to comply with the Permitted Activity Rules given in Section 13.5.1 of the Regional Plan: Water. As such a land use consent is required, please fill out Schedule 10C. For the associated discharge of contaminants (sediments, concrete, etc) during bed disturbance, a discharge permit is required, please fill out Schedule 7).

❑ *Please tick if Schedule 10C attached*

❑ *Please tick if Schedule 7 attached*

(c) For the erection/placement/alteration of the proposed dam structure within the bed of a lake or river, if consent to dam water is needed you will be unable to comply with the Permitted Activity Rules given in Section 13.2.1 and 13.3.1 of the Regional Plan: Water, and a land use consent is required, please fill out Schedule 10C).

❑ *Please tick if Schedule 10C attached*

(d) If you propose to divert the flow of the watercourse to construct a dam, are you able to comply with the Permitted Activity Rules given in Section 12.3.2 of the Regional Plan: Water?

❑ Yes (no resource consent to divert water is required)

❑ No (a *water permit for the diversion is required, see Schedule 3)*

PART B: Location of the Proposed Activity

See AEE.

B.1 Describe the property on which the proposed dam structure is to be located *(if the dam is located on Crown Riverbed, please note on (e) below)*

(a) Full name(s) of owner(s) Refer to Form 1 for Part B of this form.

(b) Full name(s) of occupier(s)_____

(c) Address/Location _____

_____

(d) Legal Description(s) *(as shown on Certificate of Title)*

Lot _____ DP _____ Sec _____

Survey District (SD) _____

Area (Nearby town etc.)_____

Other (specify)_____

Council will obtain a Certificate of Title to confirm details, if necessary.

(e) Is the dam located on Crown Riverbed: Yes: ❑ No ❑

If Yes, give the legal description of the property adjacent to the point of take

_____

B.2 If land is to be inundated as a result of the proposed dam structure, please describe the property(s) to be inundated

(a) Full name(s) of owner(s)_____

(b) Full name(s) of occupier(s)_____

(c) Address/Location _____

_____

(d) Legal Description(s) *(as shown on Certificate of Title)*

Lot _____ DP _____ Sec _____

Survey District (SD) _____

Area (Nearby town etc.)_____

Other (specify)_____

B.3 Map reference of the proposed dam structure in NZTM 2000: Refer AEE.

NZTM 2000: E_____N_____

B.4 If your proposed dam to be located within a watercourse, please provide the name of the watercourse:

Chimney Gully; also outside of watercourse.

(If the water body is unnamed then note this and give the name of the water body to which it flows into)

B.5 Please provide a plan (A4 or A3 size) with this application that shows the following:

(a) The location of the proposed dam.
(b) Natural ground contours.
(c) The pattern of land inundation that will occur when the proposed dam is full.
(d) The legal boundaries of all property(s) that will be affected by the proposal, including the names of the owners and/or occupiers of those properties.

(e) The location of any spillway or overflow.
(f) The flow-path of any watercourse(s) *(please indicate the direction of flow with an arrow).*
(g) Any other relevant features that will allow identification of the location of the dam, such as roads, bridges, dwellings, historic or waahi tapu sites, or other landmarks.
(h) Overflow / flood paths *(include buildings and infrastructure that may be within the flood path)*.
(i) Any upstream or downstream water users *(include name(s) and distance(s) if known).*
(j) A north symbol; and
(k) A scale

PART C: Description of the Water Resource/Catchment

See AEE.

C.1 If the proposed dam is located in a watercourse:

(a) Is the watercourse:

Perennial (flows all year round) : ❑

Ephemeral (flows intermittently or when there is rain) : ☒

(b) Mean flow of watercourse *(if known)*:_____(l/s or m^3/s)

(c) Mean annual low flow of watercourse (MALF) *(if known)*: _____(l/s or m^3/s)

(d) Describe frequency and duration of flows if ephemeral *(if known)*_____

_____

_____

(e) Flow for 50 year return period flood *(if known)*_____(l/s or m^3/s)

(f) Flow for 100 year return period flood *(if known)*_____(l/s or m^3/s)

(g) Flow for 100 year plus/super design event *(if known)*_____(l/s or m^3/s)

(h) Please describe the gradient of the watercourse or land on which the dam is to be located:_____

_____

_____

(i) Please describe composition of the bed of the watercourse on which the dam is to be located:_____

_____

(j) Please describe any aquatic life present in the watercourse (i.e. fish, invertebrates, aquatic vegetation and riparian vegetation):

_____

_____

_____

_____

(k) Aquatic waterfowl associated with the watercourse?

_____

_____

_____

C.2 If the proposed dam is located outside of a watercourse:

(a) Does the dam receive any natural runoff from the surrounding catchment?

❑ Yes (please describe): _____

☒ No

(b) What is the surrounding land used for immediately downstream of the proposed dam? *(please ensure that land use downstream is described to a distance appropriate to the scale of possible downstream effects in the event of dam failure)*

Farming

C.3 Have you identified any fault zones, flood zones, landslip areas or other flood hazards that may impact on the dam structure?

☐ Yes (please describe): _____

☒ No

PART D: Dam Design Details See AEE for details.

D.1 Design and Construction Methodology

(a) Have you employed a professional advisor to design the dam?

☒ Yes (give details):_____

☐ No

(b) Have the New Zealand Society on Large Dams (NZSOLD) Guidelines (2000) been considered for this dam?

☐ Yes

☒ No (describe why not):Not considered a large dam.

(c) What is the estimated start date of dam construction:_____

(d) What is the estimated completion date of dam construction:_____

(e) When will initial filling of the reservoir commence:_____

(f) When will initial filling of the reservoir finish:_____

(g) Give a description of site conditions and construction methodology, including (but not limited to)

- Foundation conditions, including any bore logs, results of shear strength testing etc.
- Excavation and key requirements
- Compaction requirements
- Proposed construction

(please note that for all larger dams of greater than "low" risk (as defined by NZSOLD), a professional engineering report will be required):

_____

_____

(h) Please enclose labelled photographs of the site with this application, including

(i) Proposed dam site, or ❑

(ii) If an existing structure, the upstream batter, downstream batter, abutments, spillway, outflow pipe, dam crest, overflow path; and ❑

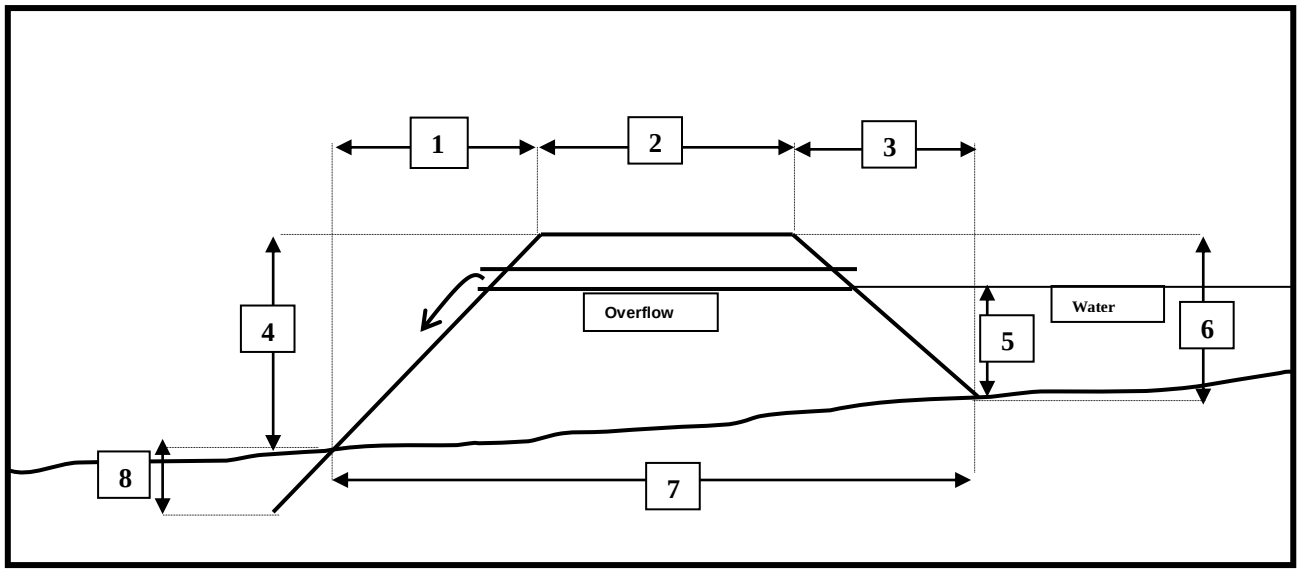
(iii) View upstream of the dam site ❑

(iv) View downstream of the dam site ❑

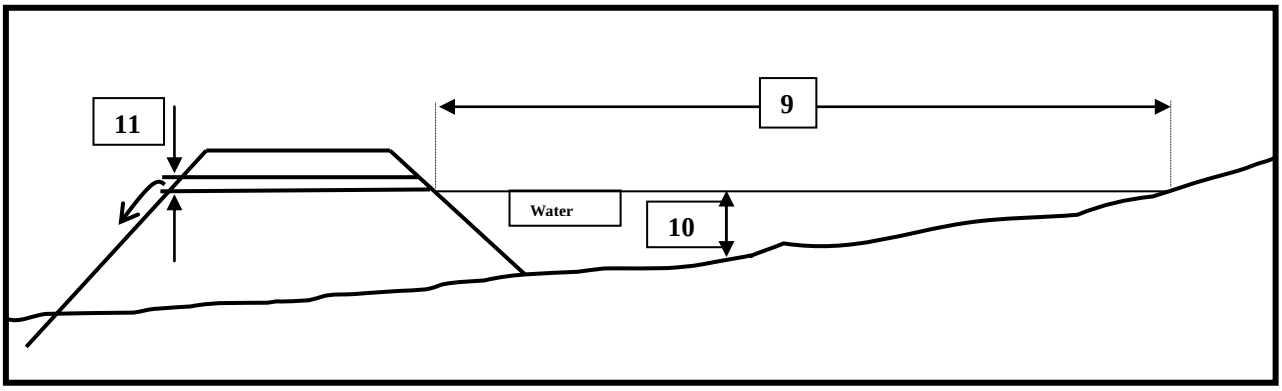
(v) Other (anything else of relevance) ❑

D.2 Dam Design and Dimensions

D.2.1 Please fill in the dimensions shown on the diagrams in the lists below (if the dam design is different from that shown below, please include a diagram showing all dimensions).



1. Downstream batter width _____ m
2. Crest width _____ m
3. Upstream batter _____ m
4. Downstream batter height _____ m
5. Overflow pipe height or spillway crest _____ m
6. Upstream batter height _____ m
7. Dam base width _____ m
8. Depth dam is to be keyed into existing ground _____ m



9. Length of pond behind dam _____ m
10. Maximum depth of reservoir _____ m
11. Diameter of overflow pipe _____ m

Other dimensions not shown on diagrams

12. Crest length: _____ m
13. Spillway width: _____ m
14. Spillway depth: _____ m
15. Spillway inlet height: _____ m
16. Spillway gradient: _____
17. Spillway surface material: _____
18. Material used for erosion protection of dam faces:
    _____
19. Surface area of reservoir behind dam (when water level at overflow pipe or spillway level):
    Normal level _____ m
    Low level _____ m
    Flood level _____ m
20. Volume of water retained by dam (when water level at overflow pipe or spillway level):
    Normal level _____ m
    Low level _____ m
    Flood level _____ m

21. Describe in detail the junction between the shoulders and the dam: _____

_____

_____

_____

_____

D.2.2. What material/materials is the dam made out of (or to be made of)?

_____

_____

D.2.3. What are the design flow capacities of the spillway?

_____

_____

D.2.4. Details of any proposed or current mitigation measures, including low flow outlets/bypasses and fish passes:

_____

_____

_____

D.2.5 For dams for the creation of stormwater treatment ponds, please provide details of the ways in which the dam will be operated to allow for appropriate stormwater detention or treatment.

_____

_____

_____

_____

_____

D.2.6. Supply accurate design drawings of the dam, including:

- Profile / elevation showing embankment cross section, design of foundations / key, conduits and drainage, service outlet and flood spillway design, and erosion protection.
- Location and design of any proposed mitigation measures, including low flow outlets / bypasses and fish passes.

D.3 Dam Safety

D.3.1 What is the potential hazard category for the dam in accordance with the NZSOLD Guidelines 2000?

- ❑ High potential impact structure
- ❑ Medium potential impact structure
- ❑ Low potential impact structure
- ❑ Very low potential impact structure

D.3.2 What is the design life of the dam:

_____

D.3.3 What maximum flood event is the dam designed to pass? _____

_____

_____

(note that all dams should be able to pass a probable maximum flood (PMF) event)

Estimated flow rate of design flood event: _____m^3/s

Any other comments:_____

_____

_____

_____

_____

D.3.4 Will the public and/or stock be prevented from accessing the dam structure and its banks?

❑ Yes (please describe):_____

_____

_____

❑ No (detail why):_____

_____

_____

D.3.5 Will a Dam Safety Review, in accordance with the NZSOLD Guidelines (2000) be undertaken for the dam at regular intervals?

❑ Yes (please describe, including frequency of review, or the circumstances when review will be initiated, and how the review will occur):_____

_____

_____

_____

❑ No (detail why):_____

_____

_____

D.3.6 Has an Emergency Action Plan been prepared for the dam, in accordance with the NZSOLD Guidelines (2000)?

❑ Yes (please attach a copy to the application

❑ No (detail why):_____

_____

_____

D.4 Dam Operation and Management *(applicable to dams with a risk greater than "low", as defined by NZSOLD)*

Describe the operating regime of the dam on a separate page (or include an up-to-date copy of your operations and maintenance manual), including:

- Management of water levels.
- Management of discharges, including low flows/flow releases and flows over fish passes.
- If the dam will be used for water supply, demonstrate that the dam will provide sufficient storage to meet the projected demand, whilst providing for any proposed flow discharges.
- Maintenance and inspection of the dam embankment and spillways.
- Maintenance of reservoir including water quality control and removal of sediment and aquatic vegetation.

D.5 Dam Break Risk Assessment

D.5.1 Please provide a risk assessment report on downstream impacts in the event of dam failure. This report should be prepared by a suitably qualified person, such as an engineer. For dams with a risk greater than "low", inundation maps should be supplied. Please ensure that the location of any dams or infrastructure is shown.

D.5.2 Do you propose to hold public liability insurance for the dam in event of dam failure?

❑ Yes (please describe, including to what value the insurance is held for): _____

_____

_____

_____

_____

❑ No (please describe why not): _____

_____

_____

_____

_____

See AEE.

PART E: Assessment of Environmental Effects of the Proposed Dam

An assessment of effects should be proportional to the scale and significance of the proposed activity. Where your proposed take could have a significant effect on water body flow or levels a detailed environmental assessment is required.

E.1 Effects of the proposed damming of water on the surface water resource:

(a) Please list any known water users that your proposed dam may affect: _____

_____

(b) Will the damming of water have an effect on water availability to neighbouring properties?

❑ Yes ☒ No ❑ Unknown

If yes, please explain the effect

_____

_____

(c) Are there any of the following present within 500 metres of the proposed dam: See AEE.

(i) Obvious signs or known aquatic biota?	❑ Yes	❑ No	❑ Unknown
(ii) Areas where food is gathered from the water body?	❑ Yes	❑ No	❑ Unknown
(iii) Natural Wetlands?	❑ Yes	❑ No	❑ Unknown
(iv) Waste discharges (e.g., dairy sheds, industrial, sewage)?	❑ Yes	❑ No	❑ Unknown
(v) Recreational activities (e.g., swimming, fishing, canoeing?)	❑ Yes	❑ No	❑ Unknown
(vi) Areas of special aesthetic value (e.g. waterfalls)?	❑ Yes	❑ No	❑ Unknown
(vii) Areas or aspects of significance to Iwi?	❑ Yes	❑ No	❑ Unknown
(viii) Other water takes?	❑ Yes	❑ No	❑ Unknown

If you have answered "Yes" to any of the above, describe what adverse effects your dam may have and the steps you propose to take to minimise (i.e. mitigate) these effects:

_____

_____

_____

_____

_____

E.2 Will the proposed damming of water affect any other individuals or organisations that may have an interest in that water?

See AEE.

(a)	Other water users	❑	Yes	❑	No	❑ Not Applicable
(b)	Recreational water users	❑	Yes	❑	No	❑ Not Applicable
(c)	Fish and Game Council	❑	Yes	❑	No	❑ Not Applicable
(d)	Iwi	❑	Yes	❑	No	❑ Not Applicable
(e)	Neighbouring landowners	❑	Yes	❑	No	❑ Not Applicable
(f)	Department of Conservation	❑	Yes	❑	No	❑ Not Applicable
(g)	Other *(e.g. Forest & Bird, LINZ)*	❑	Yes	❑	No	❑ Not Applicable

If you have answered "yes" to any of the above, please explain how they may be affected by your proposed dam:

_____

_____

_____

_____

_____

If you have answered "no" to any of the above, please explain why they will not be affected by your proposed dam:

_____

_____

_____

_____

*If you have answered "yes" to any of the above, you may need that individual or organisation's written approval for your application to proceed under non-notified consent procedures. This is discussed further in Part G.

E.3 What are the positive effects of your proposed dam?

_____

_____

_____

E.4 What monitoring, if any, do you propose to carry out to measure any effects of your proposed dam on the environment?

_____

_____

_____

_____

E.5 Please tick if you are adopting any of the following measures to ensure that any adverse effects will be avoided, remedied or mitigated:

- ❑ Release of flushing flows
- ❑ Flood attenuation
- ❑ Provision of passage for migratory fish i.e. fish pass, diversion, climbing surface.
- ❑ Wetland creation
- ❑ Fencing of reservoir and riparian planting around the edges of the reservoir
- ❑ Other (Please specify)_____

Explanation:

_____

_____

_____

_____

PART F: Alternative Locations and Methods

F.1 Does your property have alternative locations for the dam *(*such as off stream locations, or stream of lower environmental value).

- ❑ No
- ☒ Yes *(please detail why your chosen location is considered the best option for you)*

_____

2 dams on the property are outside of a stream, one requiring consent is on a ephemeral gully.

_____

_____

_____

_____

PART G: Consultation

G.1 Please comment on any consultation undertaken with those persons/parties who may be interested in or potentially affected by your proposal to dam water (e.g., other water users, Department of Conservation, Fish and Game Council, Iwi, Transit New Zealand etc).

See AEE.

_____

_____

_____

_____

_____

F.2 Please provide any written approvals to the activity using Council's standard Form 1 - Resource Consent Application

PART H: Is Your Application Complete?

H.1 In order to provide a complete application have you remembered to:

(a)	Fully complete this schedule and Form 1 (Resource Consent Application)	☒
(b)	Include a location / site plan?	☒
(c)	Include photographs of the proposed/existing dam structure?	❑
(d)	Enclose a Certificate of Title?	☒

(e) Attach any appropriate additional information? ❑ NA

Including:

(i) An emergency action plan? ❑

(ii) The dam maintenance and operations manual? ❑

(f) Complete and attach any additional schedules for associated resource consents?

Schedule 3 (to divert water) ❑

Schedule 4 or 5 (to take surface water or groundwater) ❑

Schedule 7 (to discharge contaminants or water to water) ❑

Schedule 10C (to disturb the bed of a watercourse and erect a structure) ❑

_____

_____

Notes to provide guidance on completing Schedule 2

Part A: Description of the Proposed Damming and Associated Activities

Question A.1
If you are unsure whether there is an existing or expired resource consent check with Otago Regional Council. If you know your expiring consent number, or if you are applying to transfer your currently consented dam to another location, please supply the consent number.

Question A.2
The purpose of this question is to determine why the application for consent is required. Section 12.3 of the Regional Plan: Water for Otago outlines the rules relating to the damming of water. Please tick the relevant boxes and refer to the full Permitted Activity Rule 12.3.2.1 in the Regional Plan: Water for a full description of the Rule. Maps identifying wetland areas are identified on Map series F of the Regional Plan: Water for Otago. Please contact Council if you require any assistance.

Question A.3
Tick the boxes that indicate the purpose of your proposed dam.

Question A.4
Additional consents may be required from Council in relation to the damming of surface water depending on the nature of the proposal. These include permits for works in the bed of a river, the discharge of water to water and for the taking of surface water. Staff at the Otago Regional Council will be able to advise you whether your proposal meets the conditions of the Permitted Activity Rules or whether any additional consents are required.

Part B: Location of the Proposed Activity

Questions B.1 and B.2
Please provide the name and address of the owner and occupier (if different to landowner) of the land where the water will be dammed, and the land that will be inundated, or, if owned by the Crown (i.e. Crown riverbed), the land adjacent to the dam. A copy of your certificate of title may be obtained from Land Information New Zealand (www.linz.govt.nz). LINZ may also require a licence for you to occupy the bed of the water body with your intake structure (please contact LINZ directly).

*If the dam is on the bed of a large river (particularly “navigable rivers”) the bed will likely be owned by the Crown. The beds of smaller watercourses are sometimes owned by the adjacent landowner(s).

Question B.3
NZTM 2000 maps are generally available from Public Libraries or may be purchased from Government Book Shops.

Question B.4
If you are unsure of the name of the water body, and your application is a replacement of an existing consent, the easiest way to find out the name of the water body from which you are seeking to dam is by checking your existing resource consent. If you are unsure of the name of the water body and the application is for a new dam, please contact an Otago Regional Council staff member who will be able to assist you. In many instances tributaries to larger water bodies do not have official (or legally recognised) names. If this is the case describe the water body as "an unnamed tributary of …….". If the water body has an unofficial local name you could continue to write "… locally known as……." . You can determine if a name is legally recognised by seeing if it is written on published topographic maps (see question B.3), or if any road bridges crossing it state the name of the water body (i.e. Transit or Automobile Association signs).

Question B.5
A general site plan showing as much detail of the location of your proposed dam and surrounding land as possible should be provided. This will assist Council's assessment of your application and may reduce processing time and costs.

Part C: Description of the Water Resource/Catchment

This section covers the characteristics of the water resource that you are proposing to dam. Tick the appropriate boxes and answer the appropriate questions in both either **B.1 or B.2,** as applicable.

Question C.1
Describe the watercourse which is to be dammed. For question (a) - a watercourse can be perennial (flows all year around) or ephemeral (flows intermittently or when there is rain). For questions (b) – (g): It is recommended that you engage a hydrologist to calculate the hydrological regime of the watercourse if you are unable to obtain this information yourself. Flows in your river may be measured at certain locations by Council or other organisations (e.g. NIWA). For question (j), the bed composition may be mud, silt, sand, gravel or rock, or a combination of these.

Questions (j) and (k) - The Otago Fish and Game Council and the Department of Conservation should be able to assist you in identifying the aquatic flora and fauna, and the aquatic waterfowl associated with the watercourse.

Question C.2
Describe the area outside of a watercourse which is to be dammed. Please estimate how much natural runoff the dam is likely to intercept. To what watercourse would the runoff have discharged to if the dam was not present? What is the predominant land use of the catchment of the dam?

Question C.3
Describe any faults or landslips that may be present at the dam site or in the greater area around the dam. Is the dam site within a flood zone? Are there any other hazards present that may impact on the dam structure?

Part D: Dam Design Details

Question D.1
(a) and (b) You should engage a chartered professional engineer to undertake an assessment of dam safety, if the risk posed by the dam is greater than "low". An assessment of dam safety should be undertaken with reference to the NZSOLD Dam Safety Guidelines (Technical Publication 109, June 2000). For (c) – (f), what are the estimated dates of start and finish of construction, and dam filling, should consent be granted. For (g), describe the geotechnical conditions of the land where the dam is to be built, and the construction requirements. For (h), the photographs requested will allow Otago Regional Council staff to make an assessment of the dam / proposed dam, and will allow determination of whether a site visit is necessary.

Question D.2
Please give the dimensions of your dam, and the details of the flows it is designed to contain and pass, and any design details to allow for fish passage. Details of the dam design, including plans, calculations and the results of on-site tests should be provided in a separate report accompanying this application form. For D.2.5 you should engage a chartered professional engineer experienced in the design and construction of dams to provide a plan of your proposed dam. The level of detail you provide should be appropriate for the scale of your proposal (that is, the larger the scale, the more detailed the plans should be). In addition, for stormwater ponds you should provide details of the ways in which the dam will be operated for stormwater detention or treatment.

Question D.3

You should provide a description of the ways in which the dam will be maintained to provide for its safe operation. You should include detail of any methods as recommended by the NZSOLD Guidelines (2000), including if a dam safety review will be undertaken, and whether an emergency action plan will be prepared.

Question D.4
If your dam has a risk greater than "low", you should provide a description of the ways in which the dam will be operated and maintained to provide for its safe operation.

Question D.5
Please provide a report detailing all the potential impacts and adverse effects that could occur downstream of the dam in the event of its failure. This will help Council assess the potential risks of the proposed structure. In addition, provide comment as to whether public liability insurance will be held, or is held, to cover any damage likely in the event of dam failure.

Part E: Assessment of Effects on the Environment

In this section you need to consider what the effects of your proposed take will have on the environment. You **must** provide an answer to all questions from **E.1 – E.6**.

Question E.1
(a) & (b) You need to consider whether your proposed dam will have any effect on the availability of water for other users. This will depend on the volume of water you propose to dam relative to the size of the water body and the distance downstream to the next inflow of water (i.e. where the next stream or tributary joins the water body you propose to dam).

(c) The items listed in this question are those that are commonly affected by dams. You need to consider if any of these are present in the vicinity of your proposed dam and if they are, then you will need to discuss how your proposed dam will affect them. Dams can lower the water levels of the water body (e.g. the dam may reduce the depth of water downstream of the point of the dam). This will depend on the type of water body which you are damming and the amount of water you are proposing to dam.

Question E.2
What other individuals or organisations who use this water body, or for whom the water body supports natural or cultural values, may be affected by your proposed dam? How might your dam affect them? For example, in a creek used for trout and salmon spawning, your take may affect their habitat by lowering the water level, thus Fish and Game may be an affected party. If the water body has significance to Iwi the effect of the dam may be more difficult for you to ascertain, as the values of the water body to them may be less tangible (if in doubt, it may be beneficial to consult Iwi).

Question E.3
There are a number of possible "positive" effects that dams can result in. These can include economic benefits to the community, secure water supplies for irrigation, and many others.

Question E.4
The amount of monitoring likely to be required will depend on a number of factors such as the quantity of water you are proposing to dam, the size of the water resource, and the pressure on the resource. A consent holder will commonly be required to measure the quantity of water they take on a daily basis and submit "water use records". In other cases, downstream flow measurement recording, water quality and/or biological monitoring may be required. In addition, the NZSOLD Guidelines (2000) require ongoing monitoring for the safe operation of a dam.

Question E.5
Please tick any relevant boxes and explain how any proposed methods will avoid, remedy or mitigate any actual or potential effects on the environment.

Part F: Alternative Locations and Methods

Question F.1
Please identify any alternative methods or locations of damming, as well as any other alternative water sources available to you. Please provide reason(s) why have you not chosen any of these alternative methods, locations or water sources.

Part G: Consultation

Questions G.1 and G.2
Council can advise you of those parties considered to be potentially adversely affected by your proposed activity and can also instruct you regarding Iwi consultation. In some instances it may be appropriate for you to submit your application and let Council determine who they think may be adversely affected by your proposal. Because Council charges time on an hourly basis, you may choose to consult these parties and seek their written approval to your application yourself, or you may choose for Council to pursue this for you. However, if an application is submitted without written approvals of potentially affected parties, the application goes "on hold" until these written approvals have been received. Failure to obtain written approvals within a reasonable timeframe can result in your application being notified.

Part H: Is Your Application Complete?

Question H.1
A complete application will assist Otago Regional Council in efficiently processing your application. If information is missing or inadequate your application may be returned to you or declined. Please ensure that you have fully completed the application form and included the items listed from (a) – (f). You will also need to complete Form 1, and any other relevant schedules for activities associated with the damming. Applications that are incomplete or do not provide sufficient information will be delayed and will cost more.

If you have any queries relating to information requirements, please contact the Otago Regional Council Offices:

Dunedin Office
70 Stafford St
Private Bag 1954
Dunedin
Phone 03 474 0827
Fax 03 479 0015

Alexandra Office
Dunorling St
PO Box 44
Alexandra
Phone 03 448 8063
Fax 03 448 6112

Queenstown Office
Cnr Shotover & Camp St
PO Box 958
Queenstown
Phone 03 442 5681
Fax 03 442 5682

Freephone: 0800 474 082

Website: www.orc.govt.nz

LANDPRO

Make the most of your land

Resource Consent Application to Otago Regional Council

Prepared for Matakanui Station Limited

Prepared For

Matakanui Station Limited

Prepared By

Landpro Ltd
13 Pinot Noir Drive
PO Box 302
Cromwell
Tel +64 3 445 9905

QUALITY INFORMATION

Reference: L:\18060 - Matakanui Station Ltd - Deemed Permit\Docs\Drafts\20211001_18060_Matakanui Station Limited_AEE_FINAL_v3.docx
Date: 11 January 2021
Prepared by: Zoe McCormack & Christina Bright
Reviewed by: Claire Perkins
Client Review: Andrew and Tracy Paterson, Matakanui Station
Version Number: 3

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TABLE OF CONTENTS

LIST OF APPENDICES

1. INTRODUCTION

1.1 Overview of Proposal

The applicant, Matakanui Station, hold Water Permit RM15.217.01 and Deemed Permit 4006.V1 (Table 1).

The applicant is applying to the Otago Regional Council (the Council) to replace Water Permit RM15.217.01 and Deemed Permit 4006.V1. One permit will replace both of these permits.

The above two permits are on Neds Creek and this proposal forms part of the Chatto Creek sub-catchment (referred to as the Chatto Creek Catchment), a tributary of the Manuherekia River. This application is part of the full Chatto Creek applications which includes the application by the Omakau Area Irrigation Company Limited (OAIC) and Ross Naylor. These applications are in turn sub-set applications of the full Manuherekia Catchment applications that relates to the vast bulk of water abstractions in the wider Manuherekia Catchment.

This proposal also seeks a new water permit authorising the take of water from Neds Creek as supplementary allocation.

This proposal also seeks an associated new dam permit authorising the storage of water in several existing dams across the property.

Consent durations of 35 years are sought.

Water Permit RM15.217.01 and Deemed Permit 4006.V1 are due to expire 1 October 2021. Therefore, and in accordance with Section 124 of the RMA, the applicants may continue to exercise their permits while their applications for resource consent are being determined, including during any appeal process, because applications to replace the existing permits have been made more than six months prior to their expiry.

Table 1: Summary of existing permits to be replaced.

Permit	Creek	Permit type	Permit limit	Located at or about NZTM 2000
4006.V1	Neds Creek	Deemed Permit	300,000 L/hour	E1321981 N5004937
RM15.217.01		Water Permit	55.5 L/s	
Purpose of permit				
The permits authorise water take and use for irrigation water and stock water purposes.				
Conditions of consent[1]				
Condition 4 on RM15.217.01 reads as follows: (a) *The total rate of take and any variations to it, and Deemed Permit 4006, and any variations to it, shall not exceed 138.8 litres per second;* (b) *The total volumes taken under this permit, and any variations to it, and Deemed Permit 4006, and any variations to it shall not exceed:* (i) *347,976 cubic meters per month;* (j) *4,608,033 cubic meters between 1 July in a year and 30 June in the following year.* Condition 5 on RM15.217.01 reads as follows: *Other than for exercising this permit for reasonable stock drinking water purposes, a residual flow of no less than 15 litres per second shall be maintained in Neds Creek immediately downstream of the point of take for this permit.* There is no residual flow, or any other conditions imposed on 4006.V1.				

A River Management Plan and comprehensive details regarding the wider Manuherekia Catchment referred to as the Overview Section are currently being developed and are planned to be lodged concurrently with this application. These two documents have been prepared by the Manuherekia Catchment Group (MCG). The Chatto Creek water users (including the permits which this application pertains) are members of MCG. MCG is the coordinating body of all Manuherekia water users.

This application is made on the basis of a catchment managed set of tributary residual flows for the Manuherekia Catchment, and a mainstem minimum flow at Campground. The flows proposed at various points throughout the catchment have been proposed because they contribute to reach specific values identified and will enable a cohesive transition from current catchment management with deemed permits and the Falls Dam Company Limited rationing regime, to new catchment management (MCG facilitated) that will achieve the following results:

- Flows that provide for the identified values and their management objectives will be provided at the catchment, tributary and site-specific scale.

[1] Not a full schedule of conditions. See Attachment B for copies of RM15.217.01 and 4006.V1.

- The application of residual flows will reduce existing low flow stress on many sections of river and streams in the catchment.
- Water use will be efficient with the rates and volumes allocated based on actual efficient need. Efficient irrigation will:
    - Reduce run-off from irrigation
    - maintain or improve water quality (but reduced recharge)
    - reduce recharge of groundwater
- Water use will be coordinated, and rostering will be pre-emptive of low flows.
- Water reliability will be of an appropriate level to allow spray application methods to be viable and investment in infrastructure that improves conveyance and application efficiency.
- Falls Dam will be managed optimally to balance the need of providing flows for abstraction and sustaining minimum flows in the main stem, ultimately this will mean augmentation of the main stem above Ophir through dry periods will occur as long as possible.

The overall proposal for the Manuherekia Catchment includes three management zone, this application is within the Manuherekia Mainstem Management Zone. The applicants will co-ordinate and undertake adaptive management of abstraction in this catchment, where the minimum flow (proposed at Campground) and residual flow (proposed at the Chatto Creek confluence) will be regulated.

1.2 The Applicant

Applicant Postal Address:
Matakanui Station Limited
1524 Moutere-Disputed Spur Road
RD 1
Omakau 9376

Address for Service:
C/- Landpro Limited
PO Box 302
Cromwell 9342

1.3 Pre-application Engagement with ORC

The applicant has entered into pre-application engagement with the Otago Regional Council (ORC) over the past several years, in particular in regard to various proposed plan changes and consultative meetings held by ORC. Most recently a series of specific pre-application meetings was held with ORC staff, ORC consultants, and applicant representatives throughout July – September 2020. A meeting for the Chatto Creek sub-catchment was held on 24 September 2020. The minutes of this meeting are attached in Appendix A.

1.4 Purpose of Documentation

Pursuant to Section 88 of the Resource Management Act 1991 (the RMA), this report provides an assessment of the activities effects on the environment as required by Schedule 4 of the RMA. This application is deemed to reflect the scale of the proposed activities.

1.5 Overview of Supporting Documents

This application is lodged in co-ordination with the wider Manuherekia Catchment permit replacement applications, including those made for the Manuherekia mainstem, other Manuherekia sub-catchments, private water rights and irrigation companies. There is an extensive list of supporting reports and documents. The following table aims to highlight the key documents relevant to this application that are to be lodged concurrently with this application or be lodged shortly thereafter.

Table 2: Summary of key supporting documents.

Document	Author	Details	Location
Overview report Prepared for Manuherekia Catchment Group	McKeague Consultancy, WSP and Landpro Limited.	This document sits over all of the sub-catchment/individual applications. The Overview report is the collation of the key matters associated with the whole catchment and the legislative assessment.	Submitted to ORC separately by McKeague Consultancy.
River Management Plan	McKeague Consultancy, Matt Hickey (WRM)	Outlines the proposed future management of water in the Manuherekia Catchment.	Within the Overview report
Assessment of Environmental Effects of water abstraction from the Chatto Creek catchment	Matt Hickey (Water Resource Management Ltd) Dean Olsen, (Freestone Freshwater Ltd)	Assessment of Environmental effects for abstraction from Chatto Creek catchment.	Appendix F.

There are various other reports referenced throughout this application including those prepared for the Manuherekia Catchment Water Strategy Group. Those documents are not appended to this application but are publicly available on www.mcwater.co.nz or by request.

2. DESCRIPTION OF PROPOSAL

2.1 Overview of Chatto Creek Abstractions

The schematic below (Figure 1) is presented to orient the reader to the flows in and out of the Chatto Creek catchment and includes overview of the Omakau Area Irrigation Company Limited (OAIC) County Scheme. Red lines show some of the general races, not to scale or comprehensive. The schematic is not to scale and is supported by a larger full irrigation plan contained within Appendix B.

Abstractions subject to this application (4006.V1 and RM15.217.01) are for Matakanui Station only and are the only authorised abstractions on Neds Creek.

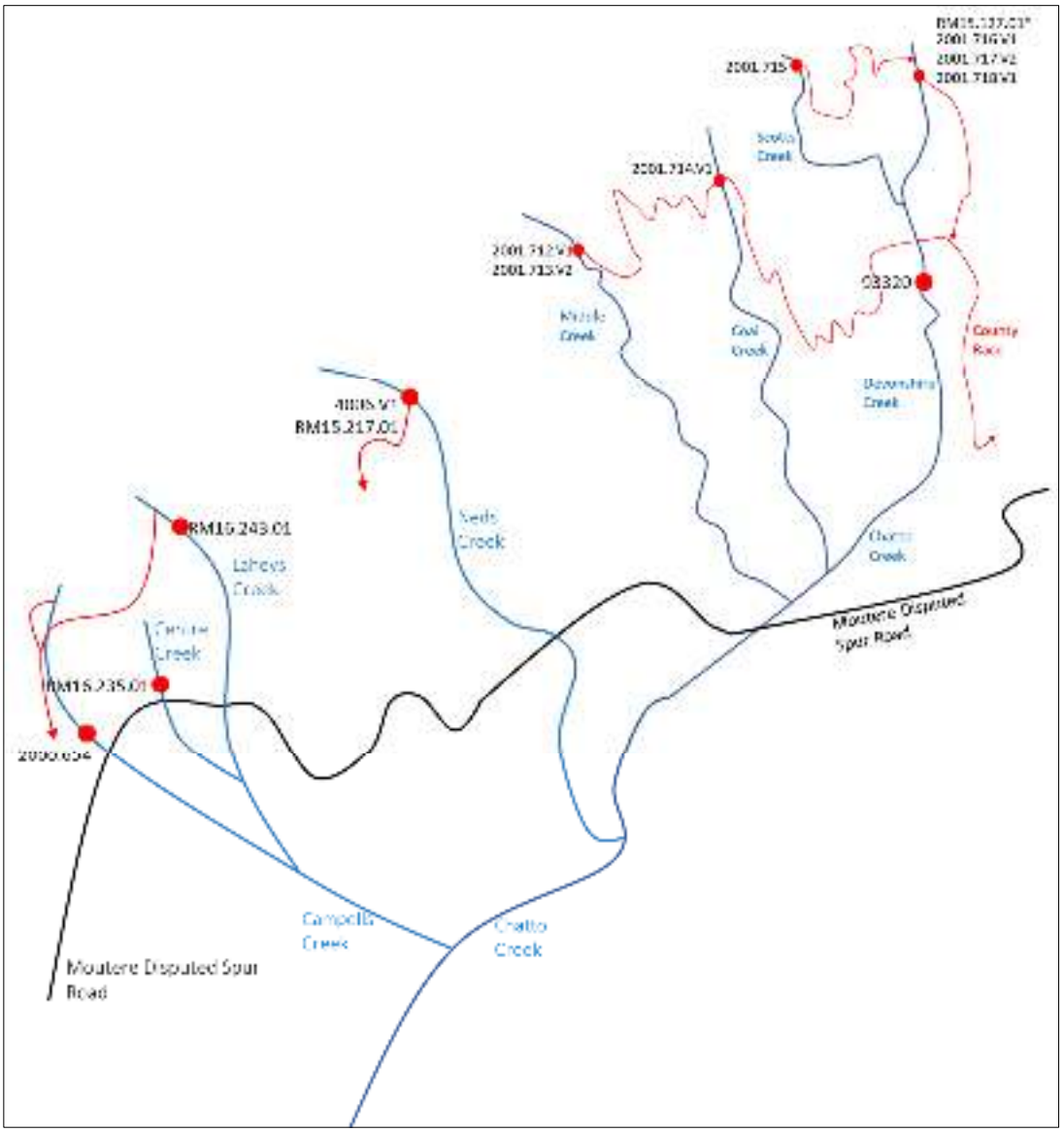


Figure 1: Schematic diagram of all consented abstractions from Chatto Creek.

2.2 Comment on Chatto Creek Catchment Water Management Group

In accordance with Policy 6.4.12A the users in the Chatto Creek catchment have formed a water management group, called the Chatto Creek Catchment Water Users Group. All members take water within the Chatto Creek Catchment. The formation of the Chatto Creek Catchment Water Users Group was instigated by the irrigators in this catchment themselves and the group have held several meetings since early 2019 so that they could understand the workings of the catchment.

The group are developing principles for coordinating their water abstractions and water rationing at the cessation of priorities and the current Falls Dam legal arrangements (explained later in this document) in the catchment.

Water sharing will commence at 100 L/s[2] at the ORC flow monitoring site on the Chatto Creek at the confluence with the Manuherekia. Users have agreed to share water available beneath their consented maximum rate of take. The new water sharing regime is being developed by the Catchment Group. This 100 l/s residual flow for Chatto Creek at the confluence with the Manuherekia is further discussed in Section 5.

2.3 Overview of Applicant's Farm, Scheme and Permits

Matakanui Station runs an extensive sheep and beef breeding unit supported by improved pastures. Historically Matakanui Station ran Romney/Merino Halfbreds. Today the majority of ewes are put to Polwarth rams. Matakanui Polwarths have proven results with winning champions and reserve champions at Shows in Omakau, Wanaka, Fairlie, and Christchurch having won there 10 times in the last 13 years. They are established as one of the most versatile and successful breeds. The property is a prominent ram stud, selling up to 250 each year.

The property was established in 1859, and as such has a long history of farming in this location. The current owners have farmed here since 2014, and the property has been in the Paterson Family since the 1950's. Matakanui Station extends from the top of the Dunstan Range down to the Chatto Creek Valley and encompasses approximately 5,100 ha of freehold land and 3,600 ha of leasehold land farmed in the summer only. The property runs about 21,000 sheep and about 1,100 head of cattle. All stock is raised to maturity.

The majority of usable land is made up of long leading spurs, open tussock flats and irrigated paddocks. Large scale irrigation development began in 2015 with close to 10 kilometres of pipe laid for gravity fed pivot and hard

[2] Hickey & Olsen (2020). Assessment of Environmental Effects of water abstraction from the Chatto Creek Catchment.

hose gun irrigation.

Of the 8,700ha (5,088 owned, and reminder leasehold) property, there is currently 357.8 ha under irrigation (pivot, hard hose guns, and overland methods) for water sourced from Neds Creek only. Currently there is 129.7 ha under pivot with several more pivots proposed for the future; 201.6ha of moveable spray irrigation; and 26.5ha of overland irrigation.

In addition to this, the applicant irrigates 88.3 ha of land via OAIC County Scheme, of this 55.7ha is overland boarder dyke irrigation with 33.6ha of moveable spray. Main race water is used to spray irrigate 85.2ha of land on the south-eastern property boundary, with 66.4ha under pivot and 18.8ha of moveable spray.

Moveable spray on the property is hard hose guns.

Of the total irrigation command area (531.6ha) often not all blocks are irrigated continuously throughout the irrigation season based on crop type and available water in any given year, and from season to season irrigation areas of the current total 531.6ha can vary.

Further spray irrigation conversion from guns to other spray such as pivot, and conversion of flood to spray (hard hose gun and pivot) will enable water to be spread further to irrigate a greater area of land from the OAIC water sources.

All water is conveyed via gravity methods throughout the property. Although a generator is used to drive the pivots. The applicant has constructed storage ponds where water taken from Neds Creek when flows are higher in winter and summer is stored for subsequent use on farm during the irrigation season. This taking and storage of the water when flows are high has occurred within the existing primary allocation permits, not supplementary.

There are two separate storage ponds on the property that allow for the storage of OAIC County and Main Scheme water shares.

The water user is investing heavily in additional storage on farm and has scoped out prime positions for an additional 620,000 m^3 of water storage for Neds Creek water and 360,000 m^3 of additional storage for the County water. In addition to the existing irrigation area, this storage would enable an additional area of 439 ha to be irrigated (total irrigable area would be 970.7 ha). The new storage pond/s are proposed to be constructed upgradient of an existing dam, this is dam 1 in Figure 2 below. In future, water will be raced to the new larger holding pond/s which then feeds the existing holding pond. Water is piped from there to the irrigation areas. The timeframe for these further developments depends on the security of supply the applicant can obtain through this consent process. These developments will not proceed without surety given by a longer consent term.

The plan in Figure 1 shows an overview of the wider catchment and Figure 2 shows the applicant's irrigation. The schematic is not to scale and is supported by a larger full scheme plan contained within Appendix B. The schematic is presented to orient the reader to the abstraction activities generally within the applicant's property.

The applicant's property extends from the top of the Dunstan Range, down to Chatto Creek. Middle Creek, Neds Creek and Lahey's Creek (and various other small gullies/Chatto creek tributaries that are ephemeral) flow in a generally eastern/southern direction through the property.

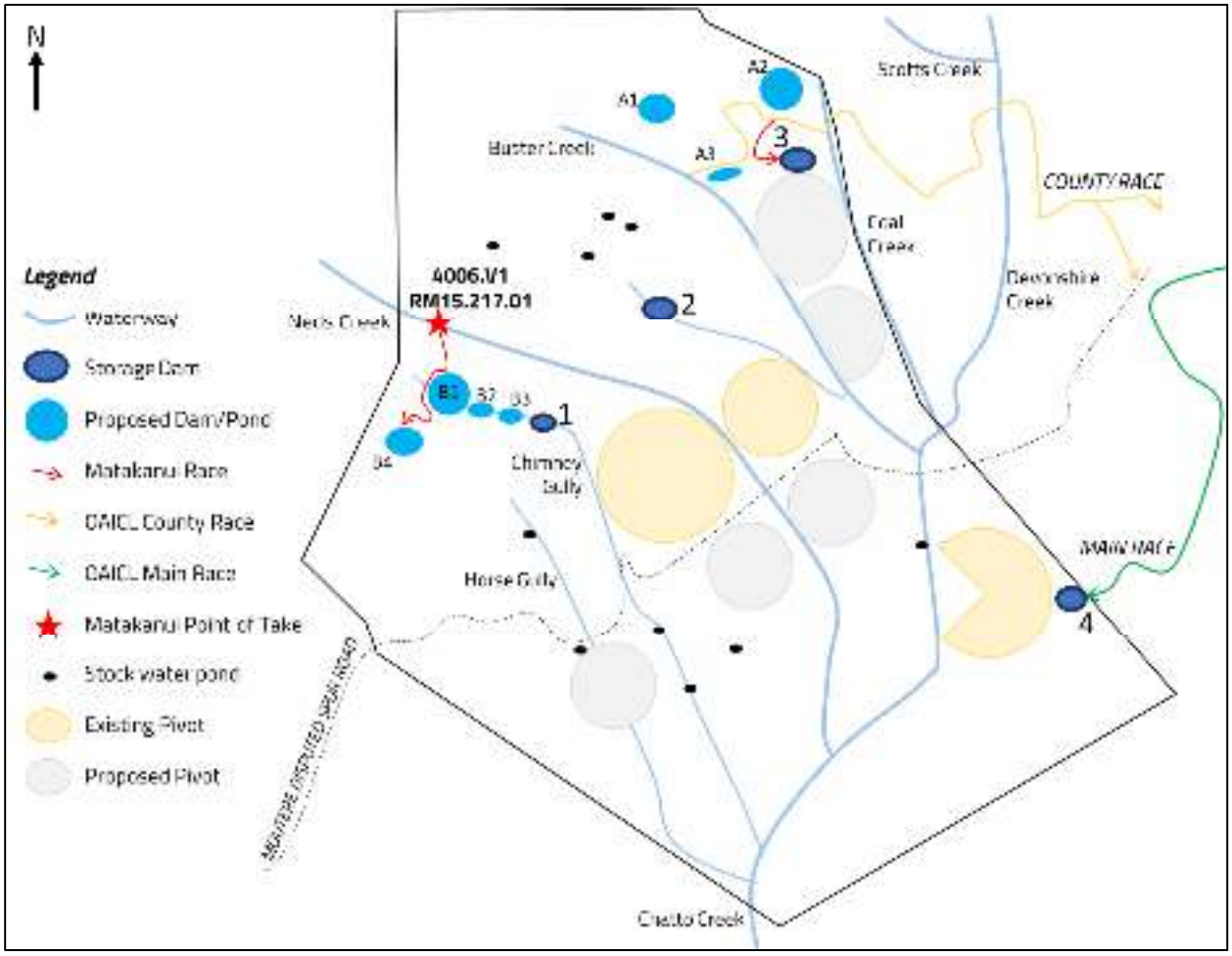


Figure 2: Overview of irrigation infrastructure on Matakanui Station and location of existing and proposed storage ponds.

Water from Neds Creek is raced to the applicant's storage dam (Dam 1 – Figure 2), water is dropped in Chimney Gully and the gully conveys water to the dam. Chimney Gully is an ephemeral tributary of Chatto Creek and has a small catchment area. From here water is piped to irrigation areas. There is a screen on the pipe outlet from the dam to irrigation areas.

The applicant receives OAIC water via the County Race and the Main Race. OAIC's County Water is delivered to Matakanui Station via the County Race. OAIC take water from Middle Creek and race this in a generally easterly direction towards Devonshire Creek, the applicant's property is the first to receive water from the country race and water from Middle Creek is taken from the race and dropped in the applicant's storage pond (Pond 3 – Figure 2). Presently, water from the County Race flood irrigates with boarder dyke up to 88.3 ha of land. Water is turned out from the County Race and flood irrigates about 14 ha of land before entering a storage pond with 42,000 m^3 of maximum storage available. Water is then raced down the property and border dyke irrigation occurs across 74.3 ha of land towards Moutere Disputed Spur Road. This area is signalled for conversation to pivots, with two pivots proposed south of Pond 3, between Buster and Coal Creeks.

On land to the south east of Chatto Creek, Matakanui Station receives Main Race water (Figure 2). Race water is delivered via continuous supply from the open race to the 20,000 m^3 storage pond on the property boundary (Pond 4 in Figure 2), where it can be stored prior to irrigation. Main Race water is used to spray irrigate up to 86 ha currently, via hard hose guns and pivot.

Table 3: Legal descriptions of where OAIC water is used.

Legal Description	Certificate of Title	Race
Section 6 BLK I Lauder SD	OT405/60	County
Section 7 BLK I Lauder SD	OT405/60	Main

Matakanui Station hold the only permit to take water from Neds Creek (red star in Figure 2) and that water is currently and proposed to irrigate the general area as shown by the black polygon in Figure 2; note this is not the total property area.

This application only considers the two permits in Neds Creek. The OAIC have permits to take water from Scotts Creek, Middle Creek, and Devonshire Creek, and Ross Naylor has permits to take water from Devonshire Creek, refer to Figure 1. These permits are subject to separate applications (but are proposed to be assessed in consideration of this application).

Moutere Station and Airdrie Limited (Moutere Airdrie Water Company) take water from Lahey's Creek (a tributary of Chatto Creek) and have recently replaced their deemed permit to take water from this Creek (and others in Chatto Creek Catchment) with Water Permits. Consent durations of 25 years were granted for those permits. A residual flow of 5 L/s at certain times (i.e., not continuously) is required near to the identified Central Otago Roundhead Galaxias habitat, which is augmented by way of a small dam in Centre Creek (located between Campbells and Lahey's Creek). The Moutere Airdrie Water Company manage that flow and have a galaxiid management plan which pertains loosely to the maintenance of galaxiid habitat at that location.

Matakanui Stations permits are summarised in Table 1 above, with some commentary around existing consent

conditions.

2.3.1 History of Permits

Water permit RM15.217.01 was originally deemed permit 4005. In 2015, Matakanui Station Limited were granted a transfer to the abstraction point of Deemed Permit 4005 to a new upstream location, co-located with the other Deemed Permit (4006) also held by the applicant.

At this time, 4005 and the transfer was granted as Water Permit RM15.217.01 and Deemed Permit 4006 became Deemed Permit 4006.V1 as a part of this transfer process with a condition was inserted to authorises the combined abstraction from permits at the single location.

2.3.2 Matakanui Station Intake

The point of take is located on Neds Creek at or about NZTM2000: E1321981 N5004937. The site of taking is from a gravel, cobble and silt bottomed pond area which resides below a culvert (Figure 3) and above a rock embankment. As can be seen in Figure 3, there is a manual sluice gate which the applicant controls abstraction from Neds Creek (also shown in Figure 5). The pool area ensures that water is able to flow down the applicant's water race at this take point.

Figure 66 shows Neds Creek below the stone embankment while Figure 7 shows the flume meter station on the applicant's water race. The telemetry station is located approximately 10 m from the flume in order to gain reception. Figure 8 shows Neds Creek upstream of the applicant's intake. Figure 9 shows the flow monitoring site on Neds Creek upstream of the Matakanui Station point of take.

Figure 3: Sluice gate intake at Matakanui culvert crossing over Neds Creek (August 2018)

Figure 4: Rock embankment below intake sluice gate (2015)

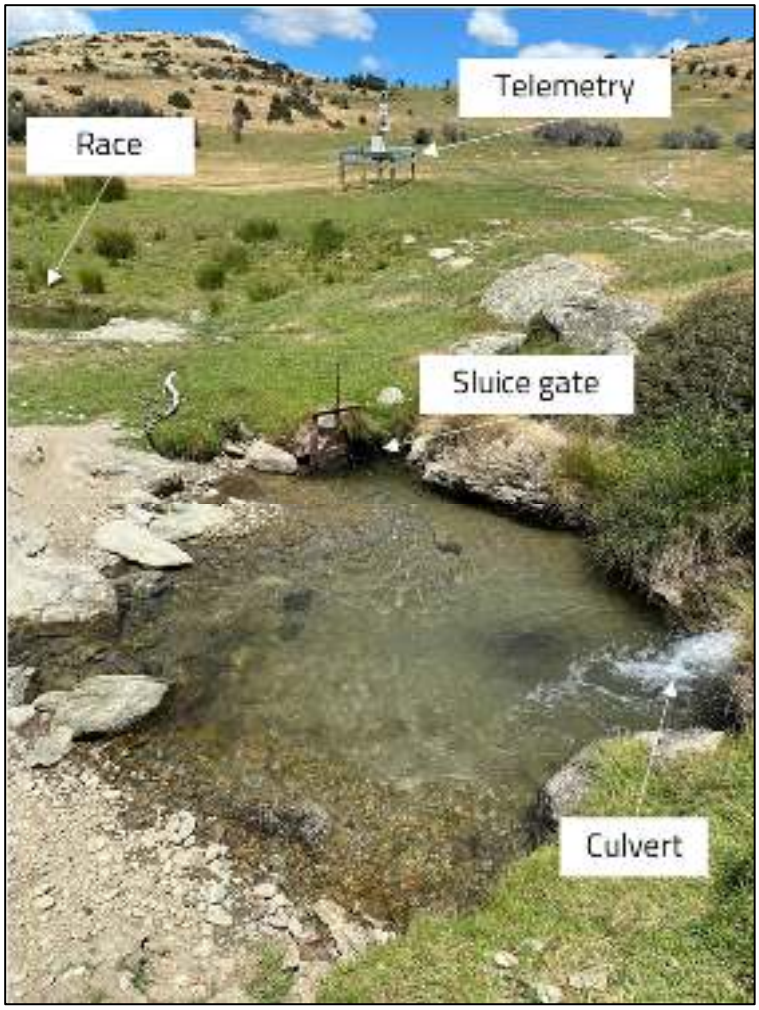


Figure 5: Culvert and sluice gate (December 2020).

The applicant utilises gravity at this intake, and flows are restricted by the size of the pipe, and water race behind the manual sluice gate.

At times of flood or freshes in Neds Creek, due to the gravity fed nature of the intake, it is difficult to stop water through the intake completely, as it overtops the control gate and flow will naturally follow the race.

The applicant has been recording continuous water level data on Neds Creek since 23rd August 2013. In December 2019 the ORC too over the running of the water level monitoring site located upstream of the applicant's point of take on Neds Creek (Figure 8). The applicant and the ORC worked collaboratively to reconfigured the site in December 2019.

Figure 6: Left - Neds Creek downstream of sluice gate (August 2018). Right – Neds Creek downstream of sluice gate with 15 l/s residual flow (December 2020).

Figure 7: Water measuring station on water race (August 2018).

Figure 8: Left - Neds Creek upstream of culvert (August 2018). Right – Neds Creek upstream of culvert (December 2020).

Figure 9: Water level monitoring site on Neds Creek (December 2019).

2.3.3 Damming Activities

On the applicant's property there are three primary storage ponds used for irrigation, and 1 pond that provides stock water.

The first (Dam 1 – Figure 2) (NZTM2000: 1323007E 5004207) is located on Chimney Gully and stores water abstracted under the applicant's private water rights on Neds Creek. Flow statistics for this waterway are unknown and the gully if ephemeral and only flows when rainfall events occurs. The pond was constructed in summer of 2014/2015 season in the location of an existing water race, where water used to flow down to flood irrigate land. Storing this water now means that it can be utilised for spray purposes. The dam stores 30,000m^3 and has a low 3m wall and is dug in. The race drops water into a small ephemeral gully in which the dam is located. Figure 10 shows a photo of the dam not long after it was constructed in 2015.

The second dam (Dam 2 – Figure 2) (1323798E 5005078N) is located on Swampy Gully and stores water that is used for stock drinking water purposes only and provide amenity values. Flow statistics for this waterway are unknown and the gully if ephemeral and only flows when rainfall events occurs. This is a shallow dam (1.5m deep on average) and stores 7,700m^3.

The third dam (Dam 3 – Figure 2) (NZTM 2000: 1324848E 5006202N) is located outside of a watercourse and stores water delivered to the property via the OAIC County scheme. The pond is located near the County Race and stores up to 42,000 m^3 of water. Water is turned out from the County Race and flood irrigates about 14 ha of land before entering the storage pond. This pond is approximately 50 years old and was built in the early 1970s.

The fourth dam (Dam 4 – Figure 2) (NZTM2000: 1326922E 5003264N) is located outside of a watercourse and stores water delivered to the property via the OAIC Main Race scheme. Race water is delivered via open race at a continuous rate to the new 20,000 m^3 storage pond located on the eastern property boundary, where it can be stored prior to irrigation. This pond is new and was built in 2019.

The applicant is continuing to invest heavily in additional storage on farm and has scoped out prime positions for an additional 620,000 m^3 of water storage for their private water right from Neds Creek, and an additional 360,000 m^3 storage for County Race water is proposed. As discussed above, additional storage for Neds Creek and security of supply for the County water will enable the applicant to invest in further spray irrigation on farm. This is contingent of securing a water permit of reasonably length of consent duration.

There are a number of additional smaller dams located around the property that are used to supplement the stock water distribution system and some have maimais that support the applicants recreational hunting pursuits.

2.3.3.1 Retakes and bywahses from Dams

Of the dams described in the section above, the retaking of water and bywashes occur by the follow means.

Table 4: Description of retakes from storage reservoirs and bywashes.

	Waterway	Size	Description of re-take	Description of bywash
Dam 1	Chimney Gully	30,000m^3	Water is delivered via the Matakanui Race. Water is taken via a XX mm pipe. There is a fish and debris screen on the outlet.	A race allows overflow from the dam back to Chimney Gully.
Dam 2	Swampy Gully	7,700m^3 *	Not used for irrigation. Stock water only.	Pond is very shallow and flows continue downstream on the gully.
Dam 3	Not in waterway	42,000m^3	Water is delivered from OAIC County race. Under the current flood irrigation scenario water is turned out from the dam via pipe to a race which irrigates with boarder dyke the land downslope of the pond.	Overflow from the County race pond is via race that is managed as like for irrigating boarder dyke irrigation system.
Dam 4	Not in waterway	20,000m^3	Water is piped from the pond to pivot irrigators and hard hose spray guns. There is a fish and debris screen on the outlet.	Race below pond used for overflow, that dissipates at edge of pivot.

*Permitted

Figure 10: Pivot irrigator in background and storage pond in foreground (July 2015).

2.3.4 Historic Take and Use

Graphs showing the rate of take and monthly and annual volumes abstracted from Neds Creek for the past 7 years are contained within Appendix C. The historic rates of take compared to the consented rate are presented in the Table 5 below.

The applicant's take has been metered since April 2013, and both permits (4006.V1 and RM15.217.01) are jointly metered at the single point of take (Figure 11). The records attached and summarised below show that the applicant has abstracted up to their consented maximum rate of take, and that water has been abstracted year-round.

For the years 2016-2018 the engineer installing the new meter after RM15.217.01 was authorised to transfer to point of take upstream for Deemed Permit 4006.V1 had not been able to the new infrastructure. Therefore, although the combined abstraction would have been at or exceeded the combined consent maximum, the metering record was capped at 115 l/s. The cut off in this data would suggest that abstraction rate of take is above 115 L/s during those two seasons. Abstraction at the applicant's maximum rate of take occurs frequently but is rarely maintained for an extended period of time, with the abstraction record reflecting what is available for abstraction from the creek at any one time.

Water is taken year-round with the bulk of water abstraction having occurred within the irrigation season each

year when water is abstracted for stock drinking and irrigation purposes. For the applicant's property, the irrigation season is generally August/September to April/May with water often required earlier due to dry ground in later winter and long summer conditions experienced through to May. Outside of these months water has historically been taken for stock drinking and for storage. It is important therefore that the applicant retain ability to take water when it is required year-round.

Season to season the abstraction records have fluctuated (Figure 11) which in part demonstrates the flow variability at the intake and the flow demand by the applicant. Over the past 7 years of records the monthly or annual consented maximum rate of take have never been exceeded. Exceedances in the instantaneous abstraction record most likely occur due to a flash flow in Neds Creek, typical of rainfall events.

For example, in January 2021, significant rainfall occurred that led to the flow meter on the race being inundated with flood waters and recording higher than consent maximum levels (Figure 11). This is noted as a metering error related to the fresh occurring in the creek and is a justifiable technical non-compliance that can be removed from the record when filtering the abstraction record, see further below. These exceedances occur due to the open channel gravity feed set-up at the intake site. This is the most preferable method of taking, and at lower creek flows works well so that water taking is within consent limits.

Also, the applicant has invested heavily in conversion from flood to spray irrigation (since 2015) this includes the construction of storage ponds and the investment has been made based on the water supply available to them under these existing permits. This has influenced the abstraction records, as infrastructure has been installed and upgraded during the irrigation season, and irrigation was suspended during the installation of the new centre pivots September to December 2014.

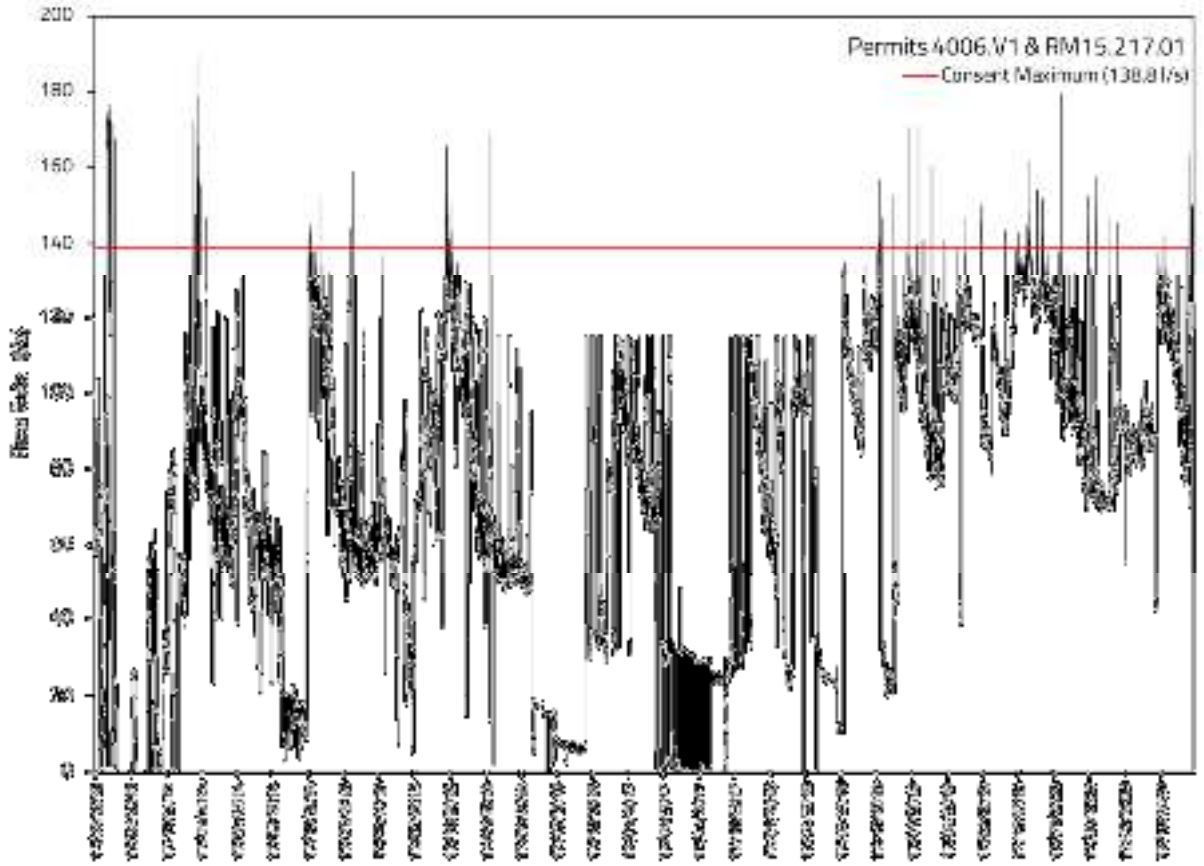


Figure 11: Abstraction record instantaneous rate (l/s) for permits 4006.V1 & RM15.217.01 for April 2013 to January 2021.

Table 5 below summarises the historic maximum abstraction. The raw abstraction reported in Table 5 is the raw record with no data filtering or exclusion of outliers or spikes in the data. Incorrect readings, exceedances or zeros can often be the result of faulty equipment, flood or weather events, or other legitimate issues. The filtered data is the raw abstraction record filtered where if the raw record contains exceedances, the consented maximum has been specified as the maximum recorded rate of take for exceedances within the margin of error, and these exceedances are acknowledged. Where justifiable exceedances have occurred due to taking of winter flows and higher flows, where this has occurred within the irrigation season or reasonable period for filling storage, the consent maximum has been applied. Here, the instantaneous record contained exceedances most likely related to freshes in Neds Creek, and therefore the record shows this as use of water for filling storage. The 10% margin of error is consistent with the margin of error associated to an open channel flow meter; this approach also accounts somewhat for metering outliers, or errors. Data was processed using excel software. The approach is consistent with recent hearing decisions (see: Long Gully Race Society RM17.176; and Queensbury Ridges Ltd (pending appeal) RM19.312); and the method proposed by the Otago Water Resources Users Group[3]. The abstraction records were sourced from the Otago Regional Council directly.

Table 5: Neds Creek – WM0505 & WM0506. Summary of historical maximums.

Historical Maximum Permit 4006.V1 and RM15.217.01 – Neds Creek			
Data record:	Raw Record - full record April 2013 – Nov 2020 Filtered – April 2013 – Nov 2020		
	Consent[1]	Raw Record[2]	Filtered[3]
Rate of Take l/s	138.8	189.2	138.8
Daily m^3	11,995	14,997	11,995
Monthly m^3	347,976	345,418	345,418
Annual m^3	4,608,033	3,303,397	3,299,938

[1] Consent Maximum, i.e., the on-paper allocation

[2] Based on maximum recorded abstraction across full period

[3] Based on methodology for auditing and filtering to remove outliers

As the applicant has utilised water abstracted for storage. Similar to the instantaneous abstraction records, annual abstraction volumes shown in Table 6 have fluctuated each season. The records show that abstraction volumes vary depending on the seasonal demand for the water, and the flows available in the Neds Creek. In each season the applicant has demonstrated that they have access to and abstract at their full instantaneous rate and that this occurs during the irrigation season. A reduced rate of take has been accessed outside of the typical

[3] Submission by Otago Water Users Resource Group on Proposed Water Permits Plan Change (Plan Change 7) to the Regional Plan: Water for Otago.

irrigation season. This as a percentage of the irrigation season volume varies across the record but shows that the applicant has utilised flows outside of the irrigation season to store water for use during the irrigation season. Storage for the private water right that these records relate to was constructed in the summer of 2014/2015, so that the annual volumes abstracted from 2015/2016 onwards reflect some water taken for storage and that taken for stock water in winter. As a percentage of the total annual abstraction, winter water (1 May to 30 September) has comprised 40 - 87% of the total annual abstraction demonstrating the need for this year-round abstraction.

Table 6: Abstraction records showing irrigation season and winter supply using filtered abstraction record.

Hydrological Year	Annual Volume (m^3)	Irrigation season volume	
		Cubic meters	As a percentage
2012/2013*	321,623	73,658	23%
2013/2014	1,712,514	1,292,892	75%
2014/2015	2,040,524	1,440,437	71%
2015/2016	2,219,393	1,480,278	67%
2016/2017	1,587,994	1,380,457	87%
2017/2018	1,842,133	1,472,505	80%
2018/2019	2,954,216	1,703,247	58%
2019/2020	3,299,938	2,082,274	63%
2020/2021*	1,643,192	933,461	57%

*Incomplete season
Hydrological year = 1 July to 30 June
Irrigation Season = 1 October to 30 April
Non-irrigation season = 1 May to 31 September

2.3.5 Titles and Easements

Matakanui Station is held within a suite of Certificate of Titles. Legal description and title reference are summarised Table 7.

Table 7: Legal description of land owned by Matakanui Station.

Parcel	Appellation	Area (ha)	Title	Owner
Section 10	Blk III Tiger Hill SD	213	OT405/60	Matakanui Station Limited
Section 7	Blk I Lauder SD	587	OT405/60	Matakanui Station Limited
Section 10	Blk X Tiger Hill SD	245	OT405/60	Matakanui Station Limited
Section 3	Blk XIV Wakefield SD	1,289	OT405/60	Matakanui Station Limited
Section 6	Blk I Lauder SD	1,653	OT405/60	Matakanui Station Limited
Pt Section 1	Blk VIII Lauder SD	1,102	OT16A/186	Matakanui Station Limited

Irrigation occurs on land outlined in Table 8.

Table 8: Legal description of land owned by Matakanui Station where irrigation occurs under current and proposed scenarios.

Owner	Appellation	Title
Matakanui Station Limited	Section 10 BLK III Tiger Hill SD	OT405/60
Matakanui Station Limited	Section 10 BLK X Tiger Hill SD	OT405/60
Matakanui Station Limited	Section 7 BLK I Lauder SD	OT405/60
Matakanui Station Limited	Section 6 BLK I Lauder SD	OT405/60

A summary of take and damming activities which relate to Water Permit RM15.217.01 and Deemed Permit 4006.V is provided below. Use activities, i.e., irrigation, is used on land parcels listed in Table 8.

- The point of take for Water Permit RM15.217.01 and Deemed Permit 4006.V, race and all storage dams north of Moutere Disputed Spur Road (all dams expect Pond 4) are located on Section 6 Blk I Lauder SD and is owned by Matakanui Station. Title ref: OT405/60.
- Pond 4 that stores water deliver via the OAIC main race and is location on Section 7 Blk I Lauder SD and is owned by Matakanui Station. Title ref: OT405/60.

A copy of the relevant title (OT405/60) is contained within Appendix D.

2.4 Allocation Sought

2.4.1 Primary Allocation

The applicant wishes to retain their primary allocation as a replacement permit and so the maximum rates of take being applied for are as summarised below. An assessment of the volumes of water required for irrigation purposes has been provided later in this report and is based on recommendations from Aqualinc, 2017[4], with a further allowance for stock drinking purposes, and conveyance to account for use of the race at the point of take on Neds Creek that is used year-round.

Year-round abstraction is proposed to continue with an annual limit proposed to ensure that water cannot be taken at the maximum instantaneous rate continuously. Although it is noted that even though the current permit has no annual limits, abstraction was not excessive. No monthly limit is proposed on the winter supply as it is

[4] McIndoe I, Brown P, Rajanayaka C, K.C. B, 2017, Guidelines for Reasonable Irrigation Water Requirements in the Otago Region. Otago Regional Council, 2. Aqualinc Research Limited

important that the applicants can store water during the winter months. A monthly limit would inhibit this efficient use of water.

The volumes for winter volumes proposed represents the pattern of taking that has been occurring and therefore the historic abstraction reported in Section 2.3.4 includes winter water flows. The applicant invested heavily in storage so that their water use is the most efficient during summer when low flows are occurring.

Primary allocation will be subject to two residual flows, a summer and winter residual flow as proposed for Chatto Creek Confluence monitoring site by the Chatto Creek Catchment Group. This is discussed further in Section 5.1.

2.4.2 Supplementary Allocation

The applicant is seeking a new water permit to authorise supplementary allocation from Neds Creek. An assessment of available water as supplementary allocation has been completed and discussed further in Section 5.2.

This supplementary allocation is designed to enable the applicant to take water for filling storage so that stored water can be used to irrigation current and proposed irrigation areas. This proposed supplementary allocation represents the pattern of taking that has been occurring, as like taking flows in water, higher flows have historically been utilised for filling storage, and therefore the historic abstraction reported in the table in section 2.3.4 includes some flows accessed outside of the irrigation season when flows are high. In future the applicant wishes to retain the ability to access higher flows for augmented stored water and seeks to authorise this as supplementary allocation.

The applicant has invested heavily in storage so that their water use is the most efficient it can be for use during summer when low flows are occurring. The volumes sought for supplementary allocation are summarised in the below table.

An assessment of reliable winter water has been completed for the Chatto Creek users, as several users have existing winter flow allocations or are seeking these as part of their applications for replacement of deemed permits (see Appendix E). A common supplementary minimum flow based at the Chatto Creek monitoring site will ensure flows in the Chatto Creek catchment of which Neds Creek discharges to, are maintained. This is further discussed in Section 5.2.

No monthly limit is proposed on the supplementary water permit as it is important that the applicant can store water in months when flows are higher, so that they may use this water more efficiently during the irrigation season. A monthly limit would inhibit this efficient use of water and limit the applicant's ability to take water when flows are higher if successive high flow events occur within a month, which frequently occurs.

2.4.3 Summary – Allocations Sought

The table below summaries allocations sought as replacement primary allocation, and a new supplementary allocation. Table 9 also includes allowance for stock drinking water and conveyance baseflow in the race.

Table 9: Proposed Abstraction Volumes.

	Rate of take and annual volumes as applied for by the applicant		
	Rate of Take l/s	**Monthly (m^3)**	**Annual (m^3)**
Irrigation Requirements			
Current irrigation - Required (per Aqualinc calcs 100%ile) 531.6 ha		791,943 m^3/month	4,472,058 m^3/year
Future irrigation - Required (per Aqualinc calcs 100%ile) 439.0 ha		669,820 m^3/month	3,776,590 m^3/year
TOTAL irrigation - current and future 970.7 ha		1,461,763 m^3/month	8,248,647 m^3/year
Other Requirements			
Stock Drinking Water	1.1 l/s	4,699 m^3/month	56,393 m^3/year
Race Baseflow	13.9 l/s	36,509 m^3/month	438,110 m^3/year
Allocations Sought			
Total primary allocation *Sought as replacement (historic maximum + conveyance + stock water)*	138.8 l/s	386,626 m^3/month	3,794,441 m^3/year
Supplementary take *Sought as new water.*	138.8 l/s	Nil	4,454,206 m^3/year *Equivalent to primary allocation shortfall, plus Aqualinc 100%ile irrigation volume for 439ha new irrigation*
Proposed management of flows [5]			
Primary allocation residual flow	15 l/s at point of take year-round		
Supplementary allocation residual flow	330 l/s at Chatto Creek confluence with Manuherekia River 6 m^3/s at Manuherekia Campground flow monitoring site		
1 October to 30 April point at which water abstraction ceases	100 l/s at Chatto Creek confluence with Manuherekia River		
1 May to 30 September point at which water abstraction ceases	250 l/s at Chatto Creek confluence with Manuherekia River		

[5] Hickey & Olsen. (October 2020). Assessment of Environmental Effects of water abstraction from the Chatto Creek Catchment.

3. DESCRIPTION OF EXISTING ENVIRONMENT

3.1 Land Use, Topography and Geology

The Chatto Creek catchment consistent of tall tussock grassland and low producing grassland in the headwaters at elevations above 600m above mean sea level (amsl), and the dominant land cover in the valley floor and river terraces is high producing grassland. Irrigation is widespread throughout the flat areas of the lower catchment. At the applicant property consistent primary of low producing grassland with pockets of high producing grassland where irrigation has provided improved pastures. Above 500m amsl the applicant's property consists of low producing grassland and above 900m amsl tall tussock grassland.

The applicant's irrigation command area is located at the foothills of the Dunstan Range between the foothills at 500 meters amsl, and Chatto Creek at 300 meters amsl.

The upper reaches of Neds Creek flow from the Dunstan Range through a steep, catchment, before flowing out onto the Manuherekia Valley, where the gradient is markedly lower. This transition from the steep valley of the upper catchment to the low gradient of the valley floor coincides with the Dunstan Fault, which runs along the eastern edge of the Dunstan Ranges. To the west of the Dunstan Fault, the basement rocks are schist, while to the east the valley floor is dominated by deposits of lacusturine clay, silt and oil shale with minor lignite seams, quartz sand and conglomerate with patches of quaternary outwash gravels of various ages.

3.2 Climate

The climate in the Omakau area can be described as a typical Central Otago semi-arid landscape and the area is subject to characteristically hot dry summers and cold winters, with mean average rainfall around 450-500 mm/year according to GrowOtago. An Aqualinc rainfall category of 450 or 550 mm/year has been applied to the property and the water use efficiency calculations. Mean annual rainfall for the irrigation areas is mostly between 500 – 600 mm, with irrigable areas closer to Chatto Creek experiencing less mean annual recharge/rainfall of between 400 – 500 mm; 120.9ha classified as 450mm/year and 849.8ha classified as 550mm/year.

The ORC's GrowOtago maps[6] categorizes median evapotranspiration potential for the period the September to April. For the general area between along Moutere Disputed Spur Road, potential evapotranspiration is 106-115mm September to October at the beginning of the irrigation season, 226-250mm November to December, 191-205 January to February, and 76-85mm at the end of the irrigation season March to April. These potential

[6] growOtago: accessed 18 December 2020. https://maps.orc.govt.nz/OtagoMaps/

evapotranspiration rates show that water loss to evapotranspiration during the irrigation season is most acute for the period November to February.

3.2.1 Climate Change

Bodecker Scientific prepared a report[7] for the Central Otago District (COD) on climate change implications. The report describes the projected changes in key climate indices. In summary, this modelling work for worst case scenario climate change projections shows shifts for some of the key indicators relevant to irrigation and farming:

Temperature - Overall, the COD is projected to become warmer over the course of this century with an increase in the annual highest daily maximum temperatures. The area around Omakau is likely to experience 17.8-21.3 more summer days where temperatures exceed 25 degrees Celsius by the end of the century under the worst-case scenario modelling. The highest maximum temperature reached in the district by the middle of this century is projected to be between 1.6 and 2.6 degrees Celsius higher than in 2000-2009 reference period, and will likely increase by up to 5.8 degrees Celsius by the end of this century under the worst-case scenario model. The projected changes in the annual maximum temperatures are more pronounced than the changes in the annual minima of daily maximum temperatures, as lowest maximum temperature reached by the middle of this century is projected to increase by 0.2 to 0.4 degrees Celsius in the Manuherekia region.

Seasonality – For Alexandra (nearest relevant reference point), under the high emissions scenario modelling, the maximum temperature reached in summer and spring increases by about 4-5 degrees Celsius by the end of this century compared to the start of the century, while autumn and winter will reach maximum temperatures that are about 3.8 degrees Celsius higher.

Frosts – 11-13 less frost days per year by the mid-century and 35-40 by the end of the century.

Precipitation – While the largest decreases in precipitation are projected to occur in the east of the COD region by the end of this century, near Ranfurly, the western areas and central around Alexandra and Omakau may experience small increases in total annual precipitation. Overall, total annual precipitation is projected to increase by between 42 and 190 mm (on average) for the western areas of the district and the Alexandra/Cromwell regions; with a statistically significant increase in total annual precipitation over the Manuherekia area. An increase in precipitation intensity of between 0.1 and 0.8 mm/day is projected for most of the COD for the worst-case model scenario for the end of the century. For the COD

[7] Cameron, C., and Kremser, S., Lewis, J., Bodeker, G., and Conway, J. (2019). The past, present and future climate of Central Otago: Implications for the District. Prepared by Bodeker Scientific for the Central Otago District Council.

there is a great deal of spatial variability in daily rainfall across the district.

Dry spells – The model simulations of climate change scenarios do not project statistically significantly changes in the length of the dry and wet spells by the end of the century for all emissions scenarios for the Central Otago district.

Snow cover - Climate change is likely to have a large impact on mountain snowpack in Central Otago. Very little snowpack and resultant water storage will remain on the top of the mountain ranges within the Central Otago district by the end of this century under the worse-case scenario modelling, with earlier onset of melt by the end of this century. The peak snow-covered area is projected to reduce by approximately 20% across the COD under the worst-case scenario modelling. The snow cover duration is likely to reduce but is particularly pronounced towards the east where the Manuherekia Catchment is situated. With warming conditions, snowmelt is expected to occur earlier in the season (mid-July compared to beginning of August). Climate change will lead to substantial increases in streamflow during winter and declines in summer driven by increasing winter precipitation and a reduction in snow storage.

The implications for farmers and irrigation are generally as follows:

- Climate change is expected to quicken the set-in speed and intensity of droughts.
- Increasing temperatures, combined with changes in rainfall patterns and a dwindling snowpack, are more likely than not to increase the risk of drought.
- Change in snowpack affects snow melt that helps to moisten the soil each spring and promote plant growth. A depletion in the total snowpack may contribute to drier landscapes, and higher drought or wildfire risk. Furthermore, climate change will lead to substantial increases in streamflow during winter and declines in summer, driven by increasing winter precipitation and a reduction in snow storage.

3.3 Soils and Profile Available Water

A detailed map of the soils (from SMap (Landcare Research/Manaaki Whenua, 2019)) within the current and proposed irrigation area is attached in Appendix A. The soils present are summarised in Table 10 below.

Most of the current irrigable land area is made up of Tiroiti, Waengamott, Waenga, and Patearoag soils.

Table 10: Soil Type Summary (Source: S-Map[8]).

Soil Type	PAW[1]	Area of Property (ha)	Types of Irrigation	Soil Description
Clare	51mm	13.3	Pivot & Moveable	Clare soils are well drained with a moderately stony topsoil and sandy texture.
Flaxton	94 - 123 mm	82.2	Pivot, Moveable, Overland	Flaxton soils are poorly drained soils with a stoneless topsoil, with loam texture.
Germ	71	38	Pivot, Moveable, Overland	German soils are moderately well drained with a moderately stony topsoil and sandy texture.
Lauder	54mm	0.7	Pivot & Moveable	Lauder soils are moderately deep imperfectly drained soils with a stoneless topsoil. Soils characterised by silty loam over clay textures.
Lindis	54-64mm	48.9	Pivot & Moveable	Lindis soils are imperfectly drained with a slightly stony topsoil and loam texture.
Omeloam	66	13.4	Pivot, Moveable, Overland	Omeloam soils are well drained with a slightly stony topsoil and loam texture
Patearoag	98-103mm	188.6	Pivot, Moveable, Overland	Patearog soils are poorly drained with a moderately stony topsoil and a silt texture.
Ranfurly	123mm	59.9	Pivot, Moveable, Overland	Ranfurly soils are moderately deep, with a stoneless topsoil, and loam texture.
Rangitata	52.9mm	4.2	Moveable	Rangitata soils are very shallow moderately well drained soils with a moderately stony topsoil, and a sandy loam texture.
Tiro	59.7	219.2	Pivot, Moveable, Overland	Tiroiti soils are shallow moderately well drained soils with a stoneless topsoil and silt over clay texture.
Waenga	71.7	150.7	Pivot, Moveable, Overland	Waenga soils are shallow moderately well drained with a moderately stony topsoil and loam texture.
Waengamott	95.3	151.7	Pivot, Moveable, Overland	Waengamott soils are shallow imperfectly drained sols with a slightly stony topsoil and silt texture.

3.4 Surface Water Hydrology

The applicants private water rights and abstraction from Neds Creek services only their own irrigation areas. The applicant's property and irrigation area is split by a number of a smaller gullies and tributaries of Chatto Creek, namely Horse Gully, Chimney Gully, and Swampy Gully, and Neds Creek and Buster Creek that run generally from the Dunstan Range north to south and meet Chatto Creek which runs through the southern end of the applicants property flowing from the north-east to the south (Figure 12).

[8] https://smap.landcareresearch.co.nz/maps-and-tools/app/

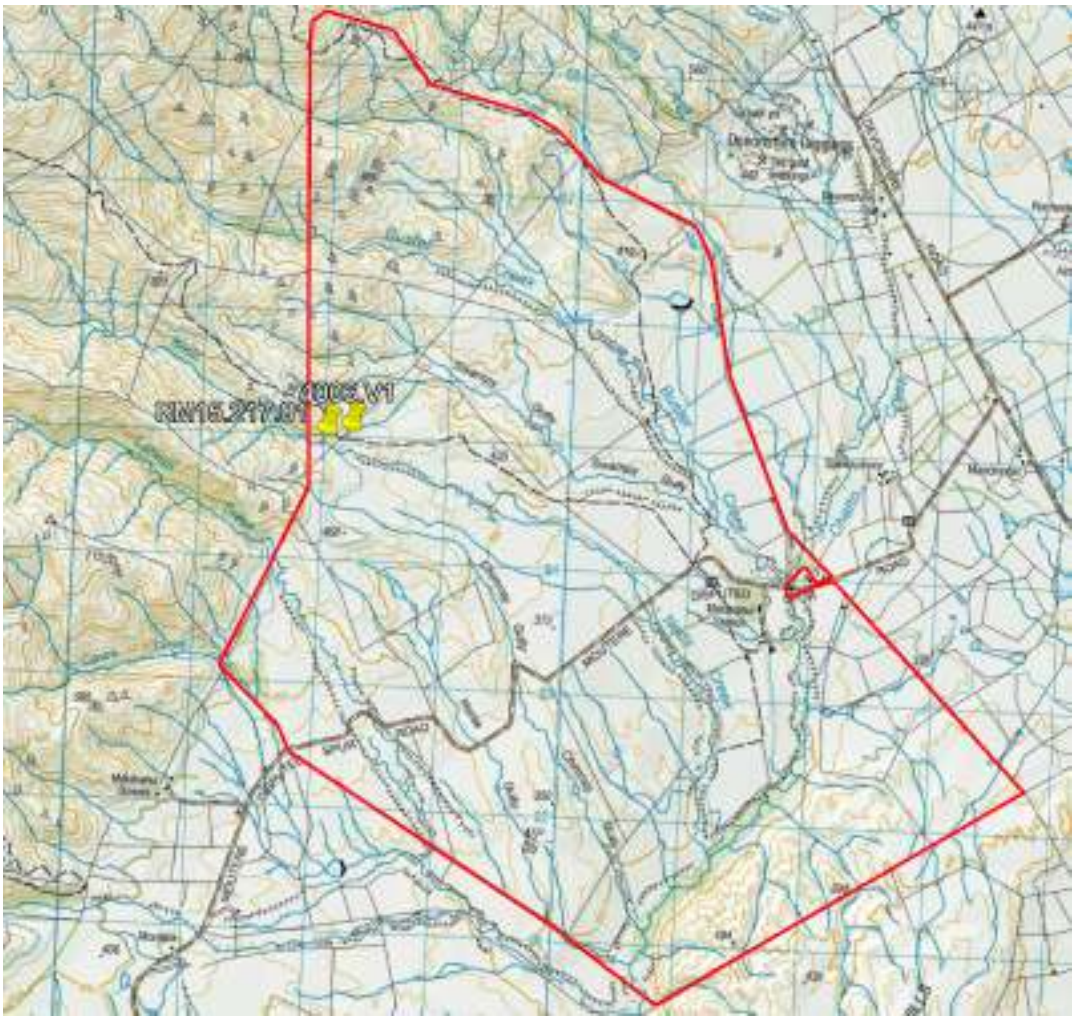


Figure 12: Location of surface waterways on applicant's property. Note property boundary approx. only.

3.4.1 Existing Abstraction and Intakes

Deemed Permits 4006 and 4005[9] were granted without conditions, and no residual flows were imposed on their operation. Historically, when the two permits were operated together, the intakes were restricted by the maximum rates of take imposed on each permit. The upper abstraction (4006) had the greater abstraction (300,000 l/hour) and the lower abstraction point (4005) had the lower rate of take (200,000 /hr). The restriction on the permits meant that at the upper take, not all of the water in the Creek was able to be taken when flows were greater than 300,000 l/hr. When the applicant was sharing flows between each take, then it was advantageous for them to use the creek to convey water down to the irrigation areas of 4005 and therefore the

[9] Refer to section 2.3.1. Deemed Permit 4005 now Water Permit RM15.217.01.

creek between each take point was never let to go dry.

Further to this, the Creek has provided a stock drinking water supply to parts of the property that have access to Neds Creek. Since the transfer of 4005 to the take point for 4006 (now permits 4006.V1 and RM15.217.01) the applicant has maintained a 15 l/s residual in Neds Creek below the current take point. This is a condition of consent on RM15.217.01. During the entire operation of the permits it is likely that there was always flow at least between each point of take. Abstraction did not exclude fish passage or habitat.

3.4.2 Neds Creek Hydrology

Neds Creek has a steep catchment and originates at or about 1,606 m above sea level on the eastern ridge of the Dunstan Range. The catchment area above the proposed site of abstraction has been estimated to be approximately 890 ha with annual median rainfall of between 451 mm to 500 mm. Chatto Creek discharges to the Manuherekia River approximately 10 km downstream of the Neds Creek and Chatto Creek confluence.

Neds Creek at the point of take is approx. 2-3m wide, and depth various based on gravels, and amount of flow in the water. The creek above and below the point of take is very similar in nature; less water depth below the point of take when abstraction is occurring. The banks are grassed, with some woody vegetation.

Neds Creek has had a continuous flow data recorded located upstream of the applicant's intake since 2013:

1. Neds Creek upstream Matakanui Station intake (2014-2019) unverified; and
2. Neds Creek upstream Matakanui Station intake (2019-current) verified.

A full characterisation of the hydrology in Neds Creek as it relates to the flow monitoring site is appended to the Chatto Creek AEE report contained in Appendix F.

The natural flow pattern above the abstraction point is not augmented by any human processes. Downstream flows over the past few years have been influenced by the applicant's own abstraction, and their historic down stream abstraction (4005) which was transferred to the take point for 4006.V1. Permit 4005 authorised abstraction at or about NZMS 260 G41: 337-662 and was transferred approximately 2 km upstream to NZTM 2000: E1321981 N5004937 (current take point) in 2015.

Flow statistics for Neds Creek have been calculated from flow monitoring records from upstream of the applicant's abstraction point (Figure 13). This monitoring site was once managed by the applicant from 2014 to December 2019, and thereon has been managed by the ORC. The monitoring site is approximately 20m upstream from the point of take and is therefore representative of flows at the point of take.

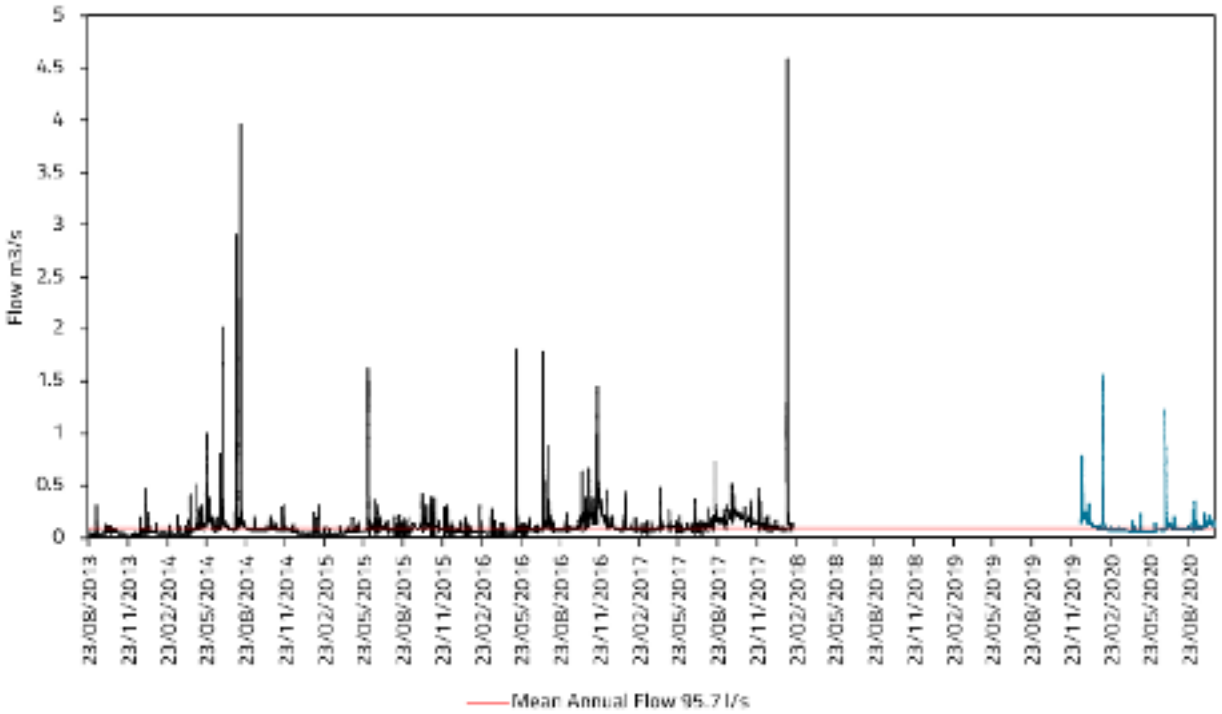


Figure 13: Neds Creek flow for the upstream of Matakanui Station point of take. Black is the earlier record 2013-2018, and blue newer record from new recorder site that was installed December 2019. Red line is mean flow as calculated from full record.

In the Chatto Creek Assessment of Environmental Effect report (referred to throughout at Chatto Creek AEE) prepared by Water Resource Management Ltd and Freestone Freshwater Ltd (Appendix F), the natural 7-day MALF estimate for Neds Creek at the point of take for 4006.V1 and RM15.217.01 is 53 l/s.

Mean flow as calculated from the full record is 95.7 l/s (Figure 13).

A broader description of the catchment hydrology and Chatto Creek is discussed in the appended Chatto Creek AEE report (Appendix F).

The site at Neds Creek is now gauged (for verification/certification purposes) once every two months, or more frequently when required, such as during a high flow or low flow events.

Neds Creek is largely an unmodified natural state from the headwaters to the confluence with Chatto Creek. With the single abstraction 5.5km upstream from the Chatto Creek confluence.

In the height of summer/irrigation season Neds Creek has experienced low flows.

3.4.3 Water Quality

As outlined in the Chatto Creek AEE (Appendix F), a review of data available for Chatto Creek on water quality state was undertaken. Ammoniacal nitrogen, dissolved reactive phosphorus and nitrate-nitrite nitrogen (NNN) were measured fortnightly in Chatto Creek between 8 September 2009 and 8 September 2010 and monthly ammoniacal nitrogen, DRP, Escherichia coli, NNN and turbidity between 27 October 2016 and 27 September 2017. The available water quality data are insufficient to allow trend analysis for the Chatto Creek catchment. The report included in Appendix F looked at each water quality variable and compared these to the water quality limits/targets (Schedule 15) contained in the Regional Plan: Water (RPW) (Schedule 15; Receiving Water Group 2; Table 5) as well as the National Objective Framework (NOF) contained in the National Policy Statement for Freshwater Management (NPS-FM).

In summary, nitrate-nitrate nitrogen and ammoniacal concentrations are above toxic levels for aquatic life (both Attribute State A) and DRP concentrations are moderate and still above toxic level although are Attribute State C. If other conditions also favour eutrophication, DRP concentrations in the C-band may be associated with an increased risk of enhanced algal and plant growth, loss of sensitive macroinvertebrate taxa, and higher respiration and decay rates.

E. coli levels at times have exceeded levels for primary and secondary contact. Of the twelve *E. coli* readings over the October 2016 – September 2017 period, two values exceeded 550 cfu/100 mL and a further two values exceeded 260 cfu/100 mL. Most of these high values occurred over the period January-March, while the other occurred in late October. The timing of these high values coincided with the irrigation season. The available data for Chatto Creek falls well short of these requirements, so it is not possible to compare data for either site on Chatto Creek with the NOF attribute table for *E. coli.* Comparison to Schedule 15 is also limited due to a lack of *E. coli* data for this site.

Turbidity readings are available for the period 27 October 2016 – 27 September 2017 (n=12). The median turbidity over this period is 2.9 NTU and the 95th percentile was 5.9 NTU. Chatto Creek is classified as having a cool-dry climate (CD), hill source (H), and hard sedimentary geology (HS). This means that Chatto Creek is in Suspended Sediment Class 3 for comparison with the Suspended Sediment attribute table in the NOF (Table 23 of Appendix 2C of the NPSFM). ORC do not have clarity data for Chatto Creek, meaning that it is not possible to formally assess the compliance of this site with the suspended sediment attribute. The report (Appendix F) estimated the median value for a one-year period for Chatto Creek was 2.9 m, which would place this site in the B-band of the NPS-FM NOF.

The report concludes:

> *The water quality observed in Chatto Creek in the study of ORC (2006) and more recent water quality sampling*

reflects the dominance of flood irrigation methods within the Chatto Creek catchment. The conversion of irrigation from flood to spray methods is expected to result in significant improvements to water quality in the Chatto Creek catchment, with substantial reductions in phosphorus, sediment and microbial contamination anticipated.

Neds Creek discharges to Chatto Creek, and therefore is it expected the water quality of Chatto Creek is indicative of upstream water quality of the headwater catchment, although lower concentrations of nutrient and bacterial contaminants is expected given the relevantly pristine headwaters of Ned's Creek and the applicant being the primary land owner.

The applicant has been collecting water quality data from Neds Creek and Chatto Creek since October 2017 and has collected data at a regular interval since. Data collection is ongoing, with the inclusion of MCI index scoring for aquatic invertebrates taking place in 2020/2021.

Samples are collected from the upstream property boundary, just upstream of Moutere Disputed Spur Road, from the downstream property boundary on Chatto Creek, and from Neds Creek near the confluence with Chatto Creek (Figure 14).

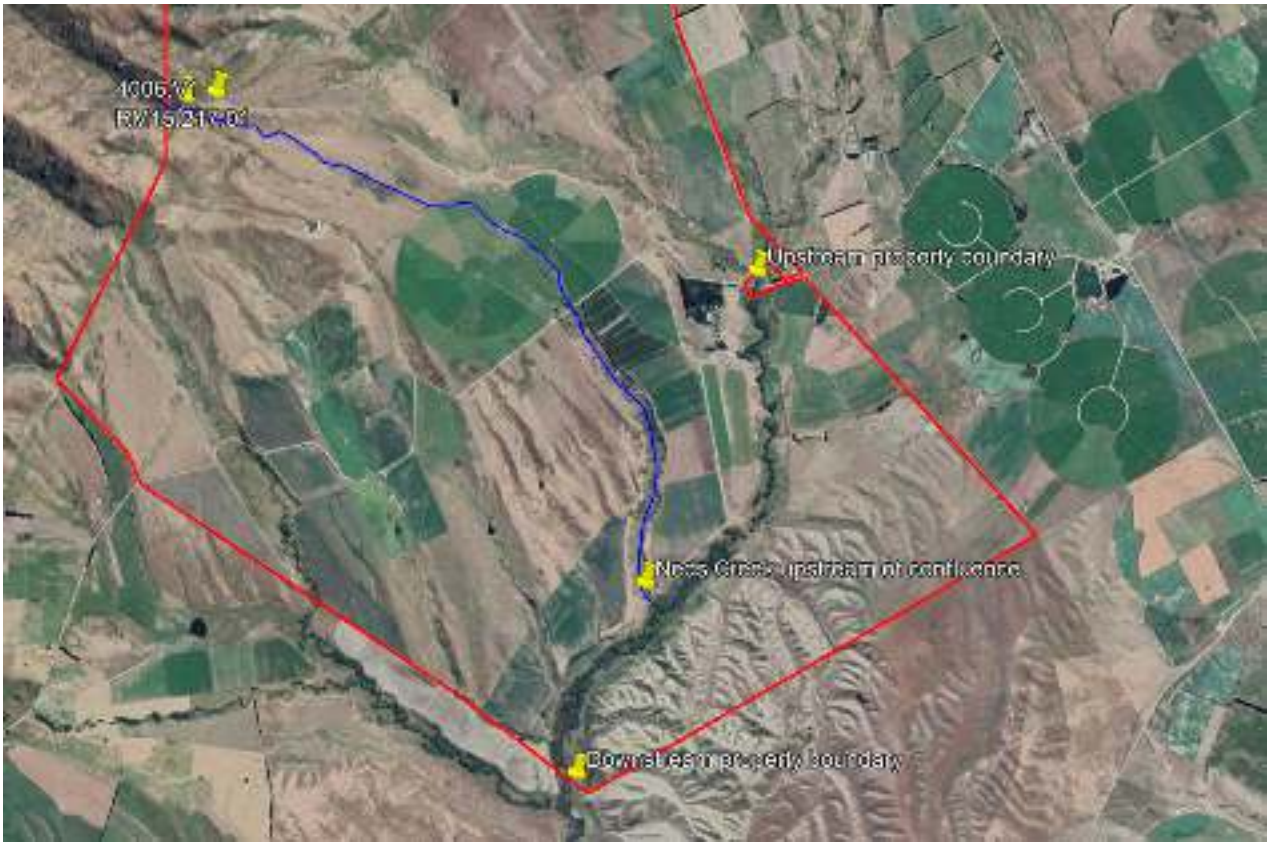


Figure 14: Matakanui Station water quality sampling sites on Chatto Creek and Neds Creek.

For the sampling period February 2019 – June 2020 the following results have been collated for the relevant attributes with current or proposed limits set out under the NPSFM.

The results indicate that the quality of Neds Creek is good and generally meets all limits in the RWP Schedule 15 and the national bottom lines (NBL) under the NPSFM (2020), with only nitrate-nitrite-nitrogen (NNN) being above the Schedule 15 limit within the RWP, noting that the RWP limit for NNN is less than the NPSFM (2020) national bottom line for nitrate-nitrogen. As like described above, *E. Coli* levels are likely to not meet standards, although the volume of data to assess the frequency of exceedances is not available.

Comparing the Neds Creek data here, to the Chatto Creek data collected by the applicant, the Neds Creek at confluence site has consistently lower concentration of E. coli, DRP, and Turbidity, and similar concentrations of NNN and ammoniacal nitrogen to Chatto Creek. The water quality of the downstream of property boundary site suggests there is no concentration effect on any water quality variable, and generally an improvement in water quality of Chatto Creek along the Matakanui Station property boundary compared to water quality at the upstream of property boundary monitoring site.

See Tables 11 and 12 below. The data and annual medians reported in these tables applies to the 2019/2020 irrigation season, and includes recent samples collected on the 10 December 2020 as the applicant continues to sample with 2020/2021 season.

Table 11: Water quality results collected by Matakanui Station for Chatto Creek 2019-2020.

Water Quality Variable	Chatto Creek @ Upstream Property Boundary	Chatto Creek @ Downstream Property Boundary	NPS-FW 2020 (NOF) NBL [1]	NOF Band	Schedule 15 limits Otago RWP
Nitrate/Nitrite-Nitrogen [1] (mg/L)	0.220	0.171	NOF limit ≤1; above NBL	A	RWP limit 0.075; does not limit
Ammoniacal Nitrogen (mg/L)	0.03	0.02	NOF limit ≤ 0.03; above NBL	A	RWP limit 0.1; meets limit
E.coli MPN/100 mL	461	205	NOF >130; likely below NBL	Likely C-D	RWP limit 260 CFU/100ml; likely meets limit
Dissolved Reactive Phosphate-P [2] (mg/L)	0.017	0.019	NOF > 0.010 and ≤ 0.018; above NBL	C	RWP limit 0.01 mg/L; likely meets limit
Turbidity (NTU)	4.8	2.9	/	/	RWP limit 5NTU; meets limit

Table 12: Water quality results collected by Matakanui Station for Neds Creek 2019-2020.

Water Quality Variable	Neds Creek U/S of Chatto Creek Confluence	NPS-FW 2020 (NOF) NBL [1]	NOF Band	Schedule 15 limits Otago RWP
Nitrate/Nitrite-Nitrogen [1] (mg/L)	0.213	NOF limit >≤1; above NBL	A	RWP limit 0.075; does not meet limit
Ammoniacal Nitrogen (mg/L)	0.03	NOF limit ≤ 0.03; above NBL	A	RWP limit 0.1; meets limit
E. coli MPN/100 mL	172	NOF >130; likely below NBL	Likely C-D	RWP limit 260 CFU/100ml; likely meets limit
Dissolved Reactive Phosphate-P [4] (mg/L)	0.013	NOF > 0.010 and ≤ 0.018 ; above NBL	C	RWP limit 0.01 mg/L; likely meets limit
Turbidity (NTU)	3.1	/	/	<5NTU; meets RWP limit

*Nitrate/Nitrite-Nitrogen mg/L is reported as no nitrate-N data only is reported, and Nitrate/Nitrite-Nitrogen mg/L in aerobic environments is assumed to be equivalent to nitrate-N.

[1] Threshold based on annual median for NPS-FW National Objective Framework (NOF) attributes requiring limits; NBL – National Bottom Line.

[2] DRP remains only proposed and is not currently including within the NPS-FW (2020). Scheduled for review 2021. NBL referred to in table are from 2019 notified version of NPS-FW.

3.5 Existing Values

The values for Neds Creek have been summarised in the sections below from various sources. Values identified below are either compulsory values as detailed within Appendix 1A of the NPS-FM 2020 or other values that must be considered (Appendix 1B of the same document).

Compulsory values include, ecosystem health, human contact, threatened species and mahinga kai. Other values include, natural form and character, drinking water supply, wai tapu, transport and tauranga waka, fishing, power generation, animal drinking water, irrigation, cultivation and production of food and beverages and commercial and industrial use.

3.5.1 Instream Values

Neds Creek is not specifically identified in Schedule 1A of the Regional Plan: Water for Otago (RPW). However, Chatto Creek, which Neds Creek is a tributary of, is identified in Schedule 1A of the RPW as containing the following values:

- Boulder bed composition of importance to resident biota.
- Absence of aquatic pest plants identified in the Pest Plant Management Strategy for the Otago Region.
- Presence of significant fish spawning areas.
- Presence of riparian vegetation of significance to aquatic habitats.
- Presence of indigenous fish species threatened with extinction.
- Significant presence of trout and eel.
- Significant habitat for roundhead galaxiid.

This schedule is now considered out of date, as it was based on information at the time the RPW was notified in 1998. The following commentary on recent fish surveys outlines the instream values of Neds Creek, and the Chatto Creek Catchment where relevant.

Sample sites on Chatto Creek have historically returned findings of Upland Bully, Central Otago Roundhead Galaxias, and Brown Trout (according to the New Zealand Freshwater Fish Database). Unpublished data from the Department of Conservation has noted however that the majority of populations of Central Otago Roundhead galaxias discovered in the period 1996-2006 within the Manuherekia Valley have now disappeared. The population in Lahey's Creek (tributary of Chatto Creek) is to be managed by an upstream permit holder (Moutere Airdrie Water Company) who take and manage water abstraction from Lahey's Creek to Young Hill Creek. A controlled residual flow near to the known habitat and ongoing adaptive management of the site is to occur so that introduction of brown trout to that refuge does not occur. Lahey's Creek is largely located within the Matakanui Station property (albeit Matakanui do not take water from Lahey's Creek).

In 2003, the NZ freshwater fish database records the presence of a few Central Otago Roundhead Galaxias, brown trout, upland bully and Koaro in a stretch of Chatto Creek between the Neds Creek and Middle Creek confluences with Chatto Creek.

The applicant undertook a fish survey in September 2015 as part of providing further information to ORC in relation to RM15.217. Three 50 m stretches of Neds Creek were electro-fished. These sites were spaced approximately 1 km apart with the upmost survey site 100 m above the current take point, see Figure 15 below. The middle site was halfway between the current and historic take point (4005) and 100 m above the applicant's old take point at 4005. The lowest site was a further 1km downstream. Brown trout were captured at all three sites (see attached ecological report – Appendix G). There were 46 brown trout captured at the top site, 21 at the middle site and 1 at the site just above the old permit intake location (4005). Ross Dungey also surveyed a length of the Neds Creek race, 3 brown trout were found within the race. Fish density (assuming 50% of fish were caught by electro-fishing methods) was estimated at between 0.68 to 0.04 fish/m^2 from the top site to the bottom site surveyed. Invertebrates were noted at each site surveyed and a visual assessment was undertaken. Mayfly and stonefly were abundant at the top site (above all abstraction), and mayfly diversity decreased downstream. Annelid and Caddis occurrence increased at the downstream survey site when compared to the upstream. Whilst no macrophytes of noticeable algal growths were present, the invertebrate population indicated healthy periphyton levels in Neds Creek.

In 2018 the ORC carried out presence or absence surveys in Neds Creek, and brown trout were observed at the point of take on Neds Creek. These surveys also identified that Neds Creek provides pool, run, riffle, rapid, and cascade habitat types. See Appendix H for results of 2018 survey.

Anecdotally, eels have been observed in Chatto Creek as it runs through the applicant's property, and in Devonshire Creek. This highlights the existing values associated to the irrigation system and infrastructure present on the property.

There are no know records of galaxiids in Neds Creek.

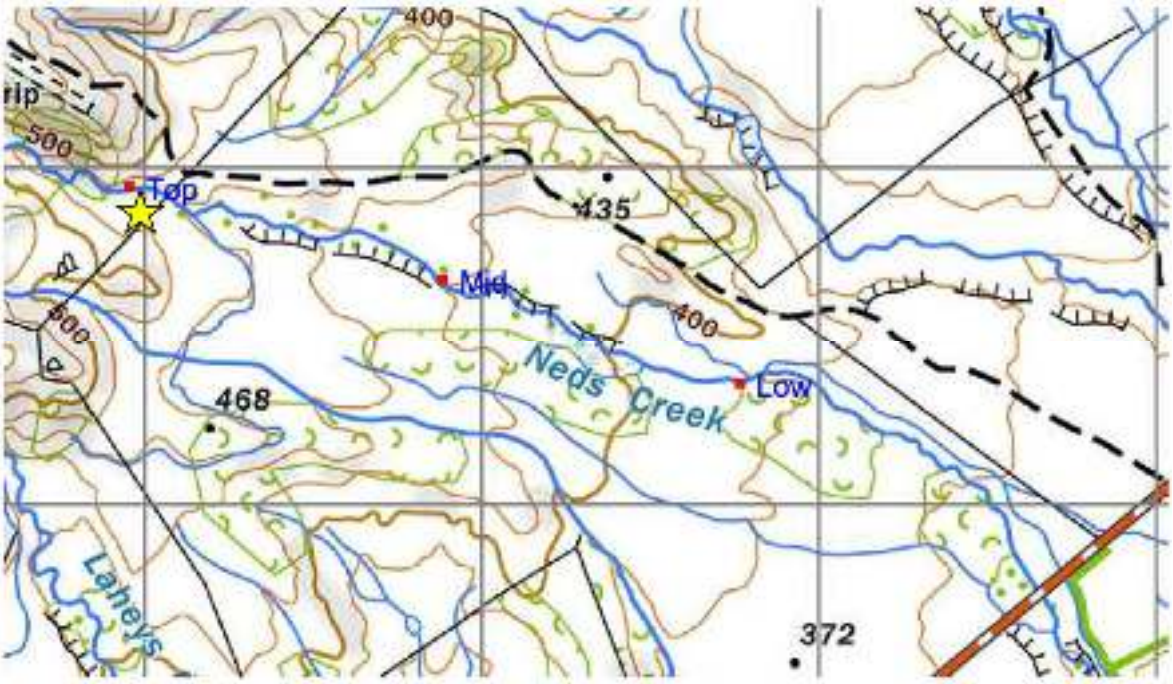


Figure 15: Location of fish surveys completed in 2015. Top, middle, and lower sites. Point of take is approximately located at the top survey site (yellow star).

The trout population above the applicant's present-day intake is noted by Ross Dungey (Attachment F) as "in very good order" indicative of high-quality water and habitat. The brown trout population above all abstraction is likely self-sustaining, and the maximum attainable size restricts their suitability as an angling resource. *'Low summer flows in the stream reaches closer to Chatto Creek confluence and in Chatto Creek, probably largely preclude this resident population making a contribution to the Manuherekia River fishery, except perhaps in periods of unusually high rainfall.'* – R. Dungey[10].

This ecological report attached, whilst in relation to the transfer of permit application RM15.217.01 specifically is included in this application as these fish surveys are not recorded in the NZ Freshwater Fish Database and provides some commentary around the habitat and species present in Neds Creek.

A fish survey in Neds Creek above the applicant's intake in 2018 confirmed the presence of trout, there were no downstream Neds Creek survey sites at the time of that survey undertaken. There were 25 brown trout found at this location, and this survey was undertaken by Ross Dungey, as part of work commissioned by the Otago Regional Council. This survey was undertaken in April 2015.

[10] Neds Creek Fish Survey. Report to Mr A. Paterson, Matakanui Station, C/- Martell Letica, Landpro. 2015. (copy contained within Attachment F)

While there is a known habitat of Central Otago Roundhead Galaxiid in Lahey's Creek on the applicants own property, galaxias were not found in Neds Creek. These were the only fish surveys undertaken in Neds Creek specifically, and it is not considered that further fish surveys of the same creek would reveal any further information that is not already known (i.e., the Creek currently supports trout habitat).

Most recent fish surveys in the Chatto Creek Catchment have found the presence of upland bully and trout only. It is unlikely (due to flows in Chatto Creek itself and due to the absence of trout barriers) that there are any other 'pockets' of galaxias in tributaries of Chatto Creek between Lahey's and Devonshire Creeks.

The instream structures that facilitated abstraction at 4005 in Neds Creek have not been removed as if they were, this would increase the risk of bank collapse and scour. The 2015 fish survey had not identified results suggesting that the structure is significantly preventing fish passage, and the 2018 ORC survey results do not indicate any obstruction of fish passage as trout are abundant upstream in Neds Creek near the applicants current upper most intake.

In 2015 there were 46 brown trout captured at the top site, in the 2018 survey there were 41 brown trout Appendix G). The results are similar suggesting there has been no change in the trout population since the 4005 transfer to the upstream site in 2015, and the 15 l/s residual flow is providing sufficient fish passage year-round.

The Manuherekia River downstream of Falls Dam is classified as a regionally significant rain-fed river as per the Otago Sports Fish and Game Management Plan for Otago Fish and Game Regional Council (2015). In 2007, the River was surveyed to have supported 2074 angler fishing days, but this applies to the entire length of the Manuherekia River and does not distinguish between lower, mid, and upper reaches. The Manuherekia River (below Falls Dam) is classified as a rural recreational fishery, on the recreational opportunities spectrum. Overall, the length of the Manuherekia River below Falls Dam is classified as a regionally important trout fishery, with a rural recreational opportunity setting, and a range of users (local, regional, junior and commercial). Although, given the higher back country value of the stretch above Falls Dam, it's most likely that the higher values and angler days are experienced in the upper reaches as opposed to the lower reaches (such as commercial users). Activities include fly, spin and bait fishing, and hunting values.

According to previous consultation with Nigel Paragreen of Fish and Game, Chatto Creek is speculated to be a locally significant trout fishery given its flow contribution and spawning values contributing to the regionally significant values of the Manuherekia River. This is not formally documented in the Sports Fish and Game Management Plan. However, as per Ross Dungey's assessment in Attachment F, this resident population of trout are unlikely to contribute to the regional fishery value of the Manuherekia River, or even Chatto Creek.

There are no known conservation interests in any of the legal parcels subject to this application, and no areas of

marginal strip.

The Chatto Creek AEE (Appendix F) reports on the Kitto (2011)[11] study and presents the results of macroinvertebrate sampling at sites in the Manuherekia catchment, including a site in Chatto Creek surveyed in December 2010. The macroinvertebrate community at the Chatto Creek site was dominated by EPT_8 taxa, with EPT taxa representing approximately 55% of taxa. High scores indicate clean water quality and high habitat quality (MCI > 120, QMCI > 6), while low scores indicate poor water and/or habitat quality (MCI < 80, QMCI < 4). The MCI (~90) for the Chatto Creek site was indicative of fair water and/or habitat quality, while the QMCI (6.00) score for this site was consistent with good-excellent water and habitat quality (Kitto 2011).

3.5.2 Schedule 1B, 1C and 1D Values

Schedule 1B identifies water takes used for public supply purposes (current at the time the RPW was notified in 1998), while Schedule 1C identifies registered historic places which occur in, on, under or over the beds or margins of lakes and rivers. There are no Schedule 1B and 1C values in the RPW listed in close proximity to the proposed activities. The Ophir and Omakau drinking registered water supply is significantly downstream of the proposal. There are no registered historic places in the area of the proposed take locations under this schedule nor are there sites of significance noted on Central Otago District Plan Map 53. Whilst there are no historic places registered, the property holds historic mining and irrigation values supported by the presence of deemed permits at this site. Pastoral farming on this property has occurred since the mid 1800's and the continuation of those values would support the historic value of the land.

Schedule 1D identifies the spiritual and cultural beliefs, values and uses associated with water bodies of significance to Kai Tahu. Manuherekia Tributaries are identified as having the following values:

- **Kaitiakitanga** – the exercise of guardianship by Kai Tahu including the ethic of stewardship;
- **Mauri** – life force;
- **Waahi tapu and/or Waiwhakaheke** – sacred places; sites, areas and values associated with water bodies that hold spiritual values of importance to Kai Tahu;
- **Waahi taoka** – treasured resource; values, sites and resources that are valued;
- **Mahika kai** – places where food is procured or produced;
- **Kohanga** – important nursery/spawning areas for native fisheries and/or breeding grounds for birds;
- **Trails** – sites and water bodies which formed part of traditional routes, including tauraka waka (landing place for canoes); and

[11] Kitto J (2011). Water quality and ecosystem health in the Manuherekia catchment. Otago Regional Council, Dunedin.

- **Cultural materials** – water bodies that are sources of traditional weaving materials (such as raupo and paru) and rongoa (medicines).

Neither Neds Creek nor Chatto Creek are specifically listed in this schedule, however, tributaries of the Manuherekia River are identified collectively as having the values listed as follows;

Mana Interests:

- Kaitiakitanga – the exercise of guardianship by Kai Tahu in accordance with tikanga Maori
- Mauri – life force of water bodies
- Waahi tapu and/or Waiwhakawheke – sacred places, sites, areas and values associated with water bodies that hold spiritual values of importance to Kai Tahu
- Waahi taoka – treasured resources

Access/Customary Use Interests:

- Mahika kai – places where food is procured or produced
- Kohanga – important nursery/spawning areas for native fisheries and/or breeding grounds for birds
- Trails – sites and water bodies that formed part of traditional routes
- Cultural materials – water bodies that are sources of traditional weaving materials and medicines

3.5.3 Natural Character and Amenity

Neds Creek was observed as containing a fairly clear silt, cobble, and gravel bottomed bed with little aquatic weed. There is very little riparian habitat at this intake location or downstream of it. Below Moutere Disputed Spur Road, Neds Creek riparian margin supports a few Willow trees. Chatto Creek riparian margins are dense with willows upstream and downstream of the Neds Creek confluence.

Above the applicant's intake there is native scrubland (Matagouri and coprosma) cover through to the tussock covered slopes of the headwaters. The section of Neds Creek below the applicants intake is a meandering stream in a relatively deeply incised (approximately 1 m deep) channel flowing through grazed pasture.

3.5.4 Recreational Values

The ORC recently released the 'Manuherekia values and aspirations' report[12], which is summary report describing the values and aspirations held by mana whenua, local community and stakeholders for the Manuherekia Rohe. The report was informed by community consultations in 2016 and 2019, the 2017 KTKO cultural values report[13],

[12] Otago Regional Council. May 2020. Freshwater Management Values and Aspirations for the Manuherekia Rohe.

[13] KTKO Consultancy Ltd. 2017. Cultural values report for the Manuherekia Catchment Proposed Plan Change5C to Regional Plan: Water for Otago.

community proposition developed by the Manuherekia Catchment Water Strategy Group in 2013 and discussions with the Manuherekia Reference Group[14].

Within the report, swimming and kayaking were identified as valued pursuits, but not site-specific reaches where these activities mostly occur. Whilst 'fishing' was identified as a valued recreation under 'cultural values' and that people would like to continue fishing in the future. Dunstan Creek is noted as backcountry value.

The size of Neds Creek (1 m deep) and that it is largely inaccessible to the public (on private land) limits the possibility of sustained recreational pursuits from Neds Creek.

Specific recreational pursuits include swimming, kayaking, boating, fishing, which are also limited due to the size of Neds Creek. The presence of trout in Neds Creek is not so significant to support high value trout fishing opportunities, and the maximum attainable size of this resident population of brown trout above abstraction limits their suitability as an angling population. Chatto Creek is not listed in the Otago Sports Fish and Game Management Plan (2015)[15].

The Chatto Creek riparian margins are choked with willows on either bank, which typically reduces angling amenity and angler's preference of these locations (the inverse of high valued trout fisheries as documented in the Otago Sports Fish and Game Management Plan (2015).

The abstraction itself directly supports a game bird population on Matakanui Station, with ducks inhabiting the applicant's Neds Creek storage reservoirs. These values will only be enhanced with the future construction of additional storage pond as planned. Other recreational pursuits able to be supported by the property include hunter access to hill country areas, where deer populations are able to be controlled by hunters. The applicant would not be able to sustain good quality hunting, if insufficient feed was able to be grown on the flats to support stock off the hill country, which opens up that land for hunters to access.

3.6 Groundwater

There is a proposed Manuherekia Groundwater Management Zone specified for where the applicant's property is located, however the abstraction activities are located outside of the proposed groundwater management zone. This zone is not currently over allocated. Groundwater levels are typically shallow across the zone, which is thought to reflect the presence of a shallow clay pan. Limited groundwater exploration has occurred in the zone

[14] The MRG has representatives from Department of Conservation, Forest and Bird, Central Otago District Council, Fish and Game, the Central Otago Environmental Society and irrigators.

[15] Approved Otago Sports Fish Game Management Plan 2015-2025 - page 62.

which also reflects the low yield from the bores that have been drilled.

Groundwater flow patterns are not well defined, but given the structure of the areas, surrounded by low permeability basement strata, flow directions are likely to be generally towards the Manuherekia River. Very little groundwater use occurs in the zone, although there is some groundwater use for domestic and stock supplies. However, there are few examples of bores accessing sufficient yield for larger supplies.

3.7 Regional Significant Wetlands

There are no Regionally Significant Wetlands or known regionally significant wetland values in the vicinity of the proposed activities. The closest Regionally Significant Wetland is the Rockdale Inland Saline Wetland Management Area, which is located adjacent to State Highway 85 just north of Chatto Creek.

The applicant has identified areas for potential rehabilitation of wetland like areas on the property. These areas are not identified as regional significant, but part of the rehabilitation will see wetland values enhanced in these areas.

3.8 Public Access

Public access to Neds Creek as it relates to the applicant property is restricted by private land. Chatto Creek recreational areas allows for public access near the State Highway near the Chatto Creek Tavern, where there is an old walking bridge.

4. ACTIVITY CLASSIFICATION

Table 13: Summary of Activity classification for Matakanui Station Activities.

Activity Description	Permitted Rule Breached	Relevant Rule	Classification
To take and use water from Neds Creek (replacement of RM15.127.01 & 4006.V1)	10A.3.1.1	10A.3.2	Non-complying
	12.1.2.5	12.1.4.5	Restricted Discretionary
To take and use water as further supplementary from Neds Creek	12.1.2.5	12.1.4.7	Restricted Discretionary
To retake water from the Neds Creek Race	12.1.2.3	12.1.4.1	Restricted Discretionary
To retake water from dams	12.1.2.3	12.1.4.1	Restricted Discretionary
To dam water	12.3.2.1	12.3.4.1	Discretionary
Instream works required as part of maintenance or re-instatement or a water take		13.5.1.1 and 13.5.1.2	Permitted
Bywash water below water storage dam		12.C.1.1 & 12.C.1.2	Permitted

4.1 Activity Status

4.1.1 Take and Use Water - Operative RWP

Surface water abstractions are covered by rules in the Regional Plan: Water for Otago. Rule 12.1.2.5 of the Regional Plan: Water for Otago permits the taking of surface water but limits the maximum abstraction volume that can be taken to 25,000 L/day/landholding. As the applicants seek to renew a water take that has a greater quantity of water than this, water permits are required.

An application for the replacement of a permit that authorised the taking of water as primary allocation in the Manuherekia Catchment downstream of Ophir granted before 28 February 1998, is a **restricted discretionary activity** under Rule 12.1.4.5 of the RPW. The matters restricted for discretion are set out in Rule 12.1.4.8 of the RPW.

The replacement of both 4006.V1 and RM15.217.01 are considered restricted discretionary activities under Rule 12.1.4.5 of the RPW, because both permits hold primary allocation status and are downstream of Ophir.

The re-take of water from the Neds Creek Race and from the dams on the property are considered restricted discretionary under Rule 12.1.4.1.

4.1.2 Take Water as Supplementary Allocation – Operative RWP

Rule 12.1.4.7 applies to the application to take water as supplementary allocation from Neds Creek. Taking and use of surface water as supplementary allocation in any catchment other than a Schedule 2B catchment is considered under Rule 12.1.4.7 as a **restricted discretionary** activity.

A minimum flow will be applied to the supplementary allocation on Neds Creek which is not less than either:

(a) 50% of the natural flow at the point of take; or
(b) The natural mean flow at the point of take.

The taking and use of surface water under Rule 12.1.4.7 is also subject to Rule 12.1.4.9. The matters to which the Otago Regional Council has restricted the exercise of its discretion are set out in Rule 12.1.4.8.

4.1.3 Take and Use Water – proposed Plan Change 7

Rule 10A.3.1.1 applies to the application as 4006.V1 is a deemed permit, and RM15.217.01 is a water permit due to expire prior to 31 December 2025. The applicants seek a consent term of 35 years and therefore the conditions required for a controlled activity under Rule 10A.3.1(i) and (ii) cannot be met. The take and use of water is therefore considered **non-complying** under Rule 10A.3.2.1.

4.1.4 Diversion or Damming of Water

There are no diversions requiring consent.

The applicant is seeking a water permit to dam water. There are 3 dams on the property that require consent. The initial takes of water are covered by the application made here to replace permits 4006.V1 and RM15.217.01, or are associated with the OAIC's application being made on behalf of the company and scheme users, for the water that is delivered to the property by the County and Main OAIC schemes. The applicant is seeking authorising for the retakes from the dams as described in Section 2.3.3.

Dam 2 (Figure 2) does not require consent as it meets the permitted activity criteria and is included for transparency only as this dam provides stock water.

Consents to dam is required for dams 1, 3, and 4 in Figure 2.

Dams 1, 3, and 4 require consent as they are equal to or greater than 20,000 m^3.

These storage dams meet all of the permitted criteria under Rule 12.3.2.1(a) of the RPW except (b) because the total storage volume is >20,000m^3 in dams/ponds 1, 2 and 4 (Figure 2). As such, the damming of water is a

discretionary activity under Rule 12.3.4.1(i) of the RPW.

No building consent is needed.

4.2 Associated Activities

In accordance with Schedule 4 of the RMA, an application must describe and demonstrate compliance with any permitted activity that is part of the proposal and describe any other resource consents required for the proposal to which an application(s) relates.

4.2.1 Stock Drinking

The water taken for stock drinking purposes are in accordance with the provisions of Section 14 of the Resource Management Act 1991 (RMA), permitting the take and use of water for the reasonable needs of an individual's animals for stock drinking.

The total stock drinking requirements from Neds Creek (assuming all stock within that supply area at one time) is estimated at 155,000 l/day, which exceeds the permitted volume of 25,000 l/day (Rule 12.1.2.1); 56,544 m^3/year. Further to this, as the take is conveyed via open race, there will be water that is taken at the same time to 'drive' the stock water down the race. As the stock drinking water component is not able to be separated from the irrigation component and that it is recorded through the same water meter, take and use of water for stock water purposes is applied to be consented, despite the provisions under S14 of the RMA.

4.2.2 Instream Works

Instream works required as part of the general maintenance or re-instatement of a water intake may occur as a permitted activity under Rule 13.5.1.1, and instream works associated with storm events are permitted under Rule 13.5.1.2. So long as the applicant complies with the conditions of these rules, no resource consent is required to authorise these activities. These rules and conditions are outlined in 13 below.

Table 14: Summary of instream bed disturbance rules.

Rule 13.5.1.1	Rule 13.5.1.2
The disturbance of the bed of any lake or river, or any Regionally Significant Wetland, and any resulting discharge or deposition of bed material associated with: … (iii) The maintenance or reinstatement of a water intake, in order to enable the exercise of a lawful take of water, is a permitted activity, providing:	The disturbance of the bed of any river for the purpose of clearing any material that has accumulated as a result of a storm event, excluding alluvium, in order to maintain the flood carrying capacity of the bed of the river, and any resulting discharge or deposition of bed material, is a permitted activity, providing:
(a) Except in the case of the demolition or removal of a structure, the structure is lawfully established; and (b) There is no increase in the scale of the existing structure; and (c) If work is undertaken between 1 May and 30 September inclusive, the Department of Conservation and the relevant Fish and Game Council will be notified as soon as reasonably practicable in advance; and (d) The bed or wetland disturbance is limited to the extent necessary to undertake the work; and (e) The bed or wetland disturbance does not cause any flooding or erosion; and (f) The time necessary to carry out and complete the whole of the work within the wetted bed of the lake or river does not exceed 10 hours in duration; and (g) All reasonable steps are taken to minimise the release of sediment to the lake or river during the disturbance, and there is no conspicuous change in the colour or visual clarity of the water body beyond a distance of 200 metres downstream of the disturbance; and (h) No lawful take of water is adversely affected as a result of the bed or wetland disturbance; and (i) The site is left tidy following completion of the activity	(a) The bed disturbance is limited to the extent necessary to clear the debris; and (b) The bed disturbance does not cause any flooding or erosion; and (c) The time necessary to carry out and complete the whole of the work within the wetted bed does not exceed 10 hours in duration; and (d) All reasonable steps are taken to minimise the release of sediment to the lake or river during the activity, and there is no conspicuous change in the colour or visual clarity of the water body beyond a distance of 200 metres downstream of the disturbance; and (e) No lawful take of water is adversely affected as a result of the bed disturbance; and (f) The site is left tidy following completion of the activity.

4.2.3 Instream Structures

Under Rule 13.1.1.1 of the Otago Regional Plan: Water, the use of any structure that is fixed in the bed of any river is a permitted activity, as described below:

Rule 13.1.1.1:
The use of any structure that is fixed in, on, under, or over the bed of any lake or river, or any Regionally Significant Wetland, is a permitted activity, providing:

- *(a) The structure is lawfully established; and*
- *(b) In the case of a change in use, the effects of the new use of the structure are the same or similar in character, intensity and scale as the preceding use; and*
- *(c) Measures are taken to avoid animal waste entering the lake, river or Regionally Significant Wetland; and*
- *(d) The structure is maintained in good repair.*

The existing rock embankment in Neds Creek was constructed at the time the take was established. As the rock embankment facilitates the abstraction at this intake (enables pooling to drive water down the sluice gate), it is a lawful part of the existing intake. Furthermore, the rock embankment does not dam the Creek, and a residual flow can easily pass. The embankment is not known to cause any flooding.

The structures are checked at least once annually, and debris cleared from the structures. The scale and intensity of the existing use will not change as a result of the proposal.

With respect to the culvert immediately upstream of the intake, this is also a permitted activity in accordance with Rule 13.2.1.7B.

Rule 13.2.1.7B:
Unless covered by Rule 13.2.1.7 or 13.2.1.7A, the erection or placement of any crossing in or on the bed of a lake or river, or any Regionally Significant Wetland, is a permitted activity, providing:

- *(a) The crossing, or its erection or placement, does not cause any flooding, nor cause erosion of the bed or banks of the lake, river or Regionally Significant Wetland, or property damage; and*
- *(b) The top of the crossing is no higher than:*
- *(c) 2 metres above the lowest part of the bed where it is located; or*
- *(d) 3.5 metres above the lowest part of the bed where it is located, if the catchment upstream of the crossing is 50 hectares or less in area and there is a culvert with a minimum diameter of 1.2 metres (or equivalent cross-sectional area); and*
- *(e) No more than 24 metres of crossing occurs on any 250 metre stretch of any lake or river, with a minimum separation distance between any two crossings in or on the same lake or river of 12 metres; and*
- *(f) There is no reduction in the flood conveyance of the lake, river or Regionally Significant Wetland; and*

(g) *The crossing and any ancillary structures are stable under flood conditions, and secured against bed erosion and debris loading; and*

(h) *Fish passage is retained; and*

(i) *Movement of bed material is not impeded; and*

(j) *Where the crossing is intended for use by stock, measures are taken to avoid animal waste entering the lake, river or Regionally Significant Wetland; and*

(k) *If the crossing is situated over or on public land, then public access over the public land is maintained.*

The existing culvert has a diameter of 800-900 mm, is no higher than 2 m above the lowest part of the bed where it is located and there are no other crossings within 250 m of this culvert. The culvert has not restricted flood conveyance and is stable under high flow/flood conditions. Fish passage is not impeded by the culvert, as the culvert is buried below the natural bed of the Creek. The crossing is entirely located on private land and stock do not typically utilise this crossing for access to different parts of the property.

4.2.4 Discharges

The rules relevant to discharges include:

- *Rule 12.C.1.1: Discharge of water or contaminants to water; and*
- *Rule 12.C.1.2: The discharge of water or any contaminant from the source water body through: (i) A water race; or (ii) A dam;*

The proposal complies with all the relevant current permitted activity requirements. Any discharges to land associated with farming activities are permitted until April 2026, and the applicant intends to prepare a farm environmental management plan (or equivalent) in future.

Rules 12.C.1.1 and 12.C.1.2 currently apply. To clarify the interpretation of these Rules, a conspicuous change in visual clarity is defined in the RPW as *a visual change in water clarity of more than 40%.*

The discharges of water from the Matakanui Station race are considered to be discharges of water to water and will comply with the conditions of Rules 12.C.1.1 and 12.C.1.2. This is because, the discharges do not result in or flooding, erosion or land instability; water is discharged back to the source waterbody; and does not result in a conspicuous change in colour or visual clarity or a noticeable increase in local sedimentation.

Given that the race and conveyance infrastructure are cleared and maintained regularly, and that stock have limited access to these parts of the network, and they follow a very gentle gradient it is very unlikely that the discharges would ever result in the activity to be non-compliant with the conditions of Rules 12.C.1.1 and 12.C.1.2. The appropriately sized controls on water into the race (gate for flow restriction on race), and bywash

channels from storage dams (concrete, gravel channel or pipe as shown in figures above) ensures that the discharge does not result in flooding, erosion, land instability of property damage.

Likewise, any bywash from the race/pipe between when the applicants are not taking for the purpose of irrigation are permitted activities. This is because any collection of flood or rainfall waters in the race discharged via bywashes or at the end of the race occur at times when flows in the receiving waterbody is high. During these times, the state of the receiving waterbodies and the water in the races will be of similar quality and as such will be unlikely to result in a visual change in water quality of more than 40%. Therefore, these types of discharges during rainfall events are permitted activities and meet the conditions of Rules 12.C.1.1 and 12.C.1.2.

Discharge of contaminants:

The ORC is reviewing its approach to water quality and has prepared Proposed Plan Change 8 (Discharge Management) to the RPW (PC8). PC8 has been called in by the Minister for the Environment and has been notified by the Environmental Protection Authority.

The operative RPW contains several permitted activity rules relating to water quality. PC6AA postponed certain discharge Rules from 2020 to 2026. Rule 12.C.1.1 permits the discharge of water or any contaminant to water, or onto or into land in circumstances which may result in a contaminant entering water, providing certain conditions are met. These conditions include avoidance of indicators of an adverse effect on water quality such as odours, a conspicuous change in colour or clarity as well as flooding, erosion and whether there is a discharge from one catchment to another. This rule is not proposed to be changed by PC8.

Discharges via a water race:

Rule 12.C.1.1A (when it applies) requires a discharge activity to meet the Schedule 16 water quality limits at all times. The discharge activities must comply with this rule in order to be permitted activities in future. Whilst the applicant applies for a long consent term for the other permits sought (which would overlap with the implementation of Rule 12.C.1.1A), the rule is likely to be superseded by a new Water and Land Plan by that time.

Consent is not required for discharges from the scheme as the rule does not currently apply. We do however note that with infrastructure and efficiency upgrades over time any bywashes from the scheme are now more controlled and therefore there is some certainty that the discharges in particular from the storage system is likely to maintain compliance with permitted activity thresholds. Cattle are unable to graze the berm of the races to reduce the potential for contaminants to enter the races and discharges/bywashes.

Discharges from a property:

Discharges from the applicant's property as a result of the use of water subject to this application are expected to comply with this permitted activity rule. Compliance is anticipated with good farm management practices such

as keeping stock out of natural waterways and identification of high-risk sediment pathways. In future the property will have and operate to a FEP (Farm Environment Plan) which will be focused on ensuring compliance with the water quality aspects of the relevant rules. There have been no discharges from the applicants' properties known to have resulted in flooding, erosion or property damage. Water is not discharged to another catchment by any of the applicants, as water remains within the Manuherekia catchment.

Animal waste system

PC8 has introduced new rules relating to animal waste systems including two permitted activity rules. There are no animal waste systems within any of the properties subject to this application.

Discharge of Nitrogen

Rule 12.C.1.3 permits the discharge of nitrogen unconditionally until April 2026, after which time nitrogen leaching limits apply, although this rule is likely to be superseded by a new Land and Water Plan by that time. Under Rule 12.C.1.3 the discharge of nitrogen by the users currently complies with this permitted activity rule.

4.2.5 Use and Maintenance of a Water Race

As the applicant utilises a water race entirely within their own property, no s417 certificate is required in this instance. General works associated with the use and maintenance of water races do not require consent.

4.2.6 Metering Exemptions

WEX0035 was applied for in 2012, as at the time the applicant was looking to install the water meter at the take point of 4006.V1 in Neds Creek, the installer was not confident that they would be able to achieve cell coverage for telemetry close to the take point. The metering exemption was applied for, and granted as a contingency, but was never required. As such WEX0035 may be cancelled by the consent authority (if that is possible). No exemption is required for the continued metering of water abstracted under the future replacement permit, as the measuring station is within 100 m of the take point from Neds Creek.

4.3 Bundling of Permits

Overall, the activities as applied for by the applicant will enable the continuation of the applicants own irrigation scheme and operation of the farm. The effects of taking and using water are different effects of the damming of water as applied for. In isolation the effects of the activities would not overlap as they occur at generally separate locations and under different conditions. However, without the taking and use of water the damming would not occur and therefore the activities themselves are triggered by each other.

The take and use of water under the RPW as primary and supplementary allocation is a restricted discretionary activity, the damming of water is a discretionary. Whilst the matters for restricted discretion are many, under PC7

the same activity to take and use water becomes non-complying. This is contrary to the intentions of the RPW for the replacement of existing permits.

If the bundling approach could be overly restrictive to the discretionary parts of the application, then those activities should not be bundled. All things considered however, as the activities themselves are inextricably linked the bundling approach would generally be applied and the most restrictive activity classification applied to the overall proposal.

5. ASSESSMENT OF ENVIRONMENTAL EFFECTS

In addition to the application being made in the prescribed forms and manner, Section 88 of the RMA also requires that every application for consent includes an assessment of the effects of the activity on the environment as set-out in Schedule 4 of the RMA. The following has been prepared according to Council's standard assessment approach and is therefore considered of a satisfactory state to fulfil the information requirements as specified under Clause 6 of Schedule 4 of the RMA.

An assessment of those matters over which council will restrict discretion as outlined in Section 12.1.4.8 of the RPW follows.

5.1 Water Take and Use as Primary Allocation

Two reports have been produced to assess the effects of the proposal. The first report is the 'Assessment of Environmental Effects of Water Abstraction from the Chatto Creek Catchment' prepared by Matt Hickey and Dean Olsen in 2020. That report is contained within Appendix F.

The report prepared by Matt Hickey and Dean Olsen utilised two key pieces of work focused on the hydrology of the Chatto Creek Catchment. One of those technical reports is appended to the report contained in Appendix F "Chatto Creek Headwater Catchments Flow Modelling" as Appendix 1 of that report. The other relevant report, "Summary of flow monitoring data collected at Neds Creek" is contained in Appendix I of this report.

The second report is the 2015 'Ecological Report' prepared by Ross Dungey that supported the previous 2015 consenting process but is still relevant to the current application. The purpose of that ecological report was to provide data on fish species present in that catchment. That report is contained within Appendix G. The ORC carried out an additional survey in 2018, those results are contained in Appendix H.

5.1.1 Allocation and Historical Water Access

Policy 6.4.2 of the RPW as it specifically relates to this proposal defines ***primary allocation*** as the greater of:

a) *That specified in Schedule 2A, but where no limit is specified in Schedule 2A, 50% of the 7-day mean annual low flow; or*

b) The sum of consented maximum instantaneous, or consented 7-day, takes of:

i. Surface water as at:…

(1) 19 February 2005 in the Welcome Creek catchment; or

(2) 7 July 2000 in the Waianakarua catchment; or

(3) 28 February 1998 in any other catchment; *and…*

This policy sets a limit for primary allocation for the taking of surface water. The proposal seeks to take water that is equal to the sum of the consented maximum instantaneous rate of take as at 28 February 1998.

The Manuherekia River catchment from mouth to headwaters has a primary allocation limit of 3,200 l/s as set in Schedule 2A of the RPW. Current consented quantities from this catchment exceeds the primary allocation limit set in Schedule 2A of the RPW. In accordance with (b)(i)(3) of this policy, a new consent granted for the same activity will retain primary allocation status because it is of a consented amount current as at 28 February 1998.

The proposal is for the renewal of an existing deemed permit and water permit to continue the existing take (138.8 L/s) and the use of water from Neds Creek. The water permit is for the same rate of take as the original deemed permit it replaced (4005) as was consented at 28 February 1998 therefore, the rate is available for allocation.

PPC7 introduced a new methodology for calculating allocation for applications that seek to replace deemed permits as controlled activities under Rule 10A.3.1.1. the methods for data analysis contained in Schedule 10A.4 are therefore irrelevant as the applicant seeks consent per Rule 10A.3.2 of PPC7.

The continuation of the existing take will not cause over-allocation of the Manuherekia Catchment under the RPW.

The historical records of abstraction (discussed in earlier section and contained in Appendix C) demonstrate that the consented maximum instantaneous rate of take has been accessed consistently almost every season for the years of record available. As such, no more than the historical abstraction record is proposed to be replaced which aligns the proposal with Policy 6.4.2A of the RPW.

The historical pattern of abstraction for Water Permit RM15.217.01 and Deemed Permit 4006.V1 has typically been an abstraction from October to April each year and winter abstractions have occurred such that water abstraction has been year-round, with a portion of the take being used to drive the water race in order to supply stock water year-round and fill storage dams.

In future the applicants propose to continue to take water year-round, this will not impact the allocation availability of Neds Creek, and the annual volumes sought are within the demonstrated historical abstraction record. The applicant proposes to replace the existing primary allocation and seeks new allocation as supplementary allocation to continue the practice of taking water to fill storage dams. The primary and supplementary allocations will enable the applicants to fill storage outside of the irrigation season and account for reduced reliability of supply during the irrigation season due to the higher summer flow limit to be imposed.

The volumes sought as replacement primary allocation are equal to what has been taken under the existing consents.

5.1.2 Effects on Hydrology

As noted in the Chatto Creek AEE [16] the hydrology of Chatto Creek is complex mainly because traditionally the water use in the catchment was border dyke and flood irrigation, but in recent times there has been a significant shift to spray irrigation methods. The high application rates associated with contour flood and border dyke irrigation means historically there has been significant return flows to Chatto Creek which has meant flows at the confluence have been higher than would be expected with the lack of existing residual flows and the current levels of allocation. Abstractions in the headwater catchment of Chatto Creek affect the natural hydrology in that they take water up to the consented limits and many of these takes are not currently subject to residual flow limits. Available flows for abstraction are driven almost entirely by natural flow fluctuations in flows.

The historic flow records for Neds Creek illustrate that some natural flow variability has been maintained across the year in Neds Creek, as not all of the water is taken all of time, and flow is always left in the creek. The existing 15 l/s residual flow maintained by the applicant can be maintained in future without significantly compromising the applicant's ability to irrigate. This has been substantiated by abstraction records. The abstraction records are relatively reliable, and the flow meter has been verified regularly. The 15 l/s residual flow is proposed to continue to be maintained by the applicant. This residual flow is in-line with the recommendation of Hickey and Olsen (2020) in the Chatto Creek AEE. Figure 16 demonstrates that there is generally always 15 l/s available to be left in the Neds Creek and this is therefore a suitable residual flow.

[16] Hickey & Olsen. (October 2020). Assessment of Environmental Effects of water abstraction from the Chatto Creek Catchment.

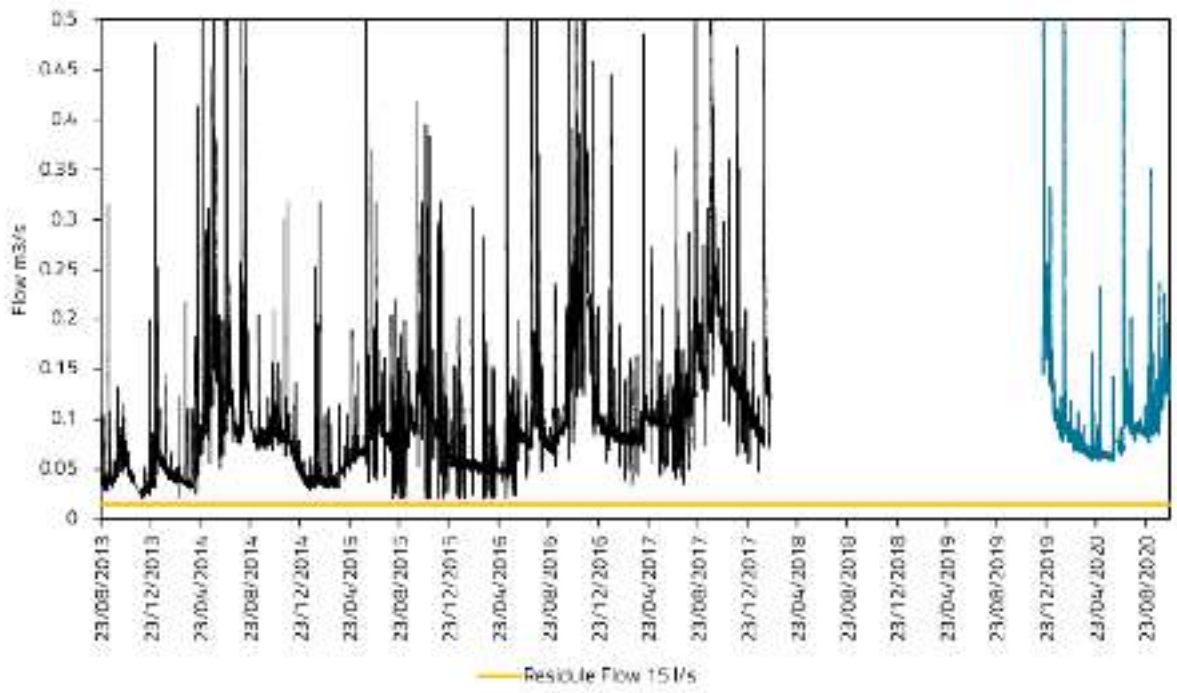


Figure 16: Full Neds Creek record capped at 0.5m^3/s for ease of viewing data, with 15 l/s residual flow.

The Chatto Creek Water Users group are also collectively proposing a residual flow for the lower Chatto Creek, to ensure flows going to the Manuherekia are managed. Implementing a residual flow in the lower Chatto Creek of 100 l/s from October to April. This will improve rearing habitat for juvenile brown and rainbow trout with >60% habitat retention and optimum habitat retention, respectively. Furthermore, this flow also provides 98% of habitat retention for upland bully and 67% habitat retention for longfin eels.

The residual flow is proposed as a condition of consent which binds the permit holder to collectively manage water abstraction and flows within the Chatto Creek Catchment with other users, and the wider Manuherekia Catchment.

Longitudinal gauging has determined that the Creek does not experience gains or losses throughout the length of the Creek and therefore there are no naturally drying reaches of Chatto Creek that may be adversely affected by the proposal (refer to Appendix F).

The proposed residual flows will benefit the Chatto Creek and wider Manuherekia River flows.

The catchment water sharing regime being developed means that there will be more flow in Chatto Creek for a greater length of the Creek than has been experienced under status quo conditions. Flows as low as 70 l/s can occur at the Chatto Creek confluence, and the proposed October-April 100 l/s residual flow in Chatto Creek is a significant improvement on those low flows currently observed.

5.1.2.1 Winter Water

The proposed residual flow conditions that relate to water users in the Chatto Creek catchment primary allocation takes will result in reduced surety of supply or access to water by permit holders during the irrigation season (1 October to 30th April). Historically, irrigation in the catchment has occurred as early as August as winters are very dry, will majority of precipitation falling as snow in the headwaters of the catchments and is locked up as snow and ice until spring, and as late as May in drought-like years. This is anticipated to result in a greater focus on accessing water for on-farm storage. As a result of this potential shift in accessing water it is important to have winter flow controls on takes. This will address the potential effects of increased taking of water during winter of water.

A winter residual flow of 250 l/s is recommended for Chatto Creek, which is optimum flow identified for trout spawning. This would apply to the period 1 May to 30 September.

The memo prepared by Water Resource Management Ltd (Appendix E) shows that flows recorded at the Chatto confluence site have always exceeded 254 l/s, with flows exceeding 580 l/s 90% of the time between May and Sept. With a winter residual flow of 250 l/s at the Chatto Creek confluence site there would be 330 l/s available 90% of the time between May and Sept on average for taking primary allocation as 'winter water'.

The current combined allocation on the Chatto Creek permits that can and do take water in the winter months are described below.

There is one existing permit that is authorised for take of solely winter water from 1 May to 30 September, Permit RM15.127.01 held by Ross Naylor. Furthermore, the OAIC and Matakanui permits that have no annual limits stipulated and have used primary allocation across the winter period for supplementing storage and early/late irrigation.

Table 15:Primary allocation winter water as authorised in Chatto Creek Catchment.

Permit	Primary allocation 'winter water'
RM15.127.01 – Ross Naylor	83.3 l/s 223,191 m^3/month 1,094,356 m^3/year 1 May to 30 September
OAIC Middle Creek & Coal Creek only	169.8 l/s
RM15.217.01 4006.V1 - Matakanui Station	138.8 l/s
TOTAL	391.9 l/s

It is not possible to distinguish if any water taken at OAIC point of take on Devonshire Creek is taken by OAIC in winter under permits 2001.716.V1, 2001.717.V2, 2001.718.V1 as there is joint metering with Ross Naylor who is authorised 1 May to 30 September. It is assumed all water taken in that period is Ross Naylor, and as Scotts Creek is not metered at the point of take, it is difficult to determine any water taken from Scotts Creek in winter that runs through the Devonshire Creek shared meter, however generally the Scotts Creek intake is shut off over winter.

The Chatto Creek AEE (Appendix F) identifies that up to 330 l/s is available in the winter months 90% of the time. Given that more than this is currently consented to be abstracted, the applicant and other Chatto Creek Catchment Water Users will need to share water in the winter to ensure that the residual flow of 250 l/s can be met at the Chatto Creek confluence with the Manuherekia River.

The winter residual flow of 250 l/s in Chatto Creek will ensure that the creek and wider catchment, including the subject creeks can still support higher flow hydrological functions and that the applicants can still take water (and the wider catchment) for filling storage.

5.1.2.2 Summary

The proposed residual flows do not represent 'flat-lining' of the creek. Flow variations and freshes are still anticipated to occur, with the applicant's maximum rate of take ensuring that those remain, allowing appropriate use of the primary allocation in summer and winter. Flow variability is recognised as a healthy attribute for a river system.

5.1.3 Effects on Instream Values

The instream values of Neds Creek are outlined in Section 3 and Appendix F and G. Native species found include Upland Bully, Central Otago Roundhead Galaxias, and Brown Trout. These values are existing and are supported under the existing flow regimes in Neds Creek.

Under the RPW a residual flow may be proposed and set at a point of take, for the purpose of providing for instream values and natural character of the source water body. An existing residual flow of 15 l/s applies to the applicant's water permit. This was volunteered by the applicant following extensive consultation with Fish and Game, and at the time of application to transfer permit 4005 Richard Allibone had advised Council that 15 l/s and the removal of the intake structure at 4005 would mitigate effects of the original transfer of take (and subsequent increased abstraction at an upstream location for both permits) on trout, in terms of habitat and passage.

The current abstraction is not significantly affecting the upstream self-sustaining resident population of brown trout in Neds Creek. The current flow conditions under which they have survived will be unaltered, and there is no significant gain to be had by an increased residual flow to Chatto Creek given that there is always connectivity

of the Creek between the applicant's intake and Chatto Creek (where a greater population would be expected to be found).

The attached ecological report from 2015 (Appendix G) concludes that abstraction has nil effect on in-stream ecology in the context of transferring the lower point of take to the upper site, this operation has been in place since authorised in 2015 and it is assumed the effects are the same, and still nil. The brown trout of the upper Neds Creek self-sustaining such that the maximum attainable size limits their suitability as an angling resource. Low summer flows in the stream reaches closer to the Chatto Creek confluence, and in Chatto Creek, probably largely preclude this population making any contribution to the Manuherekia fishery except perhaps in periods of unusually high rainfall.

Furthermore, a 100 l/s residual flow 1 October and 30 April and 250 l/s residual flow 1 May and 30 September is proposed by the Chatto Creek catchment group for the flow monitoring site located just upstream of the Manuherekia Confluence.

As outlined in the Chatto Creek AEE (Appendix F) a collective residual flow of 100 l/s at the Chatto Creek confluence site is expected to provide optimum habitat retention for CORGs. A residual flow of 100 l/s at the confluence also provides >60% habitat retention for large (>300mm) and small eels (<300mm) relative to habitat at the natural 7-day MALF. A residual flow in the lower Chatto Creek of 100 l/s will also provide >60% habitat retention for juvenile brown trout on Jowett & Richardson (2008). The 100 l/s residual flow will also provide >70% habitat retention for the abundant mayfly Deleatidium, >60% habitat retention for Pycnocentrodes.

The most appropriate location for the Neds Creek residual flow is immediately downstream of the applicant's intake. The most appropriate location for Chatto Creek is the existing flow monitoring site maintained by the ORC, that is on Chatto Creek upstream of the Manuherekia confluence, known as 'Chatto at Confluence'. This is the most appropriate residual flow location because, from a management perspective all upstream users can manage flows to achieve the residual flow proposed.

The take will also be subject to the respective downstream minimum flow on the Manuherekia River. Schedule 2A of the RPW outlines specific flow restrictions on the exercise of permits to take surface water. The minimum flow of the Manuherekia River is 820 L/s at Ophir, therefore at this flow all consented water takes, upstream of Ophir from the Manuherekia River and its tributaries are required to cease taking water. The applicant takes water from a tributary of Chatto Creek which discharges to the Manuherekia River at a point downstream of Ophir and therefore the existing water takes are not currently subject to the minimum flow restriction.

The Chatto Creek AEE states that the proposed regime operates on the expectation that all consent holders will maintain their individual residual flows at all times as well as the 100l/s at the Chatto Confluence flow site during

the irrigation season. The Chatto Creek users in the Chatto Creek Water Users Group have agreed in principle to operate co-operatively (as many of them already do) to maintain the residual flow at the Chatto Confluence site. Further to that, users on the Chatto Creek tributaries have agreed in principle to maintain residual flows as their current or future consents indicate (and where appropriate), which will improve habitat in local tributaries (if currently no residuals are imposed) and contribute some additional flows to Chatto Creek as well.

The proposed abstraction is unlikely to have any measurable effect on the four species of native fish in the Chatto Creek catchment. Of the four one is considered threatened (CORG) while another is a traditional mahinga kai species (longfin eel). Upland bully are common and relatively adapt to low flows while a single kōaro has been recorded. Introduced species, brown and rainbow trout are also found in the Chatto Creek catchment. It is expected that with the implementation of residual flows on all takes, along with a catchment specific sharing regime the ecological values of Chatto Creek will be provided for.

Whilst not a matter of restricted discretion, the applicant has been carrying out their own water quality monitoring to understand and assess any effects their operation may be having.

Instream works

If the applicants race and point of take is washed out, the applicant re-instates this as per the permitted activity rules as outlined above. Routine instream works occur as per the permitted activity rules of the RPW. The timing of routine instream works avoids spawning and therefore as the maintenance occurs as per the permitted activity rules the effects are expected to be acceptable and minor in nature.

Wetlands

No significant wetlands are located in near to the abstraction points and therefore it is considered that the proposal will not have any effect on wetland ecological values.

Fish Screens

Installation of a screen on the intake would add additional management pressures on the applicant as they would need to frequently inspect and presumably clear the screen of weed. A blocked screen could cause scouring or erosion of the stream bank at the intake location. Alternatively, given that the open race is to be maintained to the new storage pond/s, the applicant has instead installed a fish screen on the piped takes from the storage dam/s and ponds. This will avoid the adverse effects associated with entrapment of fish and given that the race terminates in a large water body, it is not considered that fish in the water race will result in an adverse effect on that resident population. A water race that terminates in a storage pond may not result in trout mortality. As the intake is presently unscreened, it could be said that the race and intake have no noticeable effect on the upstream trout population. The brown trout of upper Neds Creek are likely to be a self-sustaining resident population and the brown trout and invertebrate populations above the top site are in very good order. Exclusion of trout from

the race may affect the trout habitat as the reservoir/s habitat for trout will be unconnected to the riverine habitat.

Consequently, there is no need to prevent trout entering the intake, and alternatively, a fish screen on the piped take from the storage pond/s is proposed to avoid potential effects of entrapment of fish from the storage pond/s.

5.1.4 Effects on Recreational Values

Neds Creek is not a confirmed good trout fishery. The brown trout of upper Neds Creek are likely to be a self-sustaining resident population. Maximum attainable size limits their suitability as an angling resource. Low summer flows in the stream reaches closer to Chatto Creek confluence, and in Chatto Creek, probably largely preclude this population contributing to the Manuherekia fishery except perhaps in periods of unusually high rainfall.

In terms of swimming and kayaking values in the Manuherekia Catchment, increased flow in the summer from Chatto Creek will benefit the lower Manuherekia River swimming and recreational pursuits.

5.1.5 Effects on Natural Character and Amenity

The proposed flow limits are expected to maintain and enhance the existing amenity and natural character of Neds Creek and the wider Chatto Creek catchment.

The proposal for a residual flow on Neds Creek at the Chatto Creek confluence with the Manuherekia is expected to improved natural character in the lowest reaches of Chatto Creek. The proposed residuals will improve the ecological health of the Creek, provides for improved fish habitat and has potential to increase recreational opportunities in the lower reaches of Chatto Creek (where trout are likely to be more abundant).

The proposal will have no effect in riparian vegetation as no changes to the vegetation are proposed. The riparian zone of Neds Creek is largely inaccessible to the general public.

The natural character of the existing environment will be unchanged from that which is already consented to occur.

Intake infrastructure is already in place and no changes to the river character at the site are expected and effects will be less than minor. Effects on amenity values from the proposal are considered to be no more than minor. Recreational opportunities are limited at best and although the creek and surrounding areas could be considered to have aesthetic values, this perception will be limited by access to the property.

There are no features identified in Schedules 1B and 1C of the RPW that may be affected by the proposal.

5.1.6 Rate, Timing and Frequency of Water to be Taken and Used

The proposed rate of take is no more than current allocation, and no more than what has been demonstrated to occur historically. Therefore, the effects above the existing environment are nil.

Abstraction records are presented in Appendix C. The applicant is proposing to replace existing primary allocation and is seeking new water as a supplementary allocation. Water will continue to be mostly taken during the irrigation season, with opportunity to abstract water during periods of higher flows to fill storage and supply stock drinking water. The applicant proposes to take water at an instantaneous rate not exceeding 138.8 l/s for both primary and supplementary allocations as this represents the capacity of the system. Any noncompliance with the peak rate of take that is not accounted for as a metering margin of error or technical break down will be reported on by the applicants.

The maximum instantaneous rate of take proposed has been achieved under the current permits (Water Permit RM15.217.01 and Deemed Permit 4006.V1), and therefore there is unlikely to be any 'paper allocation' relevant to this permit. This proves that not only is the infrastructure capable of handling the peak volume abstracted, it has historically been available to the applicant who has used this water for the purposes outlined above (irrigation, stock drinking, water harvesting and operating the irrigation infrastructure).

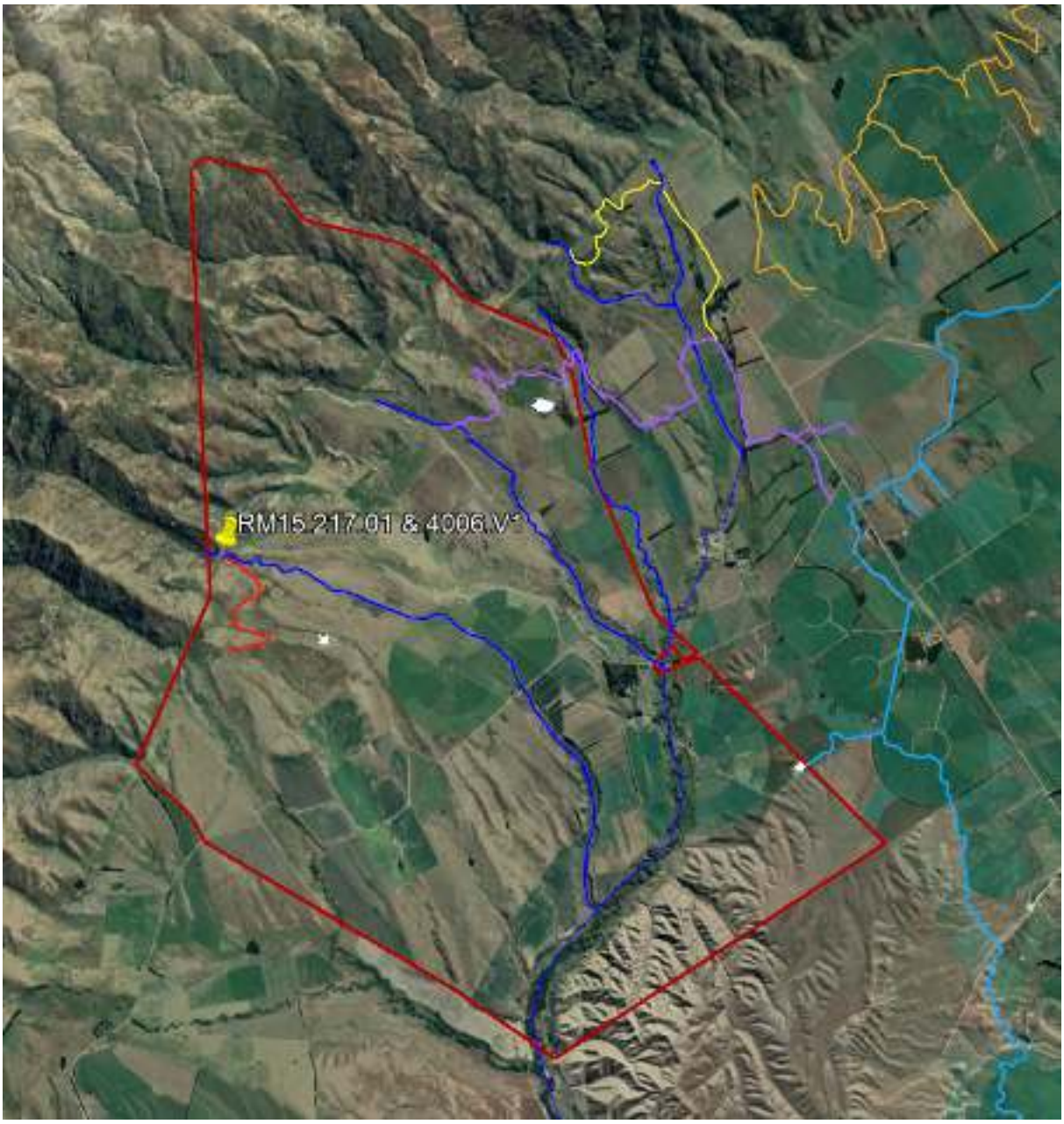
As a result of the residual flows proposed, surety of supply will be affected particularly during the lower flow times. However, in a good year the applicants should be able to take their full volume allocation when there is enough left in the creek past their intakes. As a result of the changes proposed by the Chatto Creek Catchment Water Users Group, in order to ensure that the farming operations supported by these takes are still somewhat viable it is imperative that the applicants are able to harvest flows outside of the irrigation season to fill new storage ponds that invariably will need to be constructed (at significant cost to the applicants).

Most of the annual volumes of water abstracted will be taken during the irrigation season.

5.1.7 Efficiency of Water Use and Take

The method of take of water from the Neds Creek is efficient as it utilises gravity which reduces the reliance on pumping methods and in turn the requirement for power at the site. The take utilises a culvert and rock embankment to control flow towards the applicants take point. The culvert restricts the flow that can enter the race. The race uses gravity to drive water towards the irrigation areas and/or storage dams which is the main delivery method, with a pipe network from dams continually being introduced as upgrades a completed. There are some areas of piped water conveyance beneath the irrigation areas on the property, such as pipes to the existing pivots.

The location of the applicant's race and OAIC's County and Main race's is shown in Figure 17 below. This delivery method is reasonably efficient for the intended use. The applicants don't experience significant race losses, although there will be some element of losses as are typical for this type of conveyance system. Installation of a pipe and piping the entire water race would be at a significant cost to the scheme users, and for no significant gain in efficient of water delivery. The cost to install a pipe is not commensurate to the effects associated with inefficient water conveyance. In the event that the costs for piping large lengths of the race becomes feasible then the applicants would investigate that option.



Map Legend:

- *Red – Race associated to RM15.217.01 & 4006.V1 managed by Matakanui Station Ltd (applicant) (Neds Creek)*
- *White – Matakanui station existing storage reservoirs*
- *Purple – County Race (Middle and Coal creeks)*
- *Yellow – Devonshire Race (Scotts and Devonshire creeks)*
- *Organise – Matakanui Race (Thompsons Catchment)*
- *Light Blue – Main Race (Manuherekia)*

Figure 17: Overview map of Matakanui Station property (approx. burgundy polygon) with creeks and race infrastructure.

Most of the existing water application method is already highly efficient, with spray irrigation currently making up *85 %* of total irrigable land area on-farm as applied for under this application, with little remaining flood irrigation that will be converted to spray methods in future, with one small area to remain, as the efficiency of the small14ha paddock bellow the County Race benefits from flood and delivers water to the storage pond. The applicant is not applying for a permit to replace overland irrigation land but is applying for permits that will give the applicant a 'bankable' opportunity to continue to convert to spray over time. The use of water for irrigation purposes will occur between 1 October and 30 April. Concentrating the use of irrigation water during the most appropriate timeframes ensures that the applicant is meeting best irrigation practice which avoids effects associated with flooding in winter and pugging of soils. Overall, the applicants intend to increase farm irrigation efficiency with the progressive phasing out of traditional contour irrigation methods, replaced by spray irrigation methods. Spray irrigation methods are considered to be more efficient than contour irrigation methods, although it is noted that when contour irrigation has been employed on the properties that all available runoff has been captured and reused elsewhere on the properties.

Poorly managed irrigation can cause surface runoff, soil erosion, wastage of water and soil pugging. A well-managed irrigation system will avoid these adverse effects and will result in good pasture production and effective water use.

Under flood irrigation, smaller areas of land would have been irrigated at a time with two to three return periods in a season. Water would be disbursed throughout the irrigable area, but portions of the irrigable areas may not have received water as the growing season may have ended by that time. The applicant has adopted the use of k-line spray and installed pivots in the last 5-6 years, resulting in the same area of land being irrigated under lower application rates with quicker return intervals and faster crop growth.

The applicant notes that, the hard hose gun irrigators are not as efficient at applying water as other infrastructure, such as variable rate pivot irrigators. They are, however, more efficient at applying water than the previous flood methods, which have been completely phased out on this part of the property.

The final irrigation outlay for the farm is contained in Attachment A.

An assessment of reasonable irrigation demand for pasture has been undertaken for the property in accordance with Aqualinc 2017[17]. The calculations have taken into account the local climate (Mean Annual Recharge data), soil (landcare research SMaps) and irrigation demand for pasture. An irrigable area of 531.6 ha of pasture (and

[17] McIndoe I, Brown P, Rajanayaka C, KC. B, 2017. Guidelines for Reasonable Irrigation Water Requirements in the Otago Region. Otago Regional Council, 2. Aqualinc Research Limited.

lucerne/winter crops) is to be irrigated, comprising a mix of soils contained within the MAR 450 mm and 550 mm rainfall Zone.

Table 16 summarises the Aqualinc irrigation requirements, and the full calculation is included in Appendix J.

Table 16: Summary of Aqualinc current and proposed demand and stock water/baseflow requirements

	Current demand	Future Demand
Area irrigated	531.6 ha	970 ha
Daily volume	25,530 m^3	47,140 m^3
Monthly volume	791,943 m^3	1,461,763 m^3
90th %ile annual volume	3,942,684 m^3	7,255,781 m^3
Peak annual demand	4,472,058 m^3	8,248,647 m^3

Stored water is likely to supplement monthly water requirements. During exceptionally dry years, reductions in irrigated area will be required. It is expected that the occurrence of dry years will become more prevalent in the Central Otago area and drought events more severe as a result of the global effects of climate change. The volumes of water applied for by the applicant are therefore a very necessary component for the security of the farm and the resilience of the people reliant on its productivity. The current storage and future proposed forms part of the applicant's adaptive management plan to the effects of climate change by investing in stored water now.

The annual limit proposed will mean that the maximum daily limit is not able to be taken on every day. The annual volume proposed will see a reduction in annual primary allocation volume from the on-paper allocation. The proposed review condition (see below) will ensure that if the water allocated to the applicant is not being used then the limits on the water permits can be adjusted. This will all ensure that the volume of water taken is no more than required for the purpose, as per Policy 6.4.0A of the RPW.

The abstraction between October to April accounts for about 23 - 87% of the total abstracted volume for each year on record. The bulk of abstraction has occurred during the irrigation season and will continue to occur throughout the irrigation season, with abstraction outside of the irrigation season for stock drinking and filling of storage.

The annual volumes applied for are no more than what is efficient for irrigation purposes.

Water is proposed to be stored in the existing three dams on the property, the applicants private rights water, i.e., water from Neds Creek, will be stored in one of the current storage dams, with further storage proposed for

Neds Creek water. The provision of storage will enable the applicants to store water abstracted during periods when supplementary taking is allowed, for subsequent use during the irrigation season and will provide irrigation to the proposed new irrigation areas. Storage will enable the applicant to continue to have a secure supply of water to the existing irrigation areas particularly where spray irrigation has already been installed. The lack of proposed maximum monthly volumes will enable the applicants to 'top up' the available storage of water during the irrigation season as well as when water is available, which will provide for the interim before further storage can be constructed.

Matakanui Station run sheep and beef across the property. The following stock drinking volumes presented in Table 17 summarise the stock drinking requirements on the property. Stock drinking requirements have been calculated. Volumes and rates required for stock water are more than what the stock actually drink, a baseflow is required in the race to enable this stock drinking water. The application doesn't seek to distinguish which volume may be used for irrigation or that which is used for stock water, because the two are somewhat interlinked, and there would be no way of monitoring compliance with separate rates or volumes as all water is measured together at each intake.

Given the volume sought is less than that anticipated for the efficient use needs of the irrigable area, it is considered that any flow losses via conveyance methods and use for stock drinking do not cause the take to be an inefficient use of water.

Likewise, a person is not restricted from taking water for the reasonable needs of a person's animals, and the proposed residual flows will not apply to a scenario if the applicants are only taking for the reasonable stock water needs.

Table 17:Stock drinking water requirements.

Type	Recommended l/day/head	Max approximate herd size	Daily (m^3)	Monthly (m^3)	Annual Volume (m^3)
Sheep	5	21,000	105	3,194	38,325
Cattle	45	1,100	49.5	1,506	18,068
Total			***155***	***4,699***	***56,393***

The take from Neds Creek is used for stock drinking water purposes, either via the open channels of the water races traversing the property or via the reticulated stock drinking water system. The property runs about 21,000 sheep and about 1,100 head of cattle. Stock drinking water has been calculated using the technical publication[18] prepared for Horizons Regional Council as this is considered the most comprehensive analysis of guideline values for stock drinking water amounts, and is in-line with ORC specifications.

These volumes are reasonable to meet stock drinking requirements on farm. The rates applied for, whilst in the high-end range are consistent with recommended volumes in the technical publication referenced below. Stock drinking water is a small component of the total volume of water both sought and currently authorised to be abstracted.

Table 18 and 19 provides a summary of the Aqualinc outputs, with full calculations provided in Attachment D. Note that Table 19 shows the demand for the new areas of irrigation only, not the proposed total command area i.e., current + new. This 'new' area calculation also does not duplicate any areas of current irrigation, but there are areas signalled for conversion. Refer to the Appendix B maps. A summary of how the Aqualinc volumes relate to volume historically used and volumes sought is outlined in Section 2.3.4.

[18] Aqualinc Research Limited & Aquas Consultants Limited. (2007). *Reasonable Stock Water Requirements – Guidelines for Resource Consent Applications.* Technical Report prepared for Horizons Regional Council.

Table 18: Summary of water requirements for efficient irrigation of current areas only.

Smaps Soil Name	Area	600 mm PAW	M3/DAY	M3/MONTH	MAXIMUM ANNUAL DEMAND
Clare_1a.1	13.3	60	678	21,009	120,130
Flax_105a.1	41.9	90	1,970	61,198	342,909
Flax_108a.1	13.0	120	546	16,914	102,183
Germ_2a.1	9.5	60	486	15,048	83,525
Laud_2b.1	0.7	60	34	1,065	5,911
Lindi_10a.1	0.5	60	26	807	4,481
Omel_2a.1	8.3	60	423	13,112	74,358
Pateg_5a.1	70.6	90	3,324	103,240	580,052
Pateg_6a.1	105.2	90	4,977	154,575	882,164
Ranf_4a.1	42.2	120	1,772	54,847	327,816
Tiro_4a.1	85.2	60	4,347	134,665	747,784
Waen_8a.1	78.1	60	3,984	123,441	685,174
WaenM_1a.1	63.0	90	2,962	92,021	515,569
Total	531.6		25,530	791,943	4,472,058

Table 19: Summary of water requirements for efficient irrigation of proposed new areas only.

Smaps Soil Name	Area	600 mm PAW	M3/DAY	M3/MONTH	MAXIMUM ANNUAL DEMAND
Flax_105a.1	4.5	90	216	6,718	38,993
Flax_108a.1	22.7	120	953	29,487	183,831
Germ_2a.1	28.5	60	1,452	44,994	249,799
Lindi_10a.1	16.5	60	842	26,076	145,230
Lindi_3a.1	31.8	60	1,624	50,320	279,307
Omel_2a.1	5.1	60	262	8,121	45,750
Pateg_6a.1	12.6	93.75	593	18,409	104,337
Patego_6a.1	0.2	90	11	350	2,075
Ranf_4a.1	17.7	120	743	22,988	137,397
Rang_63a.1	4.2	60	216	6,685	38,629
Tiro_4a.1	133.9	60	6,830	211,587	1,189,455
Waen_8a.1	72.6	60	3,702	114,681	636,553
WaenM_1a.1	88.6	90	4,166	129,403	725,235
Total	439.0		21,609	669,820	3,776,590

Aqualinc volumes modelled are intended to meet irrigation demand for 100% of the time. The monthly volume currently authorised is approximately 40% of this 90% probability of effective volume to irrigate 532 ha of pasture crop on the soils in this area according to Aqualinc. However, OAIC shares provide water to top-up the applicants own private water source from Neds Creek.

The pivot and hard hose guns irrigation systems are well maintained and pivots near new, and future pivot installs will utilise the latest technologies such as precision irrigation variable rate control systems, and no over-application, overland flow or leakage from the pipes or structures is considered likely. These methods are considered to be in-line with the irrigation industries best management opportunities, for the efficient use of the resource.

The irrigation strategy of Aqualinc meets a specific irrigation objective, being that production levels were to be maintained close to maximum for most of the time, and that even in the driest of conditions, sufficient water would still be available to sustain plant growth.

As assessed in Section 5.2 of this report the applicant has proven access to these volumes of water from Neds Creek. Future storage investment will provide greater water security on the property and improve water availability for existing and proposed irrigation.

In conclusion, the annual volume sought as primary allocation (3,794,592 m^3) is reasonable considering the intended use of that water, and that the volume as applied for is available to be abstracted from Neds Creek, when accounting for the storage proposed on farm. This storage has been investigated and deemed feasible.

Water is proposed to be abstracted from an established intake and is used within the same catchment. The water sources are the nearest practicable that utilise gravity to convey water to and around the use areas.

The applicant is intent on using the water that is available to them as efficiently as possible hence the investment into, and overhaul of, the irrigation setup for the farm. All water conveyed under the irrigation areas is conveyed by pipes. The existing open water race that delivers water from the creek to the storage pond will not be piped, because no fish screen is proposed on the intake, and to manage fluctuations in flow which can have detrimental effects on closed-systems, as well as avoiding the need for pressure venting.

Over-application and overland flow or leakage from the pipes or structures will be avoided as far as reasonably practicable. This will be possible should a reasonable consent duration be issued by council because certainty of water supply will enable investment in the proposed infrastructure upgrades to be undertaken. It is important to note that under application is also considered a loss in water efficiency, which will be avoided.

With respect to storage, 92,000m^3 is currently available (30,000 m^3 only for Neds Creek water), with an addition 620,000 m^3 proposed to be constructed for Neds Creek water, and 360,000 m^3 for County scheme water. This serve as the most efficient use of winter water and supplementary allocation that will service future irrigation areas as developed, and support primary allocation use during the irrigation season.

As the water applied for will be no more than that required, the activities are efficient, and therefore consistent with policy 6.4.2A of the RPW. Overall, the continued transition to improved efficiencies, storage and water security allow will ensure that the proposal will have no more than minor effects on the environment.

5.1.8 Effects on Water Quality

Neds Creek water quality is very good (Section 3.4.3), as demonstrated by the applicant's monitoring. There is unlikely to be significant degradation of water quality in Neds Creek commensurate to the spray conversion yet to be completed as a consequence of granting consents with a long consent term. Generally, water quality is not expected to be adversely affected as less run-off and sediment loss is expected to occur as a result of the conversion to spray irrigation.

No changes in stock classes or land use are proposed as a result of this application. As the proposed abstractions are currently consented, no new effects on water quality are expected.

With respect to nutrient losses, the applicants will comply with the relevant water quality standards set out in the Regional Plan: Water for Otago. Where FEPS are required these will be implemented and maintained to adaptively manage the potential effects of the use of water and resulting farm practices on water quality.

There is a sediment trap located on the southern property boundary near the pivot being irrigated with main race water. This sediment trap captures any runoff and filters this before reaching Chatto Creek.

The applicant proposes to continue their own water quality monitoring programme, which has recently include MCI score testing.

5.1.9 Water Management

The RPW promotes the integrated management of water in a way that enables continued access to suitable water whilst ensuring communities are able to provide for their social, cultural and economic wellbeing, now and for the future. Efficient use and development of the region's resources are also featured in the concept of integrated management.

The applicant is a member of the Chatto Creek Water Users Group. This water users group includes all irrigators within the Chatto Creek Catchment. The group while in their infancy, will in future work together to provide for

and future minimum flows that may apply to the catchment, and will share water throughout the catchment as agreed by the water users.

Given the applicants take is operated in isolation of other permits (under status quo flow sharing) without any known adverse effects on other users, and that the applicant is a member of a voluntary water users group it is not necessary to require as a condition of consent the restriction of the applicants consent to allow the exercise of any other water permit.

However, the following condition is proposed, that ensures that should Council impose a water allocation committee that the applicant will be required to comply with the requirement of that committee:

> *X. This permit shall be exercised or suspended in accordance with any Council approved rationing regime that applies to the lower Manuherekia River catchment.*

Given that the applicant is already in a water users group, and the group has formed themselves, it is unlikely that Council would need to impose a water allocation committee, however the condition above gives the option, should the voluntary group 'fail'.

In the future when Chatto Creek flows at the 'Chatto Confluence' are at 100 l/s 1 October to 30 April, the users will cease taking and prior to this will have entered into flow sharing arrangements; furthermore, in winter, 1 May to 30 September, the users will maintain a 250 l/s residual flow with respect to supplementary and/or winter water authorisations. This arrangement could involve a rotation of days on or off, or percentage reductions in flow that apply to all takes. The exact mechanism the users employ to achieve their proposed residual flow is largely irrelevant to Council because the users will have entered into a voluntary sharing arrangement and Water Management Group. Council policy encourages this sort of arrangement as it doesn't require intervention from Council, particularly if all parties are willing.

The Chatto Creek water users will determine principles for the Chatto Creek water management which underpins the future water sharing. These principles among other things will require that the water users share water abstraction records, water, and costs incurred in the management of Chatto Creek flows. These principles and the proposed management objectives for Chatto Creek will predicate the Chatto Creek Water User Groups legal catchment sharing arrangement which will be drafted subject to granting of consent. The legal agreement is proposed to be drafted at a future date so that it may take account of the requirements of any future consents granted (subject to consent). The applicants propose a condition of consent to have and maintain the legal agreement within a set timeframe of the commencement of the future consents.

Water users will verify their own meters annually, or five yearly (depending on the type of meter installed) as will be required as conditions of consent on the replacement permits.

Proposed conditions of consent will hold the permit holders individually accountable to ORC, which will give the decision maker certainty that the proposal will occur as proposed.

In this instance, it's not directly necessary to propose a condition relating to exercising the consent as directed by any water allocation committee, on the basis that the applicant has separate legal catchment sharing arrangements that satisfy this requirement.

5.1.10 Wetlands and Groundwater

There is no known large groundwater body that may be adversely affected by the proposal. Lahey's Creek for example is known to go dry below the neighbour's intake and water resurfaces in Lahey's Creek near to its confluence with Campbells Creek. This highlights that there may be some connectivity between tributaries with gravel beds and a shallow groundwater table within the Chatto Creek Catchment. Also, there is evidence to suggest that within Devonshire Creek (upstream from the applicant's property) there may be natural gains and losses as a result of connectivity between surface water and ground water. Although, Chatto Creek has largely been considered to not dry naturally.

Neds Creek may experience similar gains and losses however these have not been measured. The applicant has stated that Neds Creek does not go dry, even when the applicant is abstracting for irrigation.

It is not expected that the abstraction in this creek will have any significant future effects on groundwater given that any groundwater resource is not known to be significant, does not support any community supplies that may be affected and no more water than that already consented to be abstracted is proposed to be taken.

There are no expected effects on wetlands, as there are none identified within proximity to the applicant's activities.

5.1.11 Effects on Other Water Users

Neds Creek lies almost entirely within the applicants own property and there are no other lawful abstractions from this Chatto Creek tributary.

Moutere Station and Airdrie Limited take water from tributaries that discharge to Chatto Creek downstream of the Neds Creek Chatto Creek Confluence. The lower takes in the Chatto Creek Catchment (above its confluence with the Manuherekia River) are held by the Manuherekia Irrigation Society Cooperative Limited (MISCL) and Trevor Drake. Whilst the downstream irrigation company has highest priority in this catchment overall, they have not recently (since the record of abstraction available) called 'first priority' in this catchment and are not replacing this permit. The absence of other downstream lawful users in close proximity to the property means that the applicant need not consider any adverse effects on other lawful users and therefore, restriction of those takes

for that purpose is not required.

There are other water users taking water downstream of the take, however given the applicant will not be taking greater volumes than what has been used in the past the existing environment will remain unchanged to these water users.

In the future when Chatto Creek flows at the 'Chatto Confluence' are at 100 l/s 1 October to 30 April, the users will cease taking and prior to this will have entered into flow sharing arrangements; furthermore, in winter, 1 May to 30 September, the users will maintain a 250 l/s residual flow with respect to supplementary and/or winter water authorisations. This arrangement could involve a rotation of days on or off, or percentage reductions in flow that apply to all takes. The exact mechanism the users employ to achieve their proposed residual flow is largely irrelevant to Council because the users will have entered into a voluntary sharing arrangement and Water Management Group. Council policy encourages this sort of arrangement as it doesn't require intervention from Council, particularly if all parties are willing.

The Chatto Creek water users will determine principles for the Chatto Creek water management which underpins the future water sharing. These principles among other things will require that the water users share water abstraction records, water, and costs incurred in the management of Chatto Creek flows. These principles and the proposed management objectives for Chatto Creek will predicate the Chatto Creek Water User Groups legal catchment sharing arrangement which will be drafted subject to granting of consent. The legal agreement is proposed to be drafted at a future date so that it may take account of the requirements of any future consents granted (subject to consent). The applicants propose a condition of consent to have and maintain the legal agreement within a set timeframe of the commencement of the future consents.

The applicant is also a member of the Manuherekia Catchment Group. This group have drafted a River Management Plan, which this application supports. The river management plan is a detailed plan that outlines the proposed future flow and abstraction management of the Manuherekia River, on which the future flow sharing regime will be based. The applicant will operate their take in accordance with the River Management Plan, along with all other members of MCG.

5.1.12 Monitoring and Bond

The Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 (metering regulations) require all consented consumptive water takes of 5 L/s or more to be measured. The current authorises are co-located at one point of take and are measured and fitted with a datalogger. Records are telemetered to Council.

A water meter with telemetry compatible datalogger is installed at the existing monitoring site. A number of

recommended consent conditions relate to achieving required technical specifications for accurate meter and datalogger installation and ongoing operation. The data will need to be consistent with the format and specifications of Council's databases. "Comma separated value" (csv) format is considered the simplest and most widely compatible file type for this purpose. The data provider sends verified data to ORC so that they have complete accurate records.

Consents granted should be subject to a review in accordance with Sections 128 and 129 of the Act, to allow Council to adjust the amount or rate of abstraction of water allowed by each consent, should monitoring indicate that the allocation is more than required for efficient ongoing use, and to ensure that the consent specifications regarding water take data recording and transmission can be kept up-to-date as required.

Adherence to the residual flow will be monitored by Council's certified flow recorder upstream of Matakanui Stations in-take and at the Chatto Confluence site.

A bond is not necessary as the need for restoration measures to be carried out by ORC is not present.

5.1.13 Effects on Climate Change

The Bodeker climate change report (summarized in Section 3.2) identifies a decrease in snowpack by the end of the century as one of the key effects relevant to agriculture and instream flows in Central Otago. More winter precipitation is anticipated to fall as rain, resulting in less accumulated snow and therefore reduced contributions of snowmelt to river flows in spring. This is expected to lead to substantial increases in streamflow during winter and declines in summer, driven by increasing winter precipitation and a reduction in snow storage.

The local climate of the Manuherekia River valley is likely to become more variable and less predictable in the coming decades due to climate change, based on the climate change projections for the Central Otago District prepared by Bodeker Scientific in 2019 (see section 3.2). Temperatures (and therefore evapotranspiration) are expected to increase, and while precipitation may also increase, changes in the timing (largest increases in Winter and Spring) and form (more rain and less snow) may reduce water security in the area. More frequent droughts are predicted. Securing reliable water rights to the Manuherekia River, while preserving and/or enhancing the values of the watercourse will enable the applicants farming operation to continue and ensuring operating at their fullest potential into the future.

The effects of climate change more specially on river flows have been considered broadly by the Otago Regional Council[19]. The effect of climate project projections on the Chatto Creek (at confluence) are summarised below:

[19] Macara, G., Woolley, J-M., Zammit, C., Perce, P., Stuart, S., Wadhwa, S., Sood, A., and Collins, D. (2019). Climate change

- Decreases in Q95% (the fifth percentile flow – i.e., the flow that is exceeded for 95% of the flow record) are modelled in all Otago Freshwater Management Units (FMU), except for the FMU headwaters, such as Clutha/Mata-Au FMU. The Chatto Creek is expected to experience a -5 to 5% change in Q95% discharge by the mid-century (2036 – 2056) under the worst-case scenario modelling, i.e., possible decrease or increase in low flows. Mean discharges are expected to change by 10-20% under the worst-case scenario modelling by the mid-century, i.e., higher mean flows. This modelling suggests greater percentage changes in flow by the end of the century, with 50-100% increase in mean flows.
- The increase in mean annual flow is a change that is largely consistent with the changes to rainfall.
- Little appreciable change in reliability[20] is projected across most of the Otago region, with most parts of the region exhibiting slight increases but some with slight decreases. The Chatto Creek catchment generally shows a slightly negative, -0.02- 0.0%, change in reliably of supply under the worst-case scenario modelling by the end of the century.

The likely change in flows, both low and mean flow, could be large for the Manuherekia catchment, such that the consideration of flow setting limits by the ORC will ensure sustainable use of the water resource by irrigators, whilst ensuring natural hydrology and ecology is maintained and enhanced. The applicant anticipates changes in farming in the Otago Region as a result of climate change and is preparing for this by ensuring water use is efficient by converting to spray with continued developed of pivots and has invested substantially in storage.

These climate change predictions highlight the importance of large water storage in future for enabling continued productive land uses and farming practices. The timeframe linked to these predictions however falls outside the term of these consents. These activities are not anticipated to exacerbate the effects of climate change predicted on Neds or Chatto Creek, as they are predicted based on status-quo conditions. In addition, the residual and minimum flow limits proposed by this application will protect the affected waterways from any reduction in instream flows due to climate change.

On this basis climate change related effects are anticipated to be less than minor.

5.1.14 Social and Economic Impacts

Irrigation is accepted as having positive economic effects on farming businesses. Irrigation increases productivity of the property, protects from the effects of seasonal extremes and has enabled self-sufficient farm systems to develop. Irrigation development stimulates economic growth and rural development, in the investment in the irrigation industry and service providers, creation of jobs and the flow on prosperity that then has on the

projections for the Otago Region. Prepared for Otago Regional Council. NIWA Client Report No: 2019281WN.

[20] Surface water supply reliability refers to the duration of time river water abstraction is unconstrained.

communities where those jobs are held.

While the economic benefits of irrigation are dependent on a range of factors - including the cost of irrigation (related to factors such as distance from source, infrastructure requirements), climate, soil types, effective farm management – the reliability of the supply of water is one of the key overriding factors.

Farming in the Manuherekia catchment is hugely reliant on irrigation water. Irrigation in the area has developed based on confidence in continued access to water and irrigation methods and investment has been influenced by policy changes at ORC. ORC has actively emphasised and encouraged conversion from overland to spray irrigation throughout the region for many years. This directive has resulted in significant irrigation upgrades and the investment in centre pivots and movable spray irrigation such as k-line and guns.

The taking and use of this water enables these farming businesses. As a result of irrigation, the businesses in turn utilise and support a wide range of local contractors including irrigation specialists, fencing contractors, shearers, local engineers, and rural suppliers. Viable rural businesses provide local employment which in turn supports the maintenance of the local population. This in turn supports the retention of local sports clubs, playcentre groups, schools and range of other social groups and clubs and associated facilities. Another important social impact of viable farming business' is the preservation of intergenerational families living and working together. Communities that can sustain a range of different age demographics are more resilient and balanced – economically and socially

The proposed residual flow will affect the applicant's future ability to abstract water during the irrigation seasons. The social and economic impact of the proposal on the applicants is that less feed can be securely grown than what could be grown if they didn't need to leave more water in the Creeks than historically has been there. To mitigate this the applicant has already invested in storage and have proposals for putting in more storage over time, which will be at a cost to the applicants but will ensure that they are best placed to maintain some security of supply.

On the other hand, a residual flow will have positive social impacts on other users of the Chatto Creek, particularly in terms of improved recreational opportunities, and increased water volumes for paddling in lower reaches of the Manuherekia River.

Overall, the taking and use of this water results in positive effects on economic and social well-being.

5.1.15 Positive Effects

The continuation of the water-take and use activities will provide the potential to continue to provide benefits to the applicant and the wider community. As mentioned earlier, the farm systems have substantial economic

benefits to the applicant which in turn flow on to the local community.

The proposal includes significant improvements in the lowest flows of Chatto Creek, which will significantly improve aquatic habitat, encourage safe fish passage, and enhance the mauri of the wider Chatto Creek.

Overall, the proposal seeks a significant improvement on the status-quo and will provide significant positive effects to the well-being of Neds Creek, Chatto Creek, and the communities these waterbodies supports.

5.1.16 Summary of Effects

The applicants are seeking to re-secure water that has been used for many years with no reported issues. The proposal demonstrates that water will be used efficiently and in accordance with what council have determined as reasonable, and that abstraction will be no more than what is currently consented.

5.2 Effects Specific to Supplementary Allocation

Policies 6.4.9 and 6.4.10 of the RPW outline the provisions for ***supplementary allocation;*** Rule 12.1.4.7 of the RWP applies.

The purpose of policies 6.4.9 and 6.4.10 is to enable access to water at moderate flows while maintaining the aquatic ecosystem and natural character values of affected rivers and providing for natural flow variation. If the lower minimum flow can be applied in Neds Creek (above when flows can be taken from supplementary allocation), then the localised effects can be managed, and the abstraction available will be commensurate to the values present, as opposed to a faraway minimum flow limit on a River that is hydraulically dissimilar to the local catchment (i.e. heavily augmented by upstream abstraction and damming activities).

With respect of further supplementary allocation, Policy 6.4.10 has been adopted by ORC to provide access to water at higher flows for the purpose of promoting water harvesting, when the maintenance of the aquatic ecosystem and natural character values of affected rivers is not an issue.

As discussed earlier, the applicant is currently inhibited by their existing primary allocation and needs supplementary water to fill their storage ponds when flows in the Neds Creek are higher than the supplementary allocation minimum flow to be imposed. Furthermore, this proposal includes future irrigation areas that will be irrigated with water taken by the supplementary water permit and stored in the new storage ponds. As such, supplementary allocation of 138.8 l/s and 4,450,596 m^3 is proposed. The total annual volume proposed as supplementary allocation is the difference between the primary allocation shortfall for the existing irrigation area and the 100%ile annual irrigation requirement for future irrigation areas. The volume of water required ensures that water can be stored once it is available and used to fill storage. The total volume required extra year for

supplementary use on future areas will fluctuate as areas are developed and will depending on the crop or pasture type grown in any given season. Therefore, the Aqualinc maximum annual demand will ensure that enough water is available should it be needed.

5.2.1 Effects on Stream Ecology and Hydrology

Neds Creek is a tributary in the Chatto Creek catchment that drains to the Manuherekia River. These catchments are not identified in Schedule 2B of the Regional Plan: Water for Otago, and therefore supplementary allocation may be available that allows the taking of water when the flows in Neds Creek is high enough.

Supplementary abstractions are the preferred method of taking surface water in Otago, given that they always leave plenty of water in a given watercourse to enable fish passage and maintain healthy habitat for all aquatic organisms. This is certainly the case for the applicant's proposed supplementary take.

Figure 18 shows the flow record for the period 2013-2020 and shows the mean flow for this period (95.7 l/a). The flow records available for upstream of the applicant's abstraction point shows flows in excess of 1,000 l/s occur.

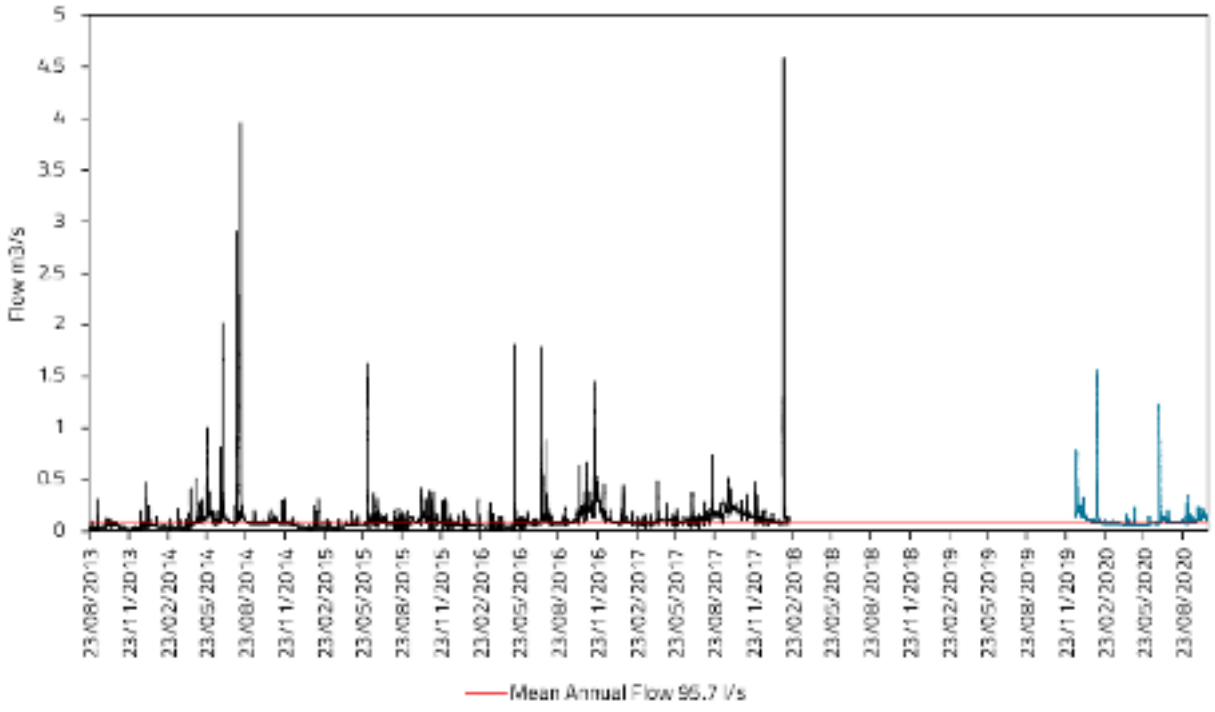


Figure 18: Flow record for Neds Creek 2013 – 2020 with mean annual flow plotted.

Policy 6.4.9 provides for the taking of water as supplementary allocation on a 50:50 flow sharing basis between instream and out of stream use. Under Rule 12.1.4.7 in the RWP, to provide for further supplementary allocation without any restriction on the volume taken, the minimum flow applied is equal to the natural mean flow under Policy 6.4.10.

Policy 6.4.10 gives provisions for taking water when it is sufficiently abundant so that taking will have no more than minor effect on instream values or other takes. This is the scenario best suited to applicants seeking supplementary allocation for water harvesting purposes. This policy is adopted to provide access to water at higher flows and promote water harvesting when the maintenance of the aquatic ecosystem and natural character values of affected rivers is not an issue.

The natural mean flow of the Neds Creek full record, as calculated from the full available data set is 95.7 l/s for the available years on record with a complete hydrological year (1 July to 30 June), those were season 2014/2015, 2015/2016, and 2016/2017 only.

Following the direction of Policy 6.4.10, a supplementary minimum flow of 95.7 l/s and abstraction above this would not result any more than minor effects to fish in the main trunk of Neds Creek (native or otherwise).

The hydrological regime would continue to be supported by downstream flow variability. The point of take is 5.5km upstream from the Confluence with Chatto Creek, and there will be additional inputs and gully flows that continue flows to the main stem of Neds Creek when supplementary flows can be accessed, so that variability of flows above mean flow would still occur for the 5.5km reach and hydrological regime would not be affected by the applicant's proposed supplementary allocation. This would not impact the hydrology of Chatto Creek as by way of primary allocation, the user will be restricted to meeting a minimum flow on the Chatto Creek.

A supplementary residual flow of 330 l/s is also recommended for Chatto Creek at confluence, which in conjunction with the supplementary minimum flow at Campground (which would apply to all Manuherekia users downstream of Ophir) would allow for taking water to storage with less than minor ecological effects. This 330 l/s supplementary minimum flow is exceeded 90% of the time during winter (May to Sept) and is also higher than the natural 7-day MALF.

Under the supplementary minimum flow scenario for any water user in the Chatto Creek catchment the following restrictions would apply:

- 330 l/s residual flow at Chatto Confluence
- 6.0 m^3/s at Campground on the Manuherekia River

Under policy 6.4.9 of the Otago Regional Council RWP, supplementary allocation can be defined in blocks. Hickey and Olsen (2020) in the "Assessment of Environmental Effects for water abstraction from Manuherikia River from the Falls Dam to the confluence with the Clutha/Mata Au" (referred to as Manuherekia AEE) report[21] prepared for the Manuherekia Catchment Group recommends winter residual flows and supplementary minimum flows for the main stem Manuherikia at key sites. Those that relate to the Chatto Creek water users are as follows:

1. 4.0 m^3/s winter minimum flow at Campground for period 1 May to 30 September; and
2. 6.0 m^3/s all year at Campground for supplementary flow.

A supplementary flow of 6.0 m^3/s all year will provide for adult trout passage which will also ensure passage for all indigenous species present in the lower Manuherikia mainstem. Hickey and Olsen (2020) recommend in the Manuherekia AEE allocating supplementary allocation in 0.5m^3/s blocks and that existing supplementary takes should be in the first supplementary block of allocation.

Therefore, for example, the supplementary allocation blocks would be as follows:

- Block 1 500l/s – minimum flow at Campground 6.0 m^3/s;
- Block 2 500 l/s – minimum flow at campground 6.5 m^3/s;
- Block 3 500 l/s – minimum flow at Campground 7.0 m^3/s; and
- Thereon.

Matakanui Station are proposing to abstract 138.8 l/s as supplementary allocation (28% of water available in the first block), and therefore this would fall within the first allocation block based on the above recommended approach, and abstraction of 138.8 l/s could occur when the Chatto Creek at confluence flow is ≥330 l/s and at the Manuherekia at Campground flow site ≥6.0 m^3/s.

A complete assessment on 'effects on other users' is not able to be completed as this time in relation to supplementary allocation, as the nature of all existing supplementary allocation in which the campground minimum flow would apply to is unknown. In terms of Chatto Creek, this option for Matakanui Station to seek new allocation as supplementary would reduce reliance on primary allocation winter water. This approach is appropriate and in-line with integrated catchment management principles. Supplementary allocation is a more efficient use of water and alleviates pressure on the primary allocation available in the Chatto Creek Catchment. Surety of supply for supplementary allocation based on the approach here and as recommended by Hickey and Olsen (2020) in the Chatto Creek AEE is good.

[21] The Manuherekia AEE prepared by Hickey and Olsen (2020) can be found appended to the Manuherekia Irrigation Company and Blackstone Irrigation Company applications lodged to ORC in December 2020.

Matakanui Station, and the other Chatto Creek water uses anticipate additional information requests in relation to any applications for supplementary allocation, as this can only be addressed once all available allocations to be distributed within supplementary blocks is determined. If it is appropriate to split the 'new' water component of the Matakanui Station application to progress the replacement of primary allocation, Matakanui Station are open to this option.

The supplementary minimum flow of 330 l/s in Chatto Creek will ensure that higher flows still occur in the catchment in-line with ecological and hydrological requirements, see Appendix F.

5.2.2 Effects on Other Water Users

For the same reasons discussed above, there would be no effects on other water users as a result of the applicant exercising their proposed supplementary allocation. There are no further users downstream on Neds Creek.

5.2.3 Available Water Allocation

Neds Creek is not listed in Schedule 2B. The applicant is the only user on Neds Creek so in theory supplementary allocation in blocks may not be considered necessary. The applicant recognises however the wider catchment approach to collaborative water use, and therefore proposes to take supplementary allocation in line with recommendations made by Hickey and Olsen (2020) as described above.

5.2.4 Efficiency of Use

No additional monthly or annual water is being sought above what has been calculated to be efficient in Section 5.1.7. The supplementary allocation has been designed for water harvesting purposes, so that the water taken and stored is proportional to the irrigation requirements of the applicant's property. This is an efficient use of water.

5.3 Effects Specific to Damming

5.3.1 Assessment of Alternatives

The applicant has already invested heavily in storage, and this is seen as a positive investment in future adaptive management to meeting irrigation shortfall under climate change scenarios.

The stored water ensures there is no instantaneous demand for water when the catchment is on water restrictions, and or when the applicant chooses to cease or lower abstraction to meet flow sharing obligations. The alternative could be to continue to abstract water during low flow periods, however the applicant does not do this to ensure the catchment wide approach to maintaining the minimum flow is achieved jointly.

5.3.2 Water Allocation

Water taken from the Matakanui Station dams is lawfully abstracted via Water Permit RM15.217.01 and Deemed Permit 4006.V1, both of which are subject to this application for a replacement water permit. Additional water from Neds Creek is being sought as part of this application, by way of supplementary allocation.

The use of storage aids in the efficient use of water, and is actively encouraged through the following polices to the Regional Water Plan

5.3.3 Effects on Other Water Users

There are no downstream users on the gullies where dams are located, and therefore there would be no effects on other water users.

There is no risk of flooding on any other persons property, all dams are located on the applicant's property. Erosion, and land instability is unlikely to have any effect as the dams constructed have been done so following engineer investigation of suitable locations.

5.3.4 Dam Safety

As discussed earlier, none of the Matakanui Station dams are considered "large" dams under the Building Act, and as such are not subject to a requirement for building consent. The volume of water that could escape the dam in the event of failure is very low, and no people or property (other than Matakanui Station) would likely be impacted as a result. Effectively the design of the dams are such that it counters the potential for failure of a dam wall (which may lead to inundation) given it has no walls and is built into the ground.

Given that the pond is constructed 'in ground' the volume of water that could escape the ponds in the event of failure is very low.

5.3.5 Ecology

The dams on Matakanui Station are located within ephemeral gullies, or located outside of waterways, there will be no adverse effects on aquatic ecology. The dams provide ecological benefit in terms of creation of habitat for waterfowl and invertebrates as a result of the outflow of the dams back to ephemeral tributaries.

Fish screens are present on all pipes from any dam or pond.

There are no nearby regionally significant wetlands, and therefore there would be no change in the water level to any regionally significant wetland as a result of damming activities.

5.3.6 Natural Character & Amenity

The dams are situated in an area that has long been used for pastoral land use. The ponds are not at odds with character and amenity values associated with this type of land use and is typical of other farms around the area, as there are many storage ponds/dams associated to irrigation in the Manuherekia.

5.3.7 Effects of Discharge from Dams

The bywashes from the dams and ponds does not result in flooding, erosion or land instability. The overflows are managed so that they occur infrequently and only when the dam or ponds levels are high enough that some water needs to be released through the contracted bywash channels and races. This primarily occurs when rainfall events occur. IN future with new storage, bywashes will occur less often, as greater storage capacity allows for greater utilisation of available flows when being taken as supplementary allocation.

All bywashes occur within the same catchment. The bywashes from the County and Main race ponds are discharged to land or another race and directly to water, and the bywashes from Dam 1 is to the same gully where the dam is, and therefore 12.C.1.1(d) is met or does not apply. With regards to 12.C.1.1(e) there is no conspicuous change in colour or visual clarity or a noticeable increase in local sedimentation for any discharge to another drain or race.

The water quality results from the downstream Chatto Creek property boundary (Section 3.4.3) do not indicate there is any potential change in the colour or clarity of the water occurring as the result of any damming and discharge activities. The clarity of Chatto Creek is improved below the applicant's property, and downstream of all dams and ponds. Therefore, there is no conspicuous change in colour or visual clarity or a noticeable increase in local sedimentation, or any floatable organic materials.

The relevant permitted thresholds for operating the bywashes from the dams meets the criteria set out under Rule 12.C.1.1 in the RWP.

The dams store only water, and therefore the discharge of water below the dams and from the ponds is permitted under Rule 12.C.1.2 in the RWP as there has not been any contaminant and water remain in the same catchment. There is no change to the water level range or hydrological function of any Regionally Significant Wetland and there is no risk of flooding, erosion, land instability or property damage. As described above there is no conspicuous change in colour or visual clarity and there are no floatable materials and minimal suspended sediment, as evidenced by the applicant's water quality monitoring at their downstream property boundary on Chatto Creek.

5.4 Positive Effects

As discussed in other sections of this document, the positive effects of the activities are numerous, and include:

- Positive economic effects from the ongoing operation of a large and productive sheep and beef farm which is a key contributor to the local and regional economies. Much of this operation would not be possible without a secure source of water.
- Positive social effects by enabling a land use to continue which directly supports the community by providing job opportunities, supporting local businesses (through equipment and supply acquisition, for example), and improving land value.
- Improved managed of the water resources of the Manuherekia Catchment by working with the wider catchment. Adherence to current and any future minimum flow will provide for identified values.
- The well-established system has been long running and such is well tuned with very few losses.
- Initiatives by the Catchment Group to manage water sustainably with flow sharing and adherence to current and future minimum flow when operative will result in improved environmental outcomes for the Chatto Creek.

The storage dams and ponds on Matakanui Station are designed to improve water security for irrigation and stock drinking and reduce instantaneous reliance on water in Bendigo Creek. Both of these factors have positive effects on the environment, helping the applicant to continue operating at a productive level and therefore contributing to the local economy, and ensuring that more water remains in Neds Creek downstream of the abstraction, with less variability in flows. Using winter water and supplementary allocation to fill storage dams and ponds is the most efficient source of water for this purpose.

5.5 Monitoring

The take will be monitored as per the metering regulations. Records will be telemetered to Council and the water meters verified annually. Monitoring of compliance with the minimum flows will occur in accordance with the River Management Plan that is to be set by the Chatto Creek Catchment Group. The River Management Plan will outline the various regulatory and reference flow sites which will be monitored to ensure compliance with the minimum and residual flows proposed.

The system is checked annually by Irritech and pumps are serviced as required. Records are kept of all checks, servicing and maintenance carried out by Irritech and farm staff.

No bond is considered necessary as there is no need for restoration measures to be carried out by ORC.

Regarding retakes from dams and ponds, the initial takes of water are monitored (with regards to the dam storing Neds Water, and the pond holding OAIC scheme water) so that a record of volumes taken are provided to ORC with telemetered water abstraction records. The rate of take from Neds Creek is already controlled and will have an efficient volume limit to be imposed on new water permit. Therefore, the retakes from the dams and ponds do not require additional meters, and the current monitoring arrangement is in accordance with the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010. We don't believe that these regulations are intended to apply to takes from a water race or from a dam.

5.6 Effects on Cultural Values

There is a hierarchy of planning framework that highlights the integration of cultural matters within all of the relevant planning documents from which this application shall provide for and have regard to. Among other things, the protection of customary rights, and relationship of Maori and their culture and traditions with their ancestral lands, water, sites waahi tapu and other taonga are matters of national importance as per Section 6 of the RMA.

The fundamental concept underpinning the NPS-FM (2020) is Te Mana o Te Wai. The six principles that relate to the role of tangata whenua and New Zealand in the management of freshwater are outlined in Section 6 of this document. Then there are of course the Kai Tahu policy documents to which this application has regard.

The applicant has been involved in the wider Manuherekia consultative processes and field days within the catchment which Aukaha and Runanga representatives have attended. The consultants working with the permit holders to replace their applications have also conversed with Kai Tahu and other parties, so that the years of science gathered by the applicants had regard to the values and interests of importance to Kai Tahu, in terms of the catchment wide proposal and this proposal specifically.

Recent Aukaha submissions on other deemed permit applications in Otago highlighted key issues and management principles. These issues and management principles are described here as they relate to this application.

Mahika kai (literally "food works") is an integral aspect of Kāi Tahu culture and it is critical to keep mahika kai intact including in terms of cultural practices, productivity and diversity of species. Mahika kai is more than just the food itself, it also encompasses cultural practices including seasonal migrations, access to the resource, the act of gathering and using resources and ensuring the future health of these resources.

Traditional mahika kai resources in the Manuherekia catchment are understood to be eels, waterfowl and lampreys. Of these species, eels are the only mahika kai species known to be present in Chatto Creek. Waterfowl

will be present on and around the applicant's storage reservoirs.

Eels have been observed in Chatto Creek. Habitat for eel is not currently the main factor affecting the distribution and abundance of longfin eels in the Manuherekia catchment. Recruitment of longfin eels in the Manuherekia catchment is low due to the presence of Roxburgh Dam, which blocks the inward migration of juvenile eels that have entered the Clutha/Mata-Au from the ocean. Historically, some of the elvers entering the Clutha/Mata-Au would have migrated up past Roxburgh into the Manuherekia catchment and beyond. The proposal supports this mahinga kai species for the Chatto Creek catchment, and Neds Creek where abstraction occurs, whilst acknowledging the greatest effect on this species has already occurred with the construction of the Roxburgh dam.

Mauri can be tangibly represented in terms of elements of the physical health of the land, a river, or surrounding biodiversity. Physical aspects used to reflect the status of mauri include:

- Aesthetic qualities e.g. natural character and indigenous flora and fauna;
- Life supporting capacity and ecosystem robustness;
- Fitness for cultural usage.

Mauri also includes intangible qualities associated with spiritual aspects, and these can also be affected by activities affecting the freshwater resource. The mauri of a resource is desecrated if it no longer supports traditional uses and values.

This assessment is focused on physical aspects of Mauri which may be used to inform potential effects on spiritual aspects.

The abstraction of water may always be considered to have a level of adverse effect on the mauri of a waterway, as the very nature of abstraction is to remove some of a resource. Recently Aukaha, on behalf of local Runaka, has indicated in submissions and evidence for deemed permit replacements that abstraction should result in at least 50% of the natural flow remaining in the waterway. The rationale for this appears to be that taking more than half of the resource is inequitable with nature and will deplete the resource.

Retention of flow variability is also seen as important, so that a waterbody can behave as it naturally would. The proposed monthly and annual limits of the abstractions combined with the residuals proposed means that the creek will continue to have flow variability and will not result in 'flat-lining' of the creek. Freshes will continue to occur. The proportion of water cumulatively abstracted in this catchment is no more than has been demonstrated to be abstracted historically and the applicants are 'giving back' to the river by providing greater flows at critical periods to improve the health of the waterbody.

The retention of connectivity along the length of a waterway and between connected water bodies is also

important. Flows are low in summer although Neds Creek always has maintained some connectivity with Chatto Creek. Whilst the proposal provides connectivity to Chatto Creek specifically, a holistic, broader interpretation of ki uta ki tai requires a broader assessment of the effects of the proposed activities.

In terms of ecology, understanding effects on habitat and ecological processes can assist with understanding effects on mahika kai. Flow variability, connectivity, and flow remaining in a water source, are inherently linked to ecological aspects of the Creek. Connectivity allows fish passage and migration to occur, and flow variability is important for flushing flows which can reduce periphyton and allow migration.

With respect of the flow left in the Creek, the applicants proposed residual flow will provide for this, and further supported by the catchment approach to water management and replacement of permit applications.

The land use activities associated with water taken from Neds Creek are to be managed in future within the framework of Farm Environmental Management Plans (FEMP). The applicant is in the process of having their FEMP developed. Irrigation methods are to continue to be converted from overland methods to spray.

5.7 Assessment of Alternatives

The applicant, Matakanui Station, do have other sources of water, being the Omakau Area Irrigation Company Limited County and Main Race Schemes. The applicant's property is on the periphery of these schemes and as such only limited water can be delivered to their property. These schemes presently irrigate land from generally to the east of Neds Creek and the South of Chatto Creek. The applicant is able to access company water on a roster, and in future their efficiency of use of that water will increase meaning that they can spread the same historical access to water over a generally greater area. Their intention is to be able to irrigate new land with company water and irrigate new land with Neds Creek.

The applicant wishes to use Neds Creek water on land closest to Neds Creek in future, being the closest available supply to that part of the property (at the foothills of the Dunstan Range). The area of land mostly irrigated by Neds Creek water is not able to be irrigated by other sources, but the applicant can for instance shift Neds Creek irrigation land so that it is closer to Neds Creek. Facilitating that conversion is reliant on the applicant obtaining a reliable supply for water under both their company interests and their private water abstraction.

There is no known groundwater resource located beneath the property in sufficient volumes.

There are no alternative sources of water available to this part of the property. County Scheme water is unable to be transferred to this irrigation area (without significant investment) in the form of pumping across Neds Creek to that irrigation area. Further, with respect of Main Race water the applicant has investigated expanding that area supported by Main Race water as they convert from flood to spray, however, that would not be able to

supplement water lost from Neds Creek and the potential lost opportunity to irrigate existing land on that part of the property.

Irrigation from Neds Creek utilises gravity, which is the cheapest form of water conveyance available. Historically, in order to convert the lower parts of the property to spray the applicant had to pump from the lower Neds Creek take, which incurred ongoing costs $50,000 per year to irrigate efficiently that part of the property. It was for that purpose that the applicant transferred their take point upstream so that they could utilise gravity and reduce costs. Any form of pumping from either County or Main race supplies would be at least in the order of $50,000 per year, which could render irrigation of those areas to run at a loss (as the cost to irrigate would be greater than the income generated from irrigation).

Other water sources, such as the Dairy Creek Irrigation Scheme have been investigated by the applicant, but the cost to irrigate their property with water from the Dairy Creek Irrigation Scheme was in upwards of $60 million. The applicant could not generate enough income from irrigation off that source and would go bankrupt.

The proposed abstraction is the best alternative for the applicant.

5.8 Cumulative Effects

The abstraction by the applicant represents the majority of water to be abstracted from Neds Creek.

Cumulatively, the taking and use of water has had a significant effect on the Chatto Creek catchment. The private users and irrigation schemes have enabled the use and development of the catchment for productive land uses and have supported the development of the Alexandra area. Flows and instream values have undoubtedly been affected by these uses and developments. These uses were lawfully established and were often undertaken by or facilitated by central government at one time or other.

The cumulative effects of water use within the catchment is being addressed by the catchment management approach being taken by the Manuherekia Catchment Group (MCG), which the applicant is a member of, and the sub-catchment group, being the Chatto Creek Water Users Group. This includes residual flow and minimum flows and a reduction in allocation cumulatively which aims to address the cumulative effects of abstraction on instream values, whilst also supporting economic and social well-being. A minimum flow will be proposed as part of the MCG proposal for the Manuherekia River, and the applicants will be subject to this.

With these measures in place, the cumulative effects of the taking and use of water will be mitigated to what is considered to be an appropriate level, taking into account both the potential adverse and positive effects of taking and using water.

5.9 Other Assessment Matters

Clause 7 of Schedule 4 of the RMA requires that an assessment of an activity's effects on the environment must address a number of matters, however, also notes that the requirement to do so is subject to the provisions of any policy statement or plan.

a) any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects:
b) any physical effect on the locality, including any landscape and visual effects:
c) any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity:
d) any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations:
e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants:
f) any risk to the neighbourhood, the wider community, or the environment through natural hazards or hazardous installations.

It is considered that the assessment provided in this report (Section 5) sufficiently addresses those matters as are relevant to the provisions of the RPW.

5.10 Proposed Conditions

Some proposed indicative conditions are outline below

5.10.1 Take and Use (includes re-takes) - applies to primary and supplementary proposals

Draft indicative water metering conditions are proposed below.

A. Recording and reporting

A.1. All taking of water must be recorded and reported in accordance with conditions A.2 below at the consent holder's expense.

A.2.

a) The consent holder must maintain a water measuring station comprising of:
    a. a meter to record the water takes, within an error accuracy range of+/- 5% for a piped system;

or +/-10% for an open channel system, over the meter's nominal flow range; and

b. a telemetry compatible datalogger with at least 12 months data storage; and
c. a telemetry unit to record the rate and volume of take, and the date and time this water was taken.

b) The water measuring station must be installed as close as is practicable to the point or points of take.
c) The consent holder must ensure the full operation of the water measuring stations at all times during the exercise of this consent.
d) The installation of the water measuring stations must be completed to full and accurate operation prior to the first exercise of this consent.
e) The water measuring stations must be calibrated by a suitably qualified operator applying International Standards methodology at least annually. Calibration documents must be supplied to the Consent Authority within 5 working days of the verification being performed, and upon request.
f) Where there is a malfunction of the water measuring station, appropriate repairs must be performed within 15 working days or as soon as is reasonably practicable.

Note: No metering of re-takes is considered necessary, i.e., takes from the race and any storage reservoir, as these have already been measured when water is taken from the Neds Creek. There are no new sources of water that would trigger the need for metering at each individual take. As such no further metering conditions are proposed.

B. Measuring of residual flow

Compliance with the individual residual flows proposed will be developed in collaboration with the Chatto Creek Water Users Group and ORC.

C. Fish Screens

Given the sediment and debris transport within the streams that can occur with higher flows in the catchments, the applicants are concerned that 3 mm fish screens would frequently block making them impractical and potentially severely impact the operation of the scheme. As outlined in Section 5.1.3 the water race terminates in one of the Neds Creek water storage dams and this does not necessarily result in trout mortality. As the intake is presently unscreened, it could be said that the race and intake have no noticeable effect on the upstream trout population that have been identified through the 2015 ecological surveys and again in 2018 when the abundance is no difference, to be a healthy isolated population of trout. Exclusion of trout from the race with screening may affect the trout habitat as the reservoir/s habitat for trout will be unconnected to the riverine habitat.

Consequently, there is no need to prevent trout entering the intake, and alternatively, a fish screen on the piped

take from the storage pond/s is proposed (existing already) to avoid potential effects of entrapment of fish from the storage pond/s.

Therefore, no fish screen at the point of take is proposed. Rather fish screens are installed on the outflows from any reservoir.

An indicative fish screen condition is proposed below.

C.1 The outtake from any storage reservoir must be screened with a fish screen.

C.2 The scheme and fish screen:

a) must be operated in accordance with the operation and maintenance plan established by conditions C.3 and C.4; and
b) must be regularly inspected and maintained in good working order at all times.

C.3. A record must be kept of all inspections and maintenance carried out and provided to the Consent Authority on request.

D. Water Management Agreement

D1. The applicants must enter into a water management agreement.

a) The water management agreement is to be signed by the current consent holders and members of the MCG and Chatto Creek sub-catchment group (or representatives of).
b) The Management agreement shall outline how flows in the Manuherekia River and its tributaries shall be shared between permit holders, including at low flows.
c) The consent holder must ensure that the Consent Authority has a copy of the most up to date Water Agreement at all times.

E. Specifics of permits

E.1 These permits shall not commence until Water Permits RM15.217.V1 and 4006.V1 have been surrendered or expired.

E.2 The abstraction must not exceed

a) Rate of take: 138.8 l/s
b) Primary Allocation annual volume: 3,794,592 m^3 abstracted between 1 July and 30 June the following

year.

c) Supplementary Allocation annual volume: 4,454,055 m^3 abstracted between 1 July and 30 June the following year.

E.3 No abstraction shall occur when flow in Chatto Creek is less than the minimum flow of 100 litres per second at the monitoring site at the Manuherekia River confluence.

E.4 No abstraction shall occur between 1 May and 30 September when flow in Chatto Creek is less than the minimum flow of 250 litres per second at the monitoring site at the Manuherekia River confluence.

E.4 No abstraction shall occur when flow in the Manuherekia River is less than the minimum flow of 1,100 litres per second at the monitoring site Manuherekia River at Campground.

E5. No abstraction as supplementary allocation for water harvesting shall occur when flow in the Manuherekia River is less than the supplementary minimum flow of 6,000 litres per second at the monitoring site Manuherekia River at Campground.

E.5 Other than exercising this permit for reasonable stock drinking water purposes, a residual flow of no less than 15 litres per second shall be maintained immediately downstream of the intake.

F. Review

F.1 Then consent authority may review the conditions of the consent in accordance with sections 128 and 129 of the RMA.

5.10.2 Summary

Note that these conditions are suggestions, subject to change and not final. They give an indication of the intent and content of conditions that would be proposed by the applicant.

6. STATUTORY CONSIDERATIONS

Schedule 4 of the RMA requires that an assessment of the activity against the matters set out in Part 2 and any relevant provisions of a document referred to in Section 104 of the RMA is provided when applying for a resource consent for any activity. These matters are assessed as follows.

6.1 Part 2 of the RMA

Part 2 of the RMA sets out the purpose and principles of the RMA. The purpose of the RMA is the sustainable

management of natural and physical resources. Sustainable management is defined in Section 5 as:

'Managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while:

(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
(b) Safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and
(c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment.'

Section 5 of the RMA must be read in conjunction with Sections 6 to 8 of the RMA.

The proposal is consistent with the purpose and principles of the RMA, as outlined in Section 5. The proposed activity will have no more than minor effects on the abilities of Neds Creek to meet the reasonably foreseeable needs of future generations, or on the life-supporting capacity of Neds Creek. Assessment of the activity above demonstrates that adverse effects will be avoided, remedied or mitigated.

There are no matters of national importance under Section 6 of the Act that will be affected by these applications in a more than minor manner, including the preservation of natural character, the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga.

This application is also consistent with the requirements of Section 7 of the Act, with particular regard given to kaitiakitanga and the ethic of stewardship, the efficient use and development of natural and physical resources, the maintenance and enhancement of amenity values, the intrinsic values of ecosystems, the finite characteristics of natural and physical resources, the protection of habitat of trout and the effects of climate change. The proposed activity is consistent with these matters, provided recommended consent conditions are adopted. The proposed activity is not inconsistent with the principles of the Treaty of Waitangi.

Overall, the application is considered to be consistent with Part 2 of the RMA.

6.2 Section 104(1)(b) of the RMA

The remaining matters of Section 104(1) to be considered when assessing an application for a resource consent are as follows:

(a) any actual and potential effects on the environment of allowing the activity; and
(b) any relevant provisions of:

(i) a national environmental standard;
(ii) other regulations;
(iii) a national Policy statement;
(iv) a New Zealand coastal Policy statement;
(v) a regional Policy statement or proposed regional Policy statement;
(vi) a plan or proposed plan; and

(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.

These matters are discussed in the following sections.

6.2.1 Environmental Effects

The actual and potential environmental effects of the proposed activities were considered in Section 5 of this report. Proposed conditions of consent will ensure that any adverse effects are avoided, remedied, or mitigated.

6.2.2 Regional Plan: Water for Otago

The Regional Plan: Water for Otago (RPW) became operative on 1 January 2004. Since it become operative it has been subject to several amendments.

The RPW is also subject to the Proposed Water Permits Plan Change (Plan Change 7, referred to here as PPC7) which includes an additional objective, as well as policies and rules relevant to water permit applications that would override, or limit the relevance of some of the existing provisions in the RPW. PPC7 seeks the creation of an interim regulatory framework for the replacement of deemed permits, and any other water permits expiring prior to 31 December 2025 to allow time for the development of a new Land and Water Regional Plan that is consistent with national policy. This interim framework is a significant departure from the framework in the operative RPW.

The ORC has also notified Proposed Plan Change 8 – Discharge Management. The weighting to be given to this plan change does not have direct bearing on the applications that form this proposal and so the weighting to be given to PC8 is not considered here, although similar assessments would be likely to apply to any consideration of the weight to afford that plan change.

The relative weighting to be applied has been discussed at length in the Overview Section. The application concurs with the overview section and agrees that the RPW is the dominant planning instrument and that little weight should be given to the provisions of PPC7 and PC8.

The following policies, which give effect to the plan's objectives, are relevant to this application for resource consent. It is noted that an application for resource consent, for a restricted discretionary activity is not required

to comply with every policy in a regional plan. At any point where the proposal does not comply with a policy, we have determined elsewhere in this application that the effects of the proposal are not so significant that consent should be declined.

6.2.2.1 PPC7 Objectives and Policies

This proposal is not contrary to Objective 10A.1.1 in that the proposal will achieve long-term sustainable management, subject to granting of sufficient consent term so that effect can be given to the proposed changes. Long-term sustainable management can be achieved without an interim holding pattern on consents to await Council plan change processes.

Policy 10A.2.1 directs granting of consent to be avoided, except where the provisions (a) – (e) of the policy are met. These exceptions are considered below:

(a) All permits sought to be replaced are valid permits.
(b) The total irrigation area does not represent an increase in the irrigated area. In this proposal there is future irrigation re identified, and therefore the proposal is inconsistent with 10A.2.1(b).
(c) There is no increase in the instantaneous rate of abstraction (138.8 l/s) proposed
(d) The proposal includes a new residual flow, and minimum flow limits. The priorities on the permit cannot be replaced and these could represent a take cessation condition, albeit these have not been called in. The proposal goes above and beyond the requirements of this policy by providing improved flow and ecological conditions in the Chatto Creek Catchment and the Manuherekia River that would not otherwise be afforded by this policy.
(e) If granted the proposal will see a reduction in annual volume of water allocated as primary allocation.

This application exceeds the requirements of this policy by proposing new conditions that will impose new minimum flows. The application is largely not contrary to policy 10A.2.1, however is seeking authorises for future irrigation with supplementary allocation.

There is a new water take proposed in this application, but is for supplementary and not primary allocation. PC& does not differentiate between supplementary and primary allocation and therefore the proposal is considered inconsistent with Policy 10A.2.2 on this basis.

Policy 10A.2.3 directs the replacement permits to take and use water only be granted with a duration of either 6 years or 15 years. The policy does not allow the proposal to be assessed on its own merits, including the proposed mitigations and environmental improvements this application seeks. The policy is a significant diversion from Policy 6.4.19 of the RPW and should be given little weight.

The applicant seeks to improve the existing environment but can only do so subject to a sufficient consent term. A 35-year consent term is consistent with Section 123 of the RMA. A 15 or even 6 year consent term is not sufficient to implement any significant on farm changes (including construction of storage for water harvesting, conversion to spray where applicable) and the consent would be un-bankable.

PPC7 is an interim planning framework to put a placeholder on existing permits so that they may be decided under the future land and water plan. The contents of the future land and water plan are unknown, their considerations and implications are also unknown. The process for the land and water plan is at the point of inception only. It would be inappropriate to consider this proposal in the context of a future planning document where there is no certainty regarding the contents of that document, especially as the merits of the proposal haven't been evaluated through the RMAs S32A process.

Policy 10A.2.3 does not apply to any discharge activities in this application.

6.2.2.2 Relevant Objectives and Policies in the Operative Regional Plan: Water for Otago

Chapters 4, 5, 6 and 8 are most relevant to this application. Key provisions from these chapters are assessed here. The key provisions of the RPW are discussed at a high level in the below sections. The specific assessment of how this application responds to those provisions in contained below.

Natural and Human Use Values

Objective 5.3.1 and 5.3.2 refer specifically to the maintenance and enhancement of schedule 1 values in the RPW as identified under Policy 5.4.1 of the RPW. The schedule 1 values for Neds Creek are listed in Section **Error! Reference source not found.** of this application. Whilst these values were scheduled with the existing activities (as proposed) in place. The proposal supports the presence of significant native fish habitat in the Chatto Creek catchment by proposed residual flows. Riparian vegetation is unaffected by the proposal, and increased flows in the lower reaches will help with weed accumulation (if any). The existing gravel bed composition is unaffected by the proposal.

Either there are no scheduled values near to the activities that may be affected by the proposal, such as 1C and 1B values, or the activities are a sufficient distance upstream or downstream of the proposed activities that the proposal has limited immediate effect on these values. The RMA protects the availability of community drinking water supplies during periods of significant water shortage. The proposal will not hinder the communities water supply.

With respect to Schedule 1D values, the proposed flow limits and reduced volume sought are anticipated to maintain or enhance these values in Neds Creek. The proposal will improve the physical characteristics of mauri of the Neds and Chatto Creeks particularly under low flow conditions, is not known to restrict access to sites of importance.

Natural Character

Objective 5.3.3 and Policy 5.4.8 refer specifically to the protection of natural character of rivers and their margins from inappropriate use or development, by having particular regard to the specific features of the natural (or influenced) riverscape taking into account the influence that existing activities have already had on the natural features of the site. Particular regard to the provisions of (a)-(b) and (d)-(f) of policy 5.4.8 has been given in Section 5 (AEE) above. The proposed activities are appropriate in this environment and the existing point of abstraction, irrigation, and storage forms part of the existing environment from which to assess the effects on natural character of the proposal.

There is no further development of the river margins proposed. The water abstraction are appropriate activities in this environment as they have occurred for decades and form the existing environment as observed.

From a general perspective, the use and development associated with the activities subject to these applications is not considered inappropriate within this environment. Irrigation and associated activities and land use are anticipated within the rural environment.

The natural character of Neds Creek will be maintained and Chatto Creek improved as a result of the increased low flows during the summer months, and maintenance of residual flows. Conditions of consent relating to the damming activities will ensure that effects associated with point 2 of the policy are avoided, mitigated or remedied, with the focus in the first instance on avoiding, particularly with dam inspections and regular maintenance.

The proposal is consistent with both the objectives and relevant provisions of the policy.

Amenity Values

Objective 5.3.4 and Policy 5.4.9 refer specifically to the maintenance or enhancement of the river and its margins amenity, by having particular regard to the specific aesthetic values and recreational opportunities provided by Neds Creek.

Neds Creek flows to Chatto Creek. As discussed elsewhere, the abstraction of water is not the only factor influencing the amenity of the river and recreational opportunities. With respect to recreational opportunities in Chatto Creek, over-use is noted as the main risk to the sustainability of high-quality habitat for aquatic ecosystems. Similarly, commercial use and maintaining public access to such areas is of concern. Both of those factors seem directly unaffected by river flow levels.

The amenity value of Neds Creek is supported by high quality headwater environments in the upper parts of the catchment, and relatively little in the lower reaches as areas are inaccessible to the public. Habitat for native fish supports key amenity values of Neds creek.

Chatto Creek supports significant amenity values, particularly in the upper reaches, however, as a result of access and invasion of exotic species in the riparian margin, the amenity is less desirable in the lower reaches, although some areas of the lower reaches are flanked by Significant Amenity Landscape on Map 53 and 57 of the Central Otago District Plan (CODP). The top reaches of Chatto Creek are supported by a largely unmodified natural landscape with natural headwater catchments converging to form the main stem Chatto Creek. These headwater creeks at the foothills do have water abstractions occurring. Above these abstractions, the headwaters are identified as Outstanding Natural Landscape on Map 53 of the CODP. The lower reaches of Chatto Creek are surrounded by modified landscapes and zoned as Rural on planning map 53 of the CODP. The riparian margins at the intake are within the applicant's land ownership.

The proposal can only but benefit upstream amenity by providing for improved fish passage downstream on of the intake on Neds Creek which would further support the small resident trout population upstream. However, the current 15 l/s residual flow sustains the fish passage required for brown trout has surveyed since the 15 l/s residual flow has been imposed as condition of consent in 2015. Brown trout abundance numbers did not change significantly between 2015 and 2018 surveys.

With respect to historic places, the RPW lists none of these. A search of Archsite also does not identify anything in close proximity to the abstraction site. However, given the gold mining and irrigation heritage in the area, there are special values associated with irrigation water races. There is a public perception that the old water races and race network is characteristic of the Central Otago Region and historical values.

The values have been considered and the proposal is consistent with policies relating to amenity where valued amenity is known to exist.

Providing for Sustainable use and development

The proposal is consistent with objective 5.3.6 in that the proposed abstraction will enable the applicant to continue utilising the water resource, subject to a number of mitigation and control measures to ensure that this continued use is sustainable, particularly with regard to life-supporting capacity and freshwater eco-system values.

Approach to Effects

Policy 5.4.2 directs that adverse effects are avoided over remedied or mitigated. The proposal avoids contamination of the Ophir and Omakau town supplies as it is downstream of these. There are no other drinking water supplies within proximity. The RMA protects drinking water supplies in terms of water rationing under times of low flows. The proposal meets the objective on this front. Schedule 1A values are provided for, whilst these are out of date, and there are no historic features that may be adversely affected as such effects are avoided.

It is difficult to completely avoid adverse effects associated with the taking and use of water, as abstraction and associated damming affects flows in waterways. However, the effects of abstraction on low flows will be mitigated by the proposed residual flows. Amenity will be supported throughout the length of Neds Creek and on to the wider Chatto Creek. The continuation of the applicant's scheme with the proposed efficiency upgrades will avoid exacerbating flooding, erosion, land instability, sedimentation or property damage.

Where practicable adverse effects will be avoided, as outlined in the AEE above. The proposal is not inconsistent with Policy 5.4.2.

Effects on existing lawful uses and priorities are avoided by the establishment of the Chatto Creek Water Users Group, and subsequent flow management proposed by the group. This is consistent with policy 5.4.3 of the RPW.

Kai Tahu's interests in this catchment has been recognised and are identified as an affected party to the proposal as outlined in Section 7 below. The proposal is consistent with policy 5.4.4 of the RPW. The Kai Tahu ki Otago Natural Resource Management Plan (NRMP) is considered in this report, along with other relevant IWI planning documents.

Shared Management

Policies 5.4.12 and 6.4.0B promote shared use and management. The proposal is entirely consistent with this policy for the reasons outlined elsewhere in this document. The applicant is a member of the Manuherekia Catchment Group and has lodged their application for consideration with the other applications in the Manuherekia Catchment so that shared management may be enabled through this consent process.

The applicant has enjoyed the flexibility to operate under their existing agreements with other users and will transition to the new shared management regime proposed.

The applicant has worked with the Chatto Creek Water Users Group to ensure that all parties' water needs are being met. The applicant is already a member of a shared water management group as are supported by ORC (by way of policy 6.4.12A).

Shared infrastructure is promoted but is not necessary where takes and use areas are geographically separated such as in the smaller headwater catchments of Chatto Creek. The applicant does utilise shared infrastructure though their company water shares (subject to separate application), which ensures that in most instances, cumulatively, there is only one direct intake from the headwaters of the Chatto Creek catchment, as opposed to multiple separate intakes on the same waterbody.

Furthermore, in 2015, the applicant opted to transfer one of their deemed permit authorised abstraction points, to the location of the other, so that shared infrastructure and the benefits of a gravity feed system, could be

utilised by having both authorised abstraction from the same location.

Life Supporting Capacity

Life-supporting capacity can be influenced by a range of factors even within a natural state catchment and is influenced in this catchment by presence of downstream dams, and septic system discharges. Notwithstanding this, the proposal seeks to retain flows in Neds Creek and Chatto Creek that are sufficient to maintain the catchments life-supporting capacity. The proposal is consistent with this policy.

User Needs

The proposal meets objective 6.3.2. The water needs of the irrigators have been applied for, matching the volumes that they need for efficient irrigation of existing and proposed irrigation areas. The irrigation then supports the viability of these farm systems which in turn supports the secondary industries. Existing community domestic supplies are not diminished as a result of the proposal.

Minimise conflict between users

Objective 6.3.3. This proposal is predicated on shared management of water within the catchment, is entirely consistent with objective 6.3.3. Chatto Creek water users are working together to form a proposal that will consider effects and access to water (including reliability of supply) from an individual water user's needs up to a whole of catchment scale. This approach is anticipated to minimise conflict amongst those taking water.

Hydrological Characteristics

Consistent with Policy 6.4.0, the hydrological regime of Neds Creek is discussed earlier in this report and at length in the attached reports with respect to Chatto Creek (Appendix F). There are unlikely to be any measurable gains or losses through the river systems, and the proposal provides for flow variability and freshes required for the healthy functioning of the hydrological system by way of a maximum rate of take. Significant investment in hydrological and ecological investigations has ensured that the abstractions can sustain habitat for key species present in the Chatto Creek Catchment.

The proposal should not affect any known groundwater resource, and the hydrological assessment have not demonstrated any note-worthy hydraulic connectivity with an unknown groundwater resource.

The proposal is consistent with Policy 6.4.0.

Required Amount

An assessment of the efficiency of the takes is discussed earlier in this report, local climate, soils, crop type and water availability have been taken into consideration. The quantities of water sought are no more than that required for the purpose of use (as indicated by Aqualinc) and no more than has historically been accessed (water availability).

The timing of abstraction proposed will counter the effect of the proposed residual on the applicants existing water availability in terms of volumes abstracted, so that in future the volumes up to those sought will also be available throughout the year. Water harvesting will ensure water can be used efficiently (i.e., applied when soil water deficit exists) an enable further conversion to spray irrigation methods. Conversion to spray also requires reliability of supply, which can limit the ability of some irrigators to convert to spray irrigation.

Race conveyances is via open races. The conveyance methods do not result in significant losses and a standard 10% water allowance is sought to account for race losses. As races are maintained and repaired overtime that these efficiency gains will be rewarded to the scheme. The conversion to pivot will mean most of the network being piped, which is an efficient conveyance method.

This application is consistent with Policy 6.4.0A.

Nearest Practicable Source

Policy 6.4.0C directs consideration of the nearest practical water source to the use areas. With respect of the Matakanui Station property, there are no other waterbodies, or other water source available to them for the irrigation and stock drinking water purposes required, other than Neds Creek and the OAIC County and Main Schemes that the applicant already receives shares from. The take is located at a location in the Creek that utilises gravity to drive water down the race, and whilst it is a distance from the use areas, the race doesn't experience significant losses between the take and use areas and all authorisations for the use and maintenance of the race by the permit holders are in place.

With respect of the OAIC water, many of those shareholders on this scheme have some other water sources that supplement the OAIC race water, as like for this application. However, what the applicant finds is that usually their private water right are used to irrigate the majority of their property, as most of the property cannot be supplied by the OAIC County or Main Race, i.e., are located upgradient, or some distance from where these schemes terminate. This indicates that the nearest practicable source for the water user is already utilised for the purpose of irrigation and stock drinking. The proposal is consistent with policy 6.4.0C of the RPW.

Enabling Taking Within Defined Allocation

Water Permit RM15.217.01 and Deemed Permit 4006.V1 hold primary allocation status. The proposal seeks to take water that holds primary allocation status and as such is consistent with Policy 6.4.1.

The supplementary allocation sought can be meet within the defined allocation for supplementary water, and is consistent with Policy 6.4.10.

History of use

Policy 6.4.2 applies, and the primary allocation of Neds Creek as been defined as the sum of consented maximum

instantaneous, or consented 7-day, takes of surface water as at 28 February 1998.

Policy 6.4.2A applies to an application where policy 6.4.2(b) also applies. The proposal seeks to grant from within primary allocation, no more than has been taken under the existing permits. The proof of use for these permits is presented in the abstraction records in Appendix C, substantiate this. Therefore, consistent with this policy enables a reduction in the allocated volumes on a permit, and both permits relinquish paper allocated annual volumes.

The applicants have accessed the historical volumes because they have needed those volumes of water for the purpose of use. Neds Creak has supplied the volumes sought, and as in future the volumes sought will be able to be abstracted year-round, the volumes sought will still be accessible to the applicants despite the residual flows proposed.

Reconsenting historical volumes abstracted is a fair apportionment of the water resources, as the volumes abstracted have supported and enabled the level of infrastructural upgrades and conversions to spray that have already occurred on the properties. Reconsenting these volumes does not take water from any other user as the volumes have been accessed.

There is no reduction in the daily or monthly use of water, as at these timesteps the applicant has demonstrated use of the full amount of paper allocation already. Although is there a reduction in annual volumes sought as primary allocation. The remainder of annual volume required will come from supplementary allocation and not primary.

Based on proof of use, demand for irrigation, stock drinking and storage, and that only actual water taken under the existing permits will be considered for the new consents (as primary allocation), the proposal is considered to be entirely consistent with Policy 6.4.2 A of the RPW.

Supplementary Allocation

Policy 6.4.2AA leaves space for a re-categorisation of allocation from primary to supplementary. There is no new water available as primary allocation in the catchment. Therefore, it is intended through this policy that, where a new consent is granted as supplementary allocation, the consent holder will continue to be provided with water equivalent to that taken in the past and water taken at higher flows can be stored for later use.

The timing of the bulk of abstraction has occurred during the irrigation season, and at times when flows in Neds Creek are low, indicating that the take is consistent with typical permits with primary allocation, however the abstraction records also demonstrate year round abstractions consistent with the use of water for filling storage. Therefore, the proposal to consent this 'out-side of irrigation season' water as supplementary allocation is consistent with Policy 6.4.2AA.

Primary Allocation Minimum Flow

The proposed minimum and residual flows aim to protect and enhance the values associated with the Chatto Creek catchment, while also ensuring reliability of supply is sufficient to enable effective and efficient use of water for the range of activities reliant on access to this water. In future the applicant will be subject to a new minimum flow proposed for the Manuherekia River at Campground. The proposal will provide for improved aquatic ecosystems and natural character under low flow conditions.

The flow limits proposed can effectively be set on a consent basis and aligns with the considerations under Schedule 2D.1 of the RPW when setting a minimum flow.

The proposal is consistent with Policy 6.4.4 and 6.4.5.

Primary allocation is defined in accordance with policy 6.4.2 of the RPW.

Alternative Approach to Minimum Flow

Policy 6.4.6 does not apply to this application the applicant takes water from Neds Creek that is downstream of Ophir.

Supplementary Minimum Flow

Policy 6.4.9 provides for supplementary allocation for the taking of water, in blocks of allocation where that is appropriate:

a) Such that up to 50% of flow at the catchment main stem, minus the assessed actual take, is available for allocation subject to a minimum flow set to ensure that no less than 50% of the natural flow remains instream; or
b) On an alternative basis, provided:
    i. The take has no measurable effect on the flow at any Schedule 2 monitoring site, or any site established in terms of Policy 6.4.4, at flows at or below any minimum flow applying to primary allocation; and
    ii. Any adverse effect on any aquatic ecosystem value or natural character of the source water body is no more than minor; and
    iii. There is no adverse effect on any lawful existing take of water.
c) Supplementary allocations and associated minimum flows for some catchments are set in Schedule 2B.

Policy 6.4.10, in addition to Policy 6.4.9, to provide for further supplementary allocation without any restriction on the volume taken, where the minimum flow applied is equal to the natural mean flow.

These policies are set on the basis for the development and application of higher minimum flow to restrict water takes with a supplementary allocation status so that they can only operate when higher flows. Supplementary minimum flows allow for and enable 'harvesting' of water in storage dams during higher flows.

This proposal includes a supplementary minimum flow consistent with Policy 6.4.10 that is considered most appropriate for the applicant.

The minimum flow as described in Section 5 has been developed based on the assessments carried out in support of this proposal, the hydrological flow record that is available for Neds Creek upstream of the applicant's intake, and the assessment prepared by Hickey and Olsen (2020) in the Manuherekia AEE that describes a suitable approach to supplementary allocation.

Residual Flows

The requirements for residual flows are discussed earlier in this report. The effect of the residual flow proposed below the applicant's point of take is beneficial to the ecosystem overall and will provide for the aquatic ecosystem and natural character of Neds Creek, and Chatto Creek, and will support the maintenance of a residual flow in the lower reaches of Chatto Creek. The proposal meets the intent of the policy. The proposed residual flow enables the taking of water whilst providing for the instream values (compulsory and other aquatic fauna under NPSFM 2020) as well as the natural character of the Chatto Creek Catchment. The purpose of Policy 6.4.7 is achieved by this proposal.

Duration of Resource Consent

Policy 6.4.19 sets out the considerations when setting the duration of a resource consent to take and use water. Consideration of this policy has been given in Section **Error! Reference source not found.** below and determined that a long consent duration as proposed meets this policy. The proposal favours a longer consent duration as indicated with consistency with the criteria of Policy 6.4.19.

Water Management Groups

This proposal is predicated on a water management group approach for the Chatto Creek Catchment and Manuherekia Catchment. Accordingly, it is considered to be consistent with this policy 6.4.12B, and council may support the water management groups'. Establishment of a water allocation is not necessary. The water users will manage water rationing amongst themselves.

For the reasons outlined above a condition consistent with Policy 6.4.12C is not required.

Promotion of Water storage

The proposal is consistent with policy 6.6.2 in that the proposed supplementary allocation will enable taking during high water availability to be stored in existing and proposed new reservoirs.

The applicant has and will continue to use and invest in new irrigation storage. A reasonable consent term will ensure that they are able to continue to invest on-farm in the efficient use and storage of their water resource which in turn will enable the applicant to adapt to and mitigate the effects of climate change and the predicted increase in seasonal extremes. The applicant can invest further, but only if a consent term commensurate to certainty of the scope and scale of effects is granted, i.e. 35 years.

Subject to granting of a sufficient consent duration, under the terms proposed (i.e., year-round) and subject to the proposed 250 l/s residual flow proposed by the Chatto Creek Water users Group for the Chatto Confluence site for outside of the irrigation season, the activities will be consistent with policy 6.6.2 and allow for water harvesting.

Water Measuring and reporting

The takes will continue to be metered in accordance with the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010. Therefore, the proposal is consistent with policy 6.4.16.

Water Quality

The ORC is reviewing its approach to water quality, including the objectives and policies within Chapter 7 of the RPW, and has prepared Proposed Plan Change 8 - Discharge Management (PC8) to the RPW. PC8 has been called in by the Minister for the Environment and has been notified by the Environmental Protection Authority.

The objectives 7.A.1-3 and policies *7.B.2, 7.B.4, 7.B.7 and 7.D.2* are not affected by PC8 and are relevant to this application.

The objectives set out a framework for enabling discharges in an appropriate way, requiring consent holders to manage the effects of their discharges whilst maintaining existing water quality and improving it where it is degraded. Policy 7.B.2 directs avoiding 'objectionable discharges' that don't maintain natural, Kai Tahu and human use values of waterbodies.

Specific to this application, the applicant intends to have and maintain a Farm Environmental Plan that identifies and then avoids any 'objectional discharges' as a result of irrigation on the properties.

The bywashes related to the dams on the property are not objectionable as they meet the conditions of the permitted activity rules.

> *Objective 7.A.1 To maintain water quality in Otago lakes, rivers, wetlands, and groundwater, but enhance water quality where it is degraded.*
>
> *Objective 7.A.2 To enable the discharge of water or contaminants to water or land, in a way that maintains*

water quality and supports natural and human use values, including Kāi Tahu values.

Objective 7.A.3 To have individuals and communities manage their discharges to reduce adverse effects, including cumulative effects, on water quality.

Policy 7.B.2 Avoid objectionable discharges of water or contaminants to maintain the natural and human use values, including Kāi Tahu values, of Otago lakes, rivers, wetlands, groundwater and open drains and water races that join them.

The use of water can affect water quality, particularly when associated with more intensive land uses. Holistically, land management practices will be encouraged. Neds Creek water quality is very good, the proposal maintains the existing water quality in Neds Creek. Improved flow under low flow times will improve water quality if there are any issues at the critical reach.

Policy 7.B.4 When considering any discharge of water or contaminants to land, have regard to:

(a) The ability of the land to assimilate the water or contaminants; and
(b) Any potential soil contamination; and
(c) Any potential land instability; and
(d) Any potential adverse effects on water quality; and
(e) Any potential adverse effects on use of any proximate coastal marine area for contact recreation and seafood gathering.

Policy 7.B.7 Encourage land management practices that reduce the adverse effects of water or contaminants discharged into water.

Policy 7.D.2 Schedule 16 discharge thresholds apply to permitted activities, from 1 April 2020, at or below the reference flows set in Schedule 16B based on median flows. (Note – Plan Change 6AA amended this policy so that the thresholds only apply from 1 April 2026. Plan Change 6AA became operative on 16 May 2020).

This proposal does not include an application for discharge to land or water, instead the applications are concerned with the replacement of deemed permits associated with the storage, taking and use of water. However, the use of water can however affect water quality, particularly when associated with more intensive land use involving stock or nitrogen leaching.

This proposal takes a holistic approach to land management and has outlined a range of measures that are designed to protect, maintain, and where necessary, enhance water quality. This includes fencing of waterways,

riparian planting, the development and use of Farm Environmental Plans and a reduction in overland flow irrigation. Many of these measures were underway prior to the introduction of the Resource Management Stock Exclusion Regulations (2020).

In terms of cross-catchment water movement, there is no 'out of catchment' transfer of water in this proposal.

Stability and Function of Structures

Objective 8.3.1 applies to this application. The Matakanui Race point of take consistent of a culvert placed in Neds Creek. The culvert is stable and has withstood significant flooding in the past. The culvert does not significantly affect the rivers ability to flood or carry sediment and gravels downstream as part of its natural function. The bed and bank of Neds Creek are not destabilised as a result of the continuation of the point of take with culvert.

This proposal is considered to be consistent with this objective.

Fish Migration Past Structures

Policy 8.5.1 applies to the Neds Creek culvert. Migration of adult trout past the culvert is not restricted. All other identified species known to be present will not be impeded by the culvert. The ecological report concluded there were no obvious barriers to trout migration but low flows and associated high water temperatures sometimes act as barriers in small streams in the Manuherekia catchment protecting upstream galaxiid populations. Given the presence of trout in Neds Creek, and the absence of galaxiids, access from trout is assumed to be unimpeded. Furthermore, low summer flows in the stream reaches closer to the Chatto Creek confluence, and in Chatto Creek, probably largely preclude this population making any contribution to the Manuherekia fishery except perhaps in periods of unusually high rainfall, therefore fish passage at lower flows is likely to affect the self-sustaining brown trout population higher in Neds Creek past the point of take.

As outlined in the AEE above, the existing structure has not resulted in a poor or unhealthy trout population in the upper reaches of Neds Creek.

6.2.2.3 PC6AA

The provisions of PC6AA are noted in the relevant policies and objectives above.

6.2.2.4 PC8 – Discharge Management

This proposal does not include applications for discharge addressed by this plan change. Any relevant of stock exclusions and intensive winter grazing are addressed in the sections below addressing national standards and regulations.

6.2.3 Partially Operative and Proposed Regional Policy Statement

The proposed RPS became partially operative as of 14 January 2019. Both the proposed and operative RPS are

partially operative, with some of the provisions from the 1998 document having been revoked. The RPS gives effect to the RMA and higher order documents such as the NPSFM. As the provisions of the RPS 1998 have been given effect to, further consideration of that document in particular is not necessary.

A further review of the RPS is currently underway, with the ORC aiming to notify a new proposed RPS in February 2021. The RPS, including the partially operative version, is considered out of date with respect to the NPSFM (2020).

6.2.3.1 Partially Operative Regional Policy Statement

The following objectives and policies from the 2019 Partially Operative Regional Policy Statement are relevant to this application. Policies in this version of the plan (January 2019, updated March 2019) that have not yet been made operative have been omitted.

- *Use resources sustainably to promote economic, social and cultural well-being for its people and communities (Objective 1.1)*
- *Provide for economic wellbeing by enabling resilient and sustainable use and development (Policy 1.1.1)*
- *Provide for social and cultural wellbeing and health and safety by recognising and providing for a number of matters including Kāi Tahu values, values of other cultures, and diverse needs of communities. (Policy 1.1.2)*
- *Recognise and provide for the integrated management of natural and physical resources to support the wellbeing of people and communities in Otago (Objective 1.2)*
- *Achieve integrated management of Otago's natural and physical resources (Policy 1.2.1)*
- *Taking the principles of Te Tiriti o Waitangi into account (Objective 2.1)*
- *Managing the natural environment to support Kāi Tahu wellbeing (Policy 2.2.1)*
- *Kāi Tahu values, interests and customary resources are recognised and provided for (Objective 2.2)*
- *Recognise and provide for the protection of sites of cultural significance to Kāi Tahu (Policy 2.2.2)*
- *Enable Kāi Tahu relationships with wāhi tupuna (Policy 2.2.3)*
- *Minimise risks of natural hazards to Otago's communities (Objective 4.1)*
- *Assess activities for natural hazard risk to people, property and communities (Policy 4.1.4)*
- *Reduce existing natural hazard risk to people and communities (Policy 4.17)*
- *Otago's communities are prepared for and able to adapt to the effects of climate change (Objective 4.2)*
- *Ensure communities are able to mitigate and adapt to the effects of climate change, including by applying a precautionary approach and by encouraging activities that assist to reduce or mitigate the effects of climate change (Policy 4.2.2)*
- *Infrastructure is managed and developed in a sustainable way. (Objective 4.3)*
- *Recognise and provide for infrastructure including by improving efficiency of natural and physical resource use and minimising adverse effects on existing land use (Policy 4.3.1)*
- *Energy resources and supplies are secure, reliable and sustainable (Objective 4.4)*
- *Protecting existing renewable electricity generation (Policy 4.4.3)*
- *Sufficient land is managed and protected for economic production. (Objective 5.3)*

- *Manage activities in rural areas to support the region's economy and communities including by enabling primary production and other rural activities (Policy 5.3.1)*
- *Minimise adverse effects of using and enjoying Otago's natural and physical resources (Objective 5.4)*
- *Apply an adaptive management approach (Policy 5.4.2)*
- *Apply a precautionary approach to adverse effects where effects are uncertain, not able to be determined, or a poorly understood but are potential significant or irreversible (Policy 5.4.3)*

This proposal seeks to recognise and provide for Kāi Tahu values, including by managing the natural environment to support Kāi Tahu well-being. It does so particularly through setting flow limits within affected waterways which will ensure abstraction does not cause disconnection of surface flows, and enhancement of habitat for mahika kai species. This proposal also takes a 'whole of catchment' management approach which is consistent conceptually with 'ki uta ki tai'. The impact of dams within waterways on Kāi Tahu values is acknowledged in the relevant sections, however, many of these dams can also have a positive effect on a range of values, including instream values when flows would normally be low. In general, it is envisaged that Kāi Tahu values, as detailed in Schedule 1A and 1B, will be protected and potentially enhanced as a result of the proposal.

Flooding is not considered to pose a significant risk to the applicants. There are no other known hazard risks. The applicant can re-establish their take as per the permitted activity Rules should damage from flooding occur.

The ongoing use of storage, and implementation of Farm Environmental Plans will assist with mitigation of the potential effects of climate change, although the effects of climate change are likely to be experienced after the expiry of replacement consents sought by this application.

Replacement of the applicant's permits with sufficient instantaneous and volumetric rates of take will ensure the operation can continue into the future, which will support the local economic and social well-being by providing sufficient reliability of supply for a range of uses, including use of existing efficient infrastructure. Water use will be via efficient means as described above, meaning the proposal does not pose any risk to soil health.

The applicants plan to co-ordinate and undertake adaptive and integrated management of abstraction in this catchment, by regulating a residual, and referencing other flow sites (Chatto Confluence flow monitoring site).

The activities that form this proposal are well established, and the associated effects resulting from these activities are well understood. Accordingly, a precautionary approach is not considered necessary, as this proposal seeks to enhance a range of values and mitigate or avoid a number of effects associated with these well-established activities.

Areas providing significant habitat for indigenous fauna or feature significant indigenous vegetation have been identified and discussed above.

Accordingly, this application is considered consistent with the relevant objectives and policies contained within the various versions of the RPS.

6.2.4 National Policy Statement for Freshwater Management 2020

The National Policy Statement for Freshwater Management was introduced in 2011. It was updated and replaced in 2014 and amended in 2017. A New National Policy Statement for Freshwater Management (NPSFM 2020) came into force 3 September and replaces the 2017 NPS.

The NPSFM 2020 is issued by government and directs local government about how to carry out their responsibilities un the RMA 1991 when it comes to matters of national significance.

A comprehensive assessment of the NPSFM 2020 is provided in the overview report. This proposal supports that assessment, and the below is in addition to that assessment.

6.2.4.1 Te Mana o te Wai

The fundamental concept underpinning the NPSFM (2020) is Te Mana o te Wai, recognising the fundamental importance of water and the health of water in protecting the health and well-being of the wider environment. Within the context of the NPSFM this encompasses 6 principles relating to the roles of tangata whenua and New Zealand in the management of freshwater and the implementation of the NPSFM.

These principles are (at 1.3(4)):

> *"(a) **Mana whakahaere**: the power, authority, and obligations of tangata whenua to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, freshwater*
>
> *(b) **Kaitiakitanga:** the obligation of tangata whenua to preserve, restore, enhance, and sustainably use freshwater for the benefit of present and future generations*
>
> *(c) **Manaakitanga:** the process by which tangata whenua show respect, generosity, and care for freshwater and for others*
>
> *(d) **Governance:** the responsibility of those with authority for making decisions about freshwater to do so in a way that prioritises the health and well-being of freshwater now and into the future*
>
> *(e) **Stewardship:** the obligation of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generations*
>
> *(f) **Care and respect:** the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation."*

The NPSFM (2020) also sets out (at 1.3(5) and at Objective 2.1) a hierarchy of obligations and an objective for Te Mana o Te Wai that prioritises:

> *"(a) first, the health and well-being of water bodies and freshwater ecosystems*

(b) second, the health needs of people (such as drinking water)

(c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future."

The replacement of Water Permit RM15.217.01 and Deemed Permit 4006.V1 and application for associated permits forms part of the wider Manuherekia Catchment proposal, with various flow limits and take points throughout the catchment. The development of the overall proposal (including the specific provisions to this application) has been based on these principles and obligations.

The applicant has endeavoured to collect scientifically robust data and to add to information already collected by the Otago Regional Council, in order to present the best available information. The applicant has maintained a flow monitoring site upstream of their abstraction on Neds Creek since 2014, and this has contributed substantially to management of the abstraction activities and understanding of the hydrology of Neds Creek to inform this application. To determine what that might be, and the gaps in information available the applicants engaged with ORC at multiple levels, and key stakeholders and community groups either in person on various field days around the Manuherekia Catchment, at Council via ORC consultative processes in regards to their ongoing plan change processes or via the applicants consultants who have largely driven the science work program over the past few years. Acknowledging the complexities of this catchment, local knowledge has also informed this process.

This application, appendices and supporting documents, indicate a sound understanding of the general health of the waterbodies in this catchment. A number of the principles above are directly relevant to ORC in giving effect to the NPSFM.

The whole of catchment approach taken in this proposal is premised on these principles of stewardship, care and respect. This proposal gives effect to these principles by setting new flow limits and through a reduction in allocation.

Policies for freshwater management to achieve Te Mana o te Wai and the Objective 2.1 are listed in 2.2 of the NPSFM (2020).

This proposal aims to manage freshwater in a way that gives effect to Policy 1. The health of freshwater will be sustained (for present and future generations) through a range of measures including setting of flow limits and reduction in allocation.

With respect of Policy 2, the Maori freshwater values have been identified and provided for by this proposal. It is anticipated that Tangata whenua will be involved in the consent process for this application.

Policy 3 considers that freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments. This proposal takes a whole of catchment approach consistent with this policy. The effects of the take and the use have been considered.

The potential effects of climate change (policy 4) on this catchment have been considered as part of this proposal and is discussed in more detail in the AEE above and in the overview report.

At present there is no planning framework under the National Objectives Frameworks set out in the NPSFM (2020), or any earlier NPSFM, which would give effect to Policy 5. This application is to replace permits expiring on 1 October 2021, which has resulted in this application being lodged prior to establishment of the plan for NOF. The applicant has been actively engaging with ORC to develop a management plan for the Manuherekia Rohe, including value identification (starting in 2016) and environmental outcomes and objectives.

This proposal sets out allocation limits and flow levels that are designed to achieve environmental outcomes that will maintain, enhance (where degraded) and protect values associated with freshwater in the catchment.

There will be no loss of wetlands as a result of the proposal consistent with Policy 6.

With regards to Policy 7, this proposal seeks to enhance ecosystem health, indigenous biodiversity, hydrological functioning, Māori freshwater values and amenity and human contact including swimming and fishing.

This proposal may result in some loss of value to irrigation, cultivation, and food production through a reduction in reliability of supply through flow limits. While this is inconsistent with this policy, it is consistent with the NPSFM's (2020) overarching hierarchy of obligations in Te Mana o te Wai.

This proposal will not result in loss of the extent of a waterway, and overall, this proposal is considered to be generally consistent with Policy 7.

Policy 8 does not apply.

Habitat of eels and galaxiid is most relevant to this proposal in relation to Policy 9. The proposed flow limits, and abstraction limits on the take and volume will protect these indigenous species.

Policy 10 outlines that the habitat of trout and salmon is protected, insofar as this is consistent with Policy 9. Exclusion of trout from races may affect the trout habitat as the reservoir/s habitat for trout will be unconnected to the riverine habitat. However, it could contravene Policy 9 to enable continued fish passage through the race networks. There are screens on the outflows from ponds and dams to prevent ingress of fish and other debris. Passage is not restricted past the applicant's point of take. Trout values are provided for elsewhere in the Chatto

Creek catchment and in Neds Creek.

Consistent with Policy 11, no new primary allocation water allocation is sought, and is proposed to be allocated and used efficiently.

With respect of Policy 12:

Policy 12: The national target (as set out in Appendix 3) for water quality improvement is achieved.

Ammoniacal nitrogen, dissolved reactive phosphorus and nitrate-nitrite nitrogen (NNN) were measured fortnightly in Chatto Creek between 8 September 2009 and 8 September 2010 and monthly ammoniacal nitrogen, DRP, Escherichia coli, NNN and turbidity between 27 October 2016 and 27 September 2017. The available water quality data are insufficient to allow trend analysis for the Chatto Creek catchment. With the data available, water quality within the catchment has been assessed as above the national bottom lines set out in Appendix 3 of the NPSFM for nitrate and ammonium that could broadly be assessed from the available data.

Data collected by the applicant for Neds Creek and Chatto Creek at the upstream and downstream property boundary has been assessed as meeting the national bottom lines set for the available water quality variables, with he exception of E. Coli which like does not meet the standards all the time.

See Tables 11 and 12.

With respect of Policy 13, the applicants have been monitoring the hydrological condition of Neds Creek for some years now and have collaborated with ORC to understand the hydrology of the Neds Creek and wider Chatto Creek catchment. The water takes will continue to be metered and it is expected that ORC will meet their obligations under this policy to continue to monitor the condition of water bodies, to ensure consistency of monitoring within the catchment and across Otago, and to allow a clear understanding of trends. Water quality in the Chatto Creek catchment is generally very good.

Metering data collected by the applicant will support the ORC in meeting Policy 14.

The catchment wider proposal presented in this application gives effect to Policy 15 of the NPS-FM 2020, in the absence of an ORC planning framework that gives effect to the NPS-FM 2020. This proposal has been developed to enable the affected community to provide for its social, economic, and cultural wellbeing whilst prioritising the health and well-being of the wider environment.

Clauses 3.16, 3.17 direct council to set environmental flow limits and levels and identify take limits.

The values identified for this catchment or specific parts of this catchment are set out in Section 3 of this

document. Section 5.1 and 5.2 outlines a number of proposed outcomes for these values in relation to primary and supplementary allocation abstractions. The values and outcomes are based on the work of the ORC to date in developing environmental limits and take limits for this catchment, and the work of the Chatto Creek Water Users Group carried out to understand their abstractions and the hydrology of the catchment better. The minimum and residual flows proposed, and the allocation (or take) limits have been developed to achieve these environmental outcomes, including the matters listed in Clause 3.17(4). The proposed residual flow will achieve habitat retention for compulsory values and improve fish passage in the lowest reaches.

Clause 3.20 directs councils to take action to halt or reverse degradation. The Chatto Creek catchment and headwater creeks are of very good water quality and not known to be degraded. The proposed residual will make a catchment contribution to downstream river areas that may be degraded, in terms of increased low flows.

The NPSFM also sets out a number of policies for regional councils to include in regional plans. Clause 3.24 (loss of river extent and values) and Clause 3.28 (allocation including efficient allocation) have been addressed in the analysis of relevant NPSFM policies above. One of the key policies not addressed already in the analysis of the NPSFM here relates to fish passage. Clause 3.26 requires councils to include the following objective in regional plans:

> *"3.24(1) The passage of fish is maintained, or is improved, by instream structures, except where it is desirable to prevent the passage of some fish species in order to protect desired fish species, their life stages, or their habitat."*

For the reasons outlined above, it may be desirable to limit the passage of adult trout at this location, in order to protect habitat that may be considered suitable for CORGs (a compulsory value) in Neds Creek despite the absence of actual CORGs survey record. However, the presence of trout precludes opportunity to enhance any opportunity for CORGs in Neds Creek. Passage for trout is provided for and not inhibited.

This application is considered to be consistent with the objective contained in Clause 3.24(1) of the NPSFM (2020).

6.2.5 Resource Management (National Environmental Standards for Freshwater) Regulations 2020

The Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (referred to here as the NESF). The NESF regulates activities that pose risk to the health of freshwater and freshwater ecosystems.

The NESF come into force on 3 September 2020, although clauses relating to intensive winter grazing, stocking holding areas other than feedlots and application of synthetic nitrogen fertiliser to pastoral land come into force in mid-2021.

At the time of lodging this application, regulations had been very recently released, with some aspects not yet in force. The applicant is currently working to understand the implications of these regulations on their operations. The applicant has a draft FEP being prepared by a consultant on their behalf. However, at this stage there are no appointed certifiers and no clear certification process of FEPs as this is still being developed. The applicants FFP will be in place by the winter of 2021.

Monitoring of water quality will increase amongst the catchment and sub-catchments, particularly as ORC seek to understand existing state and trends in water quality and meet their obligations under the NPSFM 2020. The applicant too intends to continue with their water quality monitoring program.

6.2.6 Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007

Clauses 6, 7 and 8 of the Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007 (NES) apply to water and discharge permits issued by regional councils.

This proposal does not have the potential to affect registered drinking water supplies that provide 501 or more people with drinking water for 60 or more calendar days each year given the separation distance to such a supply. Furthermore, the emergency provisions of the NES need not apply as the effects of the proposed activity will not be significantly adverse (Regulations 11 and 12).

6.2.7 Resource Management (Stock Exclusion) Regulations 2020

The regulations apply to exclusion of stock from waterbodies. Stock means beef cattle, dairy cattle, dairy support cattle, deer or pigs. The rules do not apply to sheep. The regulations came into force 3 September 2020 and will be phased in over time. The regulations apply to low slope land and all land, to rivers more than 1 m wide.

These regulations specifically state that people who 'owns or controls stock' to comply with these rules.

The applicant is currently working to understand the implications of these regulations on their operations.

Notwithstanding the above, the applicant is aware of their future obligations under this regulation.

6.2.8 Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 and Amendment regulations 2020

The applicant will measure and report the water take at the various intakes in the appropriate format to meet their obligations under these regulations.

The Regulations have been given further consideration to in Section 5.5 of this report.

We don't believe that these regulations are intended to apply to takes from a water race or from a dam.

6.2.9 Section 104(2A) Value of Investment

When making an application for replacement of existing permits, and S124 of the RMA applies, Schedule 4 Clause 3(b) of the RMA requires an assessment of the value of investment of the existing consent holder.

Without this water the land currently irrigated would have to be farmed under a dry land farming regime, which is not financially viable given the applicants recent investment in new centre pivots and k-line sprinklers. Since major conversion to spray irrigation in 2015 the property has invested hundreds of thousands of dollars into spray irrigation on farm (for Private Water and Scheme Water).

The property has been built up over the years around the availability and security of this water supply whilst the construction of the dams has sought to improve the historic surety of supply. Both the dam, irrigators and supporting infrastructure (conveyance system) are significant infrastructural assets that capitalise and take advantage of the water available and drive the property towards more efficiency gains from using water differently.

Ceasing the exercise of all permits would have devastating effects on the applicant and their ability to provide for their wellbeing and would be unlikely to provide significant additional benefit to any other downstream user, or instream value or catchment baseflow that is commensurate to the loss that would be experienced by the applicant. The applicant has invested much time, energy, and money into the farm. As such, the applicant's economic welfare lies entirely in the production capability of their lands. Without water for irrigation, pastures cannot be supported during the growing season and would wilt and die leaving no feed for stock held on the property. Feed would have to be imported onto the farm at a huge cost. Furthermore, this source of water is the only secure and consistent source of water available for stock drinking water which would have a combination of adverse effects on the applicant and animal welfare if it were unavailable for abstraction.

It is concluded that the applicants' use of water was such that the water is of high value to the property and is absolutely critical to maintain the viable productivity on the applicants' property.

Recent govt valuations have estimated the freehold property at around $12.2 million dollars (Quickmap January 2021).

6.2.10 Kai Ta Kāi Tahu Policy Documents

6.2.10.1 Te Runanga o Ngai Tahu Freshwater Policy Statement (TRONT)

The TRONT Freshwater Policy Statement (FPS) has status as an iwi management plan, that was drafted to complement and be read alongside the Kai Tahu Ki Otago Natural Resource Management Plan. The Policy Statement highlights a number of themes such as the direction for the present generation to ensure that the taonga is available for future generations in as good as, if not better quality. And that this can be achieved by the development, restoration and enhancement of programmes for freshwater bodies.

Integrated Management was also a key topic in the policy statement, and in that respect, whilst the FPS is mostly talking of integrated management in terms of the organisational level, the policy statement confirms that catchment management planning is the preferred approach in relation to freshwater. This includes catchment-specific strategies as providing a better basis for achieving integrated sustainable management of natural and physical resources. The applicant is working with their other Chatto Creek catchment users.

Where Kai Tahu values have been identified, they should be at least maintained or enhanced. Particular consideration of Mauri is given here relating to the spiritual presence of the river. It's possible that under status quo flow conditions where flows as low as 70 L/s in the lower reaches of Chatto Creek have been experienced that not only was Chatto Creek not providing for ecological health of the river system during those times it was also not providing for cultural values, including the mauri, or life force of the river. The imposition of a residual flow for Chatto Creek protects this stretch of water and seeks to enhance the mauri of the Creek.

The resources are holistic, and the application does not seek to separate reaches of the watercourses but recognises that downstream effects can have upstream benefits. The proposal recognises and has assessed all effects including those on future generations. The properties are intended to stay in the respective current family ownership and the security of resources will ensure that the farms can be passed on through the generations.

The Kai Tahu Ki Otago Natural Resource Management Plan gives further regard to these matters and is assessed in the next section below.

6.2.10.2 Kai Tahu Ki Otago Natural Resource Management Plan (2005)

Neds Creek is a tributary of Chatto Creek that flows to the Manuehrikia River, and is therefore identified in Schedule 1D of the RPW as having significant cultural values associated with tributaries of the Manuherekia River. These cultural values include Kaitiakitanga, Mauri, Waahi Tapu and/or Waiwhakaheke, Waahi taoka, Mahika kai, Kohanga, trails and cultural materials.

The following values in Schedule 1D of the RPW are identified;

- Kaitiakitanga – the exercise of guardianship by Kai Tahu including the ethic of stewardship;
- Mauri – life force;
- Waahi tapu and/or Waiwhakaheke – sacred places; sites, areas and values associated with water bodies that hold spiritual values of importance to Kai Tahu;
- Waahi taoka – treasured resource; values, sites and resources that are valued;
- Mahika kai – places where food is procured or produced;
- Kohanga – important nursery/spawning areas for native fisheries and/or breeding grounds for birds;
- Trails – sites and water bodies which formed part of traditional routes, including tauraka waka (landing place for canoes); and
- Cultural materials – water bodies that are sources of traditional weaving materials (such as raupo and paru) and rongoa (medicines).

The 'Kāi Tahu ki Otago Natural Resource Management Plan' 2005 (NRMP) outlines general mana whenua policies for activities within Otago. Wai Māori issues in relation to water abstractions include inefficient irrigation methods and reluctance to consider alternatives, volume of extractions being more than is required, lack of harvesting, cumulative extractions, over-allocation and mining privileges that allow for complete dewatering. The following Policies apply to water takes:

- To require an assessment of instream values for all activities affecting water;
- To promote the cultural importance of water to Kāi Tahu ki Otago in all water management within the Otago Region and Lower Waitaki Catchment;
- To protect and restore the mauri of all water;
- To oppose any further cross mixing of waters.
- To require that resource consents applications seek only the amount of water actually required for the purpose specified in the application;
- To require that all water takes are metered and reported on, and information be made available upon request to Kāi Tahu ki Otago;
- To oppose the granting of water take consents for 35 years, consistent with a precautionary approach, either a review clause or a reduced term may be sought;
- To require that fish passage is provided for at all times, both upstream and downstream.
- To encourage those that extract water for irrigation to use the most efficient method of application;
- To require that a consent term for water extractions for irrigation be of 5-10 years where Ka Papatipu Rūnaka considers the method of irrigation to be inefficient to allow for an upgrade to a more efficient method;
- To require that any works be undertaken either before or after spawning season of potentially affected

species as identified by the affected Papatipu Rūnaka;

- To discourage activities on riverbanks that have the potential to cause or increase bank erosion;
- To require flow regimes that mimic natural flows.
- To promote sustainable land use in the Clutha/Mata-au Catchment.
- To require native fish ingress and egress past all dams and structures.
- To discourage over-watering;
- To encourage dry land farming practices where appropriate;
- Identifying waterways that exclusively support indigenous fish;
- To require that fish screens be fitted to all pumps and race intakes;
- To oppose the creation of new dams within this Catchment (Clutha/Matau-au Catchment);
- To promote sustainable land use in the Clutha/Mata-au Catchment.

The proposal is generally consistent with the policies of the NRMP, and in particular, the proposal includes a proposed recommended residual flow.

The property total over 8,000 ha in size, whilst irrigation from the applicant's water permits makes up approx. 6% of the total property area (this is for current irrigation only) which supports the ability to farm in the higher country with feed on the flats finishing and carrying stock through the winter. Dryland farming will continue on the remining proportion of the property, with an area of proposed irrigation included in this proposal that bring the total irrigation command area to 12% of the total property; the irrigation requirement for the proposed irrigation areas is meet by stored water and supplementary allocation.

To be able to accommodate Wai Māori Policies with regard to implementation of efficient irrigation techniques, a long consent duration is necessary to be able to secure the capital investments required to initiate the farm-scale changes including conversion to spray and installation of storage to buffer the higher residual flows proposed and protect existing infrastructure. While the consent duration requested is contrary to Wai Māori Issues and Policies, a precautionary approach is not a 'no-risk' approach as this is not the intention of the RMA (Aquamarine Limited v Southland Regional Council C126/97 at 145). There is no plausible evidence that the activity will have an irreversible effect on the environment. Furthermore, the actual or potential effects of the activities are able to be quantified by scientific measurement, so in this instance application of a 'precautionary approach' would be inconsistent with the contemporary RMA setting (Sea-Tow v Auckland Regional Council A066/06 at [462]). Review is always available to council should circumstances change throughout the proposed duration of consent to avoid, remedy or mitigate any unforeseen adverse effect. Standard review clauses imposed in a resource consent issued by council would not be contested, which is consistent with the policy. Further, 5-10-year consent durations may be preferred where irrigation is entirely overland but given the existing conversion to spray and significant investment that is highly dependent on long-term water security, any short term consent would be unreasonable. For certainty, the applicant proposes to phase out overland irrigation within a 10 year timeframe

and install an automatic gate on the intake within 5 years of commencement of any resulting consent, but ONLY if a consent duration of 35 years is granted.

The proposal avoids cross-mixing of waters, the take will continue to be monitored and no more than the volumes actually required for irrigation, stock drinking water and race operation have been sought. With respect to mauri, specific consideration has been given above.

The proposal is entirely consistent with the relevant policies as outlined above and addresses key issues and values.

6.2.11 Sections 105 and 107 of the RMA

In addition to the matters in Section 104(1) of the RMA, if an application is for a discharge permit a consent authority must have regard to the matters as specified in Section 105. Section 105 does not apply to the proposal, all bywashes from dams are permitted activities.

Section 107 does not apply to the proposal for the same reasons.

6.3 Section 104D Particular Restrictions for Non-Complying Activities

Overall, the application is ***non-complying.***

The effects of the specifics of this proposal are assessed as being no more than minor, and therefore the proposal is likely to pass the first 'gateway' test of Section 104D.

The proposal passes the second gateway test of S104D, which is complicated by PPC7. This proposal on its own is assessed as being consistent with the relevant policies and objectives of the operative RPW as detailed in Section **Error! Reference source not found.** of this report.

The proposal is considered consistent with Objective 10A.1.1 of PPC7 as it will provide long-term sustainable management of surface water. It is also consistent with Policy 10A.2.1 of PPC7 and is only inconsistent with Policies 10A.2.2 and 10A.2.3 in that it seeks a long term of consent and new areas of irrigation are proposed.

This proposal passes both gateway tests. However, when considered in the context of the overall proposal (including other applications) it passes the second test only in that the proposal is consistent with the bulk of relevant objectives and policies in the RPW, and inconsistent with one policy under PPC7.

Overall, consideration can be given to the granting of the consent and a full assessment of the application in accordance with Section 104 can be made.

6.4 RMA Amendment Act 2020

This includes provisions for farm plans (part 9A). This does not yet apply.

7. CONSULTATION

Clause 6(1)(f) of Schedule 4 of the RMA requires the identification of, and any consultation undertaken with, persons affected by the activity.

With respect to the Neds Creek take, Fish & Game (F&G) may have an interest in the proposal given the presence of trout in Neds Creek. F&G's concerns are expected to be limited considering the resident population does not support angling opportunities in the creek itself and the population does not contribute to the fishing values in the wider Manuherekia Catchment given the disconnection between the upstream habitat and any habitat in Chatto Creek. The applicants hunting activities are not affected by the proposal and therefore F&G are not affected on that basis. At the time of processing of RM15.217 the Council only determined minor effects on trout values, this was due to the presence of trout in Neds Creek. For that reason, it was determined that the application could proceed non-notified subject to the applicant obtaining unconditional written approval from Fish and Game. The applicant volunteered a 15 l/s residual flow past the new take point for RM15.217.01 and the written approval of Fish and Game was obtained. That transfer application followed a non-notified process. As no changes to that condition are proposed, and the residual flow is already agreed, F&G are not considered an affected party by this proposal specifically.

Aukaha are considered an affected party to the proposal, as representatives of iwi's interests in surface water abstractions in the Otago Region.

Department of Conservation (DoC) are not considered an affected party given the absence of native fish in the Neds Creek catchment, and partly given that DoC have not registered conservation interests on any titles subject to this proposal.

At various time of preparing this application, and more broadly for the Chatto Creek water users, consultation and discussions have occurred broadly with those groups outlined above. Discussion and consultation focused around identifying key reaches or effects of most concern to stakeholders with respect to the catchment wide abstractions.

With respect to other lawfully established water users, MISCL are unaffected by the proposed replacement of the Neds Creek take, given that there are no changes to the take sought. MISCL is not replacing their Neds Creek downstream authorised water take, and therefore are not affected by this proposal.

The honourable David Parker has registered his interest in being notified of future water permit applications in order to exercise his discretion to submit on behalf of the Crown.

The applicant seeks public notification.

8. CONSENT DURATION, REVIEW AND LAPSE

Consideration of the proposed consent duration is a matter for discretion under Rule 12.1.4.8 of the RPW. Policy 6.4.19 of the RPW also applies and sets matters to consider when setting the duration of a resource consent. Policy 10A.2.3 of PPC7 also applies to the setting of consent duration. Section 123 of the RMA details that the maximum consent term that may be granted is 35-years and minimum is 5 years from the date of commencement where a consent term is not specified.

This application maintains that the RPW (and hence policy 6.4.19) is the dominant planning instrument and that little weight should be given to the provisions of PPC7 (policy 10A.2.3 in particular in relation to this application). Consideration of both are given for completeness.

- ***The duration of the purpose of use, climatic variability and consequent changes in local demand for water;***

The use of water for irrigation and stock water purposes is likely to be required in the long term, given the nature of the soils and climate on the properties and especially when taking into consideration climatic variability and a tendency towards more seasonal extremes as outlined in the Bodeker science report[22]. The use of the water for irrigation supply is most likely to be in effect for a duration of not less than 35 years given the suitability of the properties and surrounding environment for these purposes.

Variability in climatic events is predicted to become more extreme with increases in droughts and flooding events expected. Therefore, the volumes as proposed will be required to cope with these predicted climatic events, particularly the likelihood of more drought events. Farm systems will be adaptively managed by way of a FEMP which will enable the farm system to adapt to the effects of climate variability over the long term. The applicant is in the process of having their FEMP developed. Likewise, the proposed residual flow can be reviewed as per review conditions, that would determine "*whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which becomes evident after the date of commencement of the consent".* The applicant will monitor their take, their catchment management approach, and the proposed residual flow. The effects of climatic variability will be able to be addressed adaptively through implementation of Farm Environment Plans

[22] Cameron, C., and Kremser, S., Lewis, J., Bodeker, G., and Conway, J. (2019). The past, present and future climate of Central Otago: Implications for the District. Prepared by Bodeker Scientific for the Central Otago District Council.

and review conditions on the permit.

The proposed takes do not adversely affect community water supplies.

- ***The presence of a catchment minimum flow or aquifer restriction level;***

This catchment has a minimum flow set, and that minimum flow will apply to this application. ORC have been in the process (since 2014) of setting new allocation and catchment limits in the Manuherekia Catchment. The timing of ORC's Water and Land Plan is at odds with the need to replace deemed permits and lodge applications prior to the six-month expiration date of the permits (1 October 2021). PPC7 sets an interim planning framework that enables an application to be replaced with the same flow conditions that apply to the permit but with significant restrictions and reductions on the existing permits that are not specific to the permits.

This application proposes new residual flows which are specific Chatto Creek and will provide for the identified values to the catchment as a whole. The applicant proposes to maintain the Manuherekia River minimum flow. The proposal goes above and beyond this consideration which just requires that a minimum flow exists. This proposal goes beyond the provisions of PPC7 and the requirements of the RPW, the proposal gives effect to the higher-level planning documents and as such a longer consent duration may be granted.

- ***The extent to which the risk of potentially significant adverse effects arising from the activity may be adequately managed through review conditions;***

The risk of significant adverse effects arising from the proposal is low. The existing environment is relatively well-known and the existing hydrology and ecological values of Neds Creek in particular are relatively well known. The proposal is based on the best available information to date. The applicants know that a residual flow will not be lost to ground, and the that proposed residual flows will provide an improvement on the existing conditions and values present, as this residual flow has been occurring for some time, the benefits of this have already been observed and will continue to occur.

A potential risk is that the proposal does not achieve the environmental outcomes that are sought, and that recharges back to the Manuherekia Catchment as a result of overland flow irrigation are experienced less. There is a risk that the new flow regime results in changes that have not been observed before. There is a low level of risk of this occurring which will be mitigated by the applicant proffering monitoring and review conditions on the permit to take and use water. The conditions proposed will adequately manage the potential effects of the proposal. There are no significant adverse effects of the proposal.

- ***Conditions that allow for the adaptive management of the take and use of water; and***

Adaptive management includes the conversion of spray to overland over time, as returns allow so that appropriate and efficient infrastructure can be installed with a long term view that reflects the longevity of the

activities proposed. The residual flow on Chatto Creek will be adaptively managed as provide for by conditions of consent.

The applicant has storage and intends to develop more as part of their adaptive management to climate change.

- ***The value of the investment in infrastructure and use of industry best practice.***

The value of investment in infrastructure, the livestock, feed grown and economic prosperity of the communities the water abstractions support is significant.

The applicants employ local contractors for haymaking, fencing, cultivation, irrigation and reticulated supply, measuring and reporting, and the effects of the profitability of the business are felt throughout the community both directly or indirectly.

In recent years Rabo-Bank have hosted a winter feed growing competition in the Manuherekia Valley. The funds raised at these competitions (10s of thousands) have been considerable and are donated back to local schools, first response (literally life-saving facilities) and other important local entities such as the proposed Omakau Domain Function Centre that will be utilised by various community groups in future. These organisations/local projects would not benefit in the event that irrigation was unable to continue to occur to at least the same level that has been enjoyed over the last 20 years and would severely influence the local economy.

Investment in existing irrigation infrastructure, is not a 'sunk cost' these irrigation improvements have been invested in on the basis of a long-term farming opportunities in these catchments. The feasibility of viable farming businesses in this catchment are reliant on the water that sustains them.

The proposal is consistent with current best practices and changes to these best practice standards are not likely to be substantial within the requested consent duration. It is accepted that Council may initiate a review of the consent if flow meter data reveals the consented volumes are significantly higher than what is actually being taken. It is important however that a decision to review on this basis is made using an appropriate amount of data to determine statistical probability for potential future demand. It is also accepted that council may initiate a review of the consent if there are restrictions or limits set through an NPSFM or operative plan. Regulations are stand-alone statutory instruments and consent reviews are not necessary to impose conditions on consent holders in relation to these.

The request for a 35-year consent duration gives the applicants the security to make ongoing investment decisions based on the returns from their operation over this duration. The surety of a longer consent term is bankable and the ability to invest in continued upgrades entirely depends on the bankability of the consent. Furthermore, millions of dollars have already been spent on converting to irrigation over at least the past 20 years. The historic investment in spray was obviously influenced and facilitated by the applicants existing consent

durations, and less pressure of permit expiration.

Although it has very little weight, Policy 10A.2.3 applies to this application. PPC7 Policy 10A.2.3 is to not grant a duration exceeding six years, irrespective of any other policies in the Plan, except where Rule 10A.3.2.1 applies and the abstraction will have no more than minor adverse effects (including no more than minor cumulative effects) on the ecology and the hydrology of the surface water body (and any connected water body) from which the abstraction is to occur and the resource consent granted will expire before 31 December 2035.

The applicant's property and irrigation are not insignificant, and collectively currently irrigates up to 531.3 ha of land, with an additional 439 ha of future irrigation area already identified and invested in with irrigation set-out plans having been prepared, and geotechnical reports for some of the proposed storage dams that would provide water to these new areas. A longer consent duration is required, not only to enable the required-on farm upgrades for irrigation at the farm scale for the current irrigation command area with certainty that conversion from flood to spray will be bankable, but also the opportunity to continue on with current plans for future irrigation that will make their farm profitable into the future.

Short consent terms create significant challenges for the applicants in financing the works required on farm to shift to more efficient means of irrigation, and in providing for environmental gains as described in this application. A consent with a shorter term could not then have conditions relating to on-farm or scheme improvements, as the conditions could not be met by the applicants in the short term without the long-term security of supply to secure capital for the investments. An application that would be consistent with Policy 10A.2.3 would not provide significant environmental benefits like those proposed in this application. Further, a short consent term would push back the applicant's ability to fund significant changes by 10 years or more, reducing the likelihood that environmental gains could be achieved in a generation (35 years).

In accordance with Section 123 of the RMA, a consent duration of 35 years may be granted for a resource consent to take and use water and dam a waterway. The proposal favours criteria (a) – (f) of policy 6.4.19, and as such a longer consent duration (up to 35 years) would be consistent with this policy. Policy 10A.2.3 has little weight on this proposal.

9. CONCLUSION

The applicant, Matakanui Station Limited, is applying to the Otago Regional Council (the Council) to replace Water Permit RM15.217.01 and Deemed Permit 4006.V1. One permit will replace both of these permits for the take and use of water from Neds Creek. The applicant is also seeking a new water permit for supplementary allocation from Neds Creek and is seeking consent to dam water.

An appropriate residual flow has been proposed which will provide for continued maintenance and improvements

in aquatic habitat. A collaborative approach has been taken with the applicant working with their local community and other catchment users. The applicant is a member of the Chatto Creek Water Users Group and collectively this group is proposing a residual flow on Chatto Creek for the summer and winter period. Furthermore, the applicant is a member of the Manuherekia Catchment Group and collectively this group is proposing a minimum flows for the mainstem Manuherekia River at campground that will apply to the applicants permits.

A total of 970.7 ha of land is to be irrigated, and the continued transition to spray irrigation methods is proposed over time, with further new storage that support the applicants existing and future irrigation. The continuation of the existing consented rate of take and the annual volumes as applied for, along with supplementary allocation, will provide the applicant with the security needed to invest in irrigation infrastructure to further improve irrigation efficiency on the property and reduce reliance on contour irrigation methods. Resource consents issued for a 35-year term will provide the necessary security.

Overall, the effects of the activity are considered to be no more than minor, and the proposal is consistent with the purpose and principles of the RMA. Council can have certainty in the effects of the proposal, and that the proposal will occur as proposed in this document. The intent of the proposed conditions will ensure that any adverse effects are avoided, mitigated or remedied. Overall, consent may be granted under Section 104B of the RMA.

A decision to grant the resource consent application(s) under Section 104B is recommended on the basis that:

a) the adverse effects on the environment are virtually certain to be insignificant;
b) the proposal is consistent with the requirements of the RMA, relevant regional/district plan objectives and policies and other relevant matters.

Appendix A: Minutes from pre-application engagement with ORC

Manuherekia Sub-catchment Chatto Creek Meeting Minutes
Held 24 September 2020

In attendance:
ORC: Natasha Pritchard, Pete Ravenscroft, Ciaran Campbell, Vicky Swaney
Incite: Angela Fenemor, Adele Dawson
Landpro: Claire Perkins

Apologies:

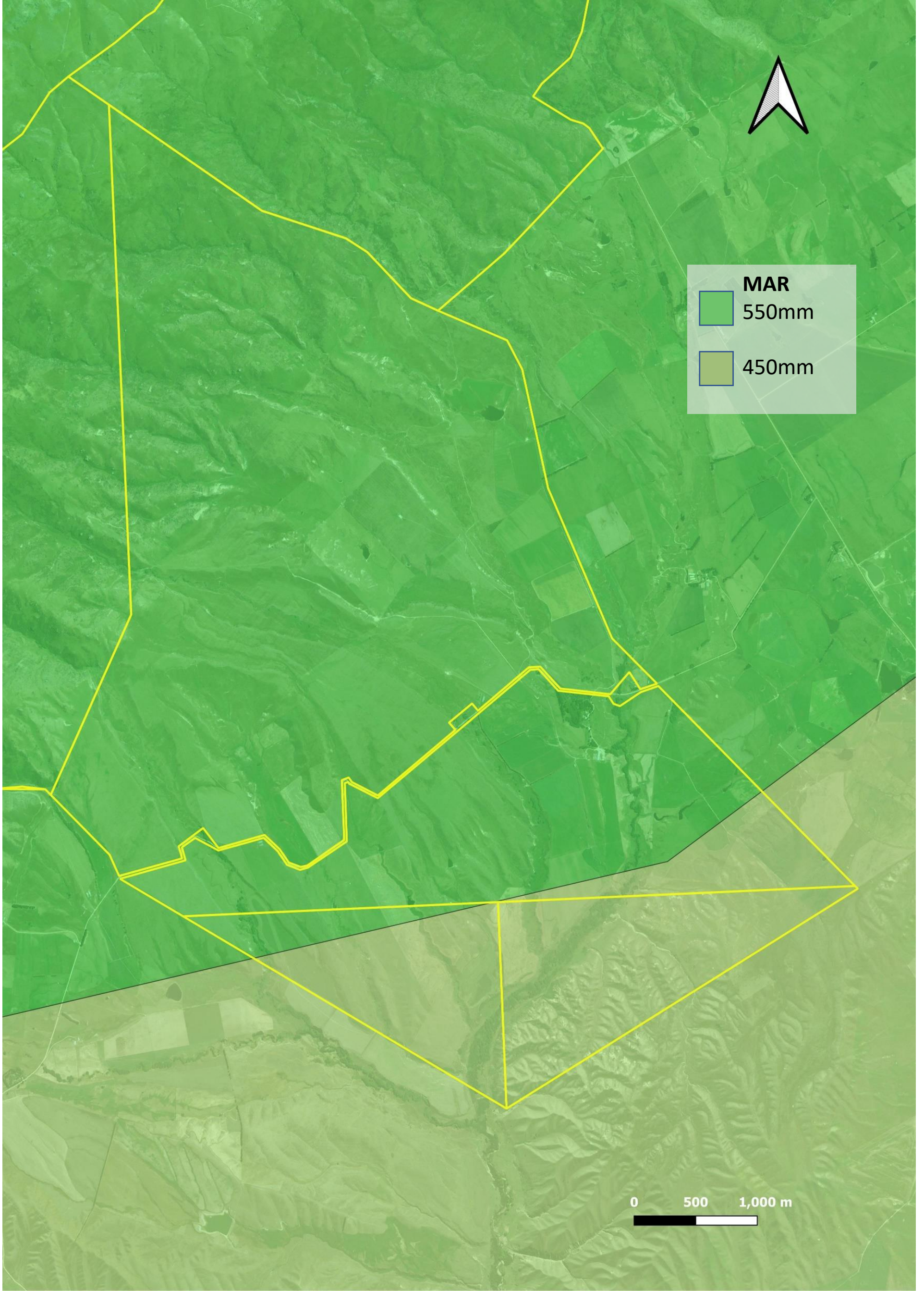
Item	Subject
1	***Overview of sub-catchment*** • Sub-catchment group meeting last week. All consent holders are on-board with working together to source Science work and manage flows including those who currently have consents. • Landpro is representing all shareholders except Trevor Drake who has already applied for his consent. • Some overlap with Thomsons Creek catchment. Naylor uses water in Chatto Creek and Thomsons Creek catchment. Complicated by water in both directions • Table of primary allocations was shared on screen. Includes OAICL 'County Scheme' and Devonshire Race', MICS (not to be replaced), Matakanui Station, Naylor, and Drake (lodged). Naylor currently a primary take but could be supplementary. • Minor by-washes at points of take. • Good measuring of takes and have redone allocations
2	**Consent requirements** • Working through dams on properties and need for consents. There are some in-river dams. • Some takes fall into Thomson Catchment but will come in this package. • New supplementary takes being sought for Matakanui and Naylor. • Question on fish screens – some have but not all – Matt is looking at fish screens requirements
3	**Science information/data** • Flow recorder at the top of Neds Creek – good hydrological record. • Quite a few galaxias at the top of the catchment- Matt Hickey and Dean Olsen working on this at moment. • Mat and Dean to be aware of natives in 200 – 500 m of stream. See more in wet year but in dry season hardly see any. • Roundhead galaxias – downstream 'sandwich ' populations. Flows good for galaxias but not trout. Management for galaxias. Galaxias in Devonshire Creek below OIACL take point. CO roundhead galaxias in main stem. Could be subject to cumulative effects. • Flood run off will be reduce due to pivot irrigation which is in use for first year. When using flood irrigation, it recharges stream.

	• Rainbow trout spawn in lower reaches of Chatto creek. Trout at take points. • Stock water. Unsure if used for stock water and believe most of races are not fenced. Reticulated stock water is being proposed. • Water quality pretty good – Dean is looking at this • Water uses and land uses - mainly stock water, irrigation but not diary. Ross Naylor has beef cattle but not dairy support • Efficiency of races – not known at moment will address in application No proposal to upgrade or replace races. • Consultation – not in last 18 months, was visited years ago as part of Manuherekia site visit with DOC, Fish and Game etc.
4	**Key issues** • Pete advised have some information on naturalised flows from Topnet and is happy to share information – will pass this onto Matt

Actions arising: None

Date of next meeting:

Appendix B: Maps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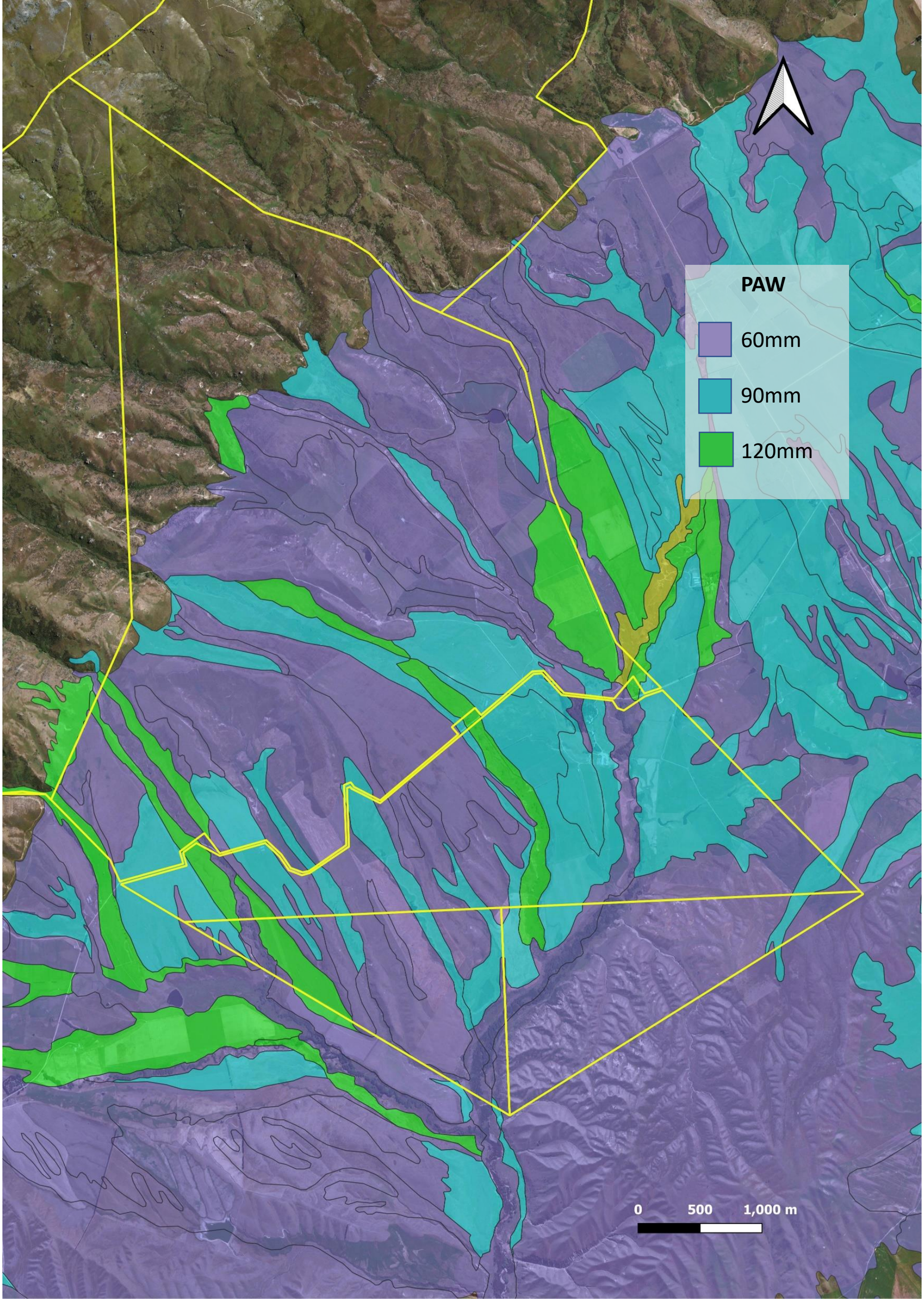
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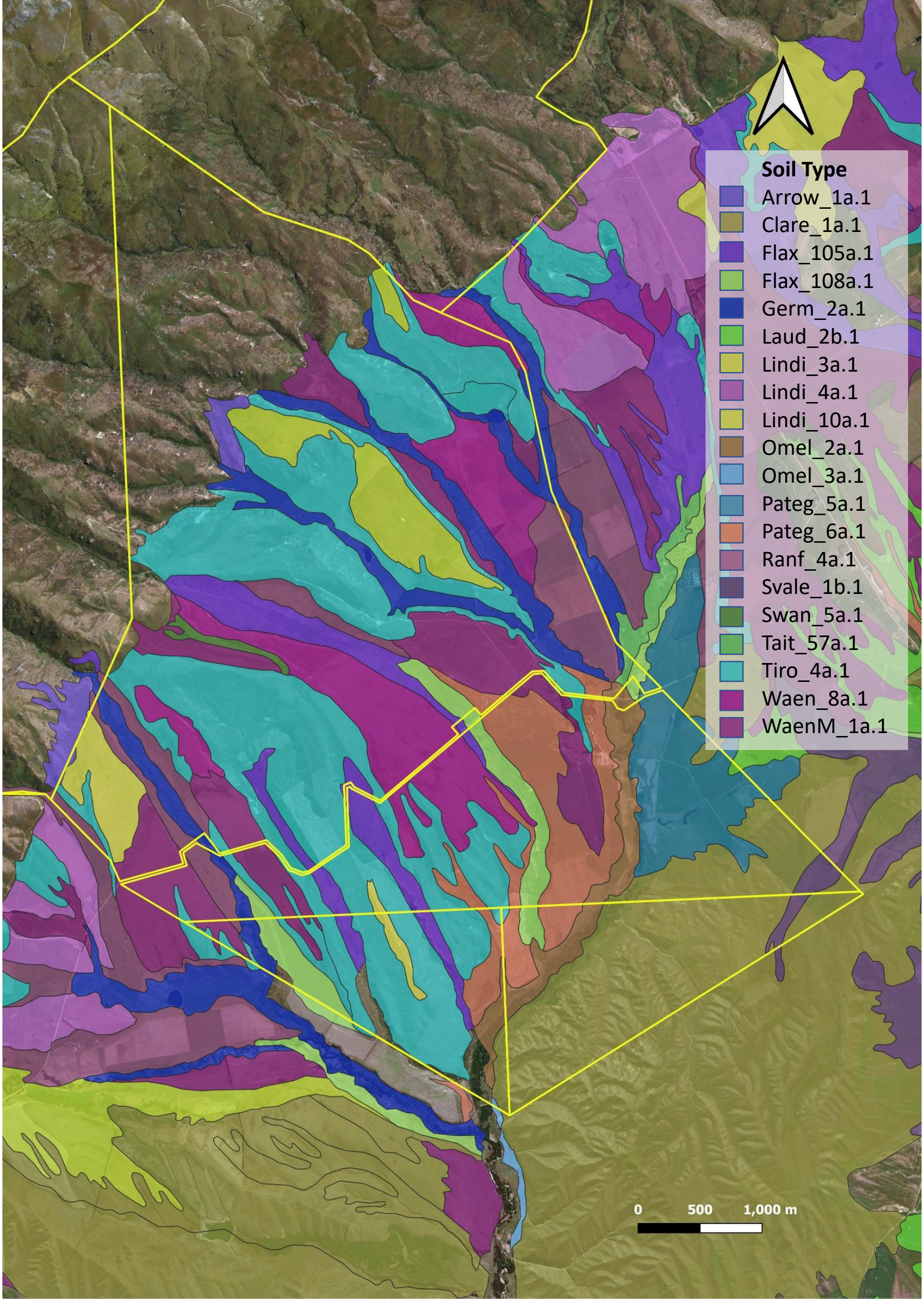
Soil Type
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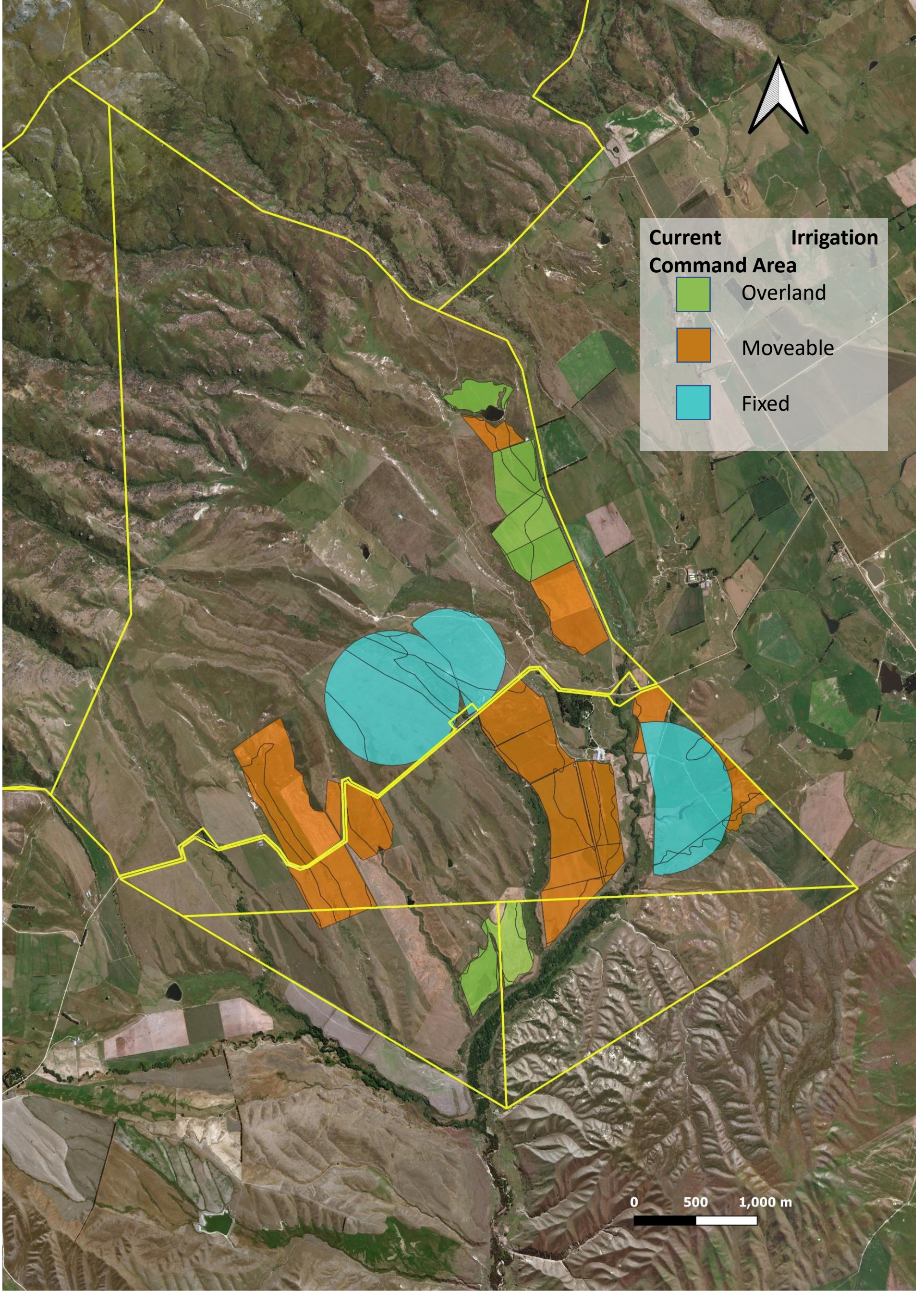
Clare_1a.1
Flax_105a.1
Flax_108a.1
Germ_2a.1
Laud_2b.1
Lindi_3a.1
Lindi_4a.1
Lindi_10a.1
Omel_2a.1
Omel_3a.1
Pateg_5a.1
Pateg_6a.1
Ranf_4a.1
Svale_1b.1
Swan_5a.1
Tait_57a.1
Tiro_4a.1
Waen_8a.1
WaenM_1a.1
0
500
1,000 m

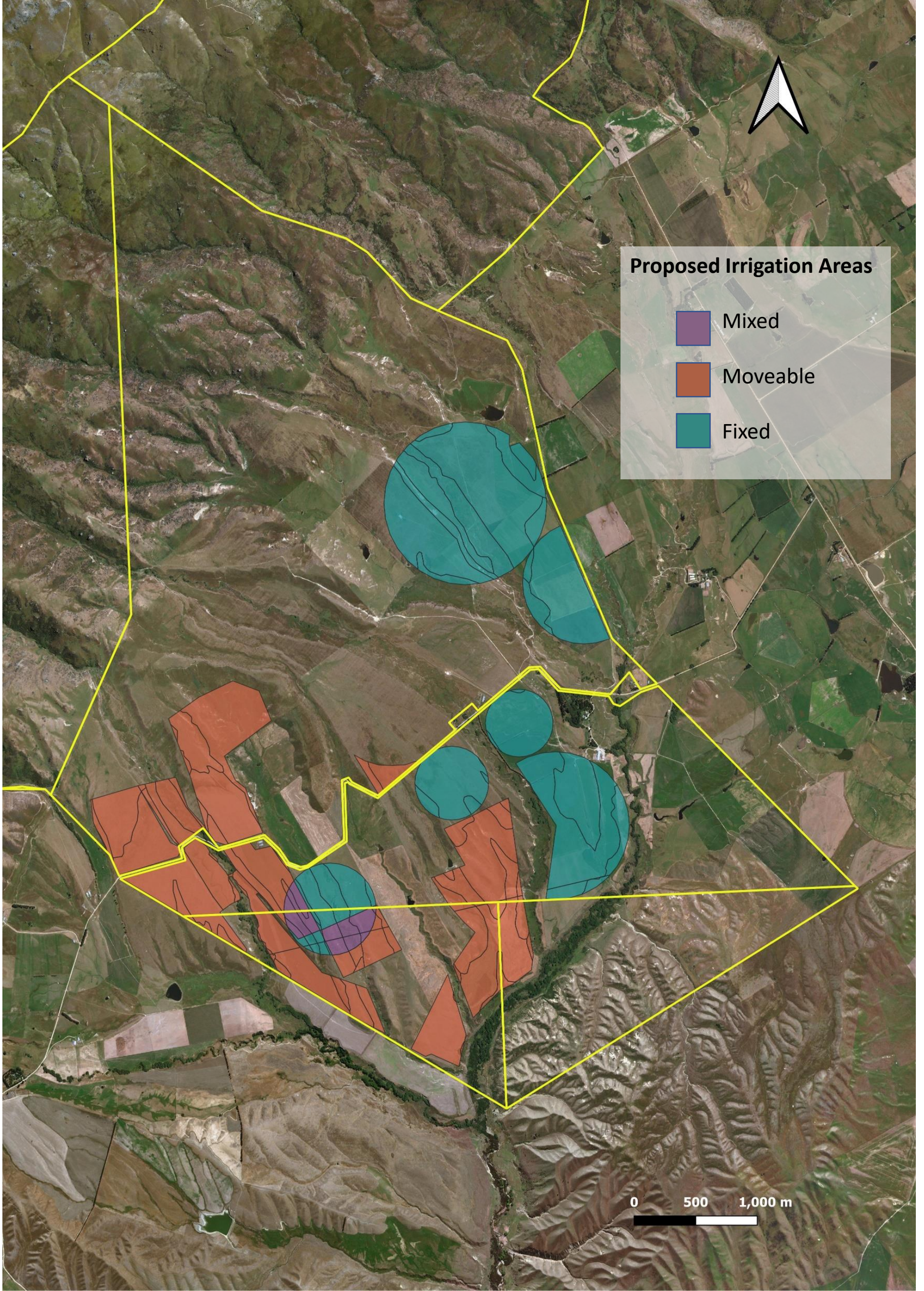
Total* Indicative Irrigation Command Area

- Overland
- Moveable
- Fixed
- Proposed

**Total all irrigation includes current plus proposed future irrigation areas.*

0 500 1,000 m


Current Irrigation Command Area
Overland
Moveable
Fixed
0
500
1,000 m


Proposed Irrigation Areas
Mixed
Moveable
Fixed
0
500
1,000 m

Appendix C: Abstraction Records

File Note

10 January 2021 Landpro Reference: 18060

Subject: Matakanui Station Deemed Permits - Historical Maximums

Tables and graphs on the following pages summarise monthly and seasonal volumes for:

4006.V1 & RM15.217.01 WM0505 Neds Creek

Table 1 below summarises the historic maximum abstraction. The raw abstraction reported in Table 1 is the raw record with no data filtering or exclusion of outliers or spikes in the data. Incorrect readings, exceedances or zeros can often be the result of faulty equipment, flood or weather events, or other legitimate issues. The filtered data is the raw abstraction record filtered where if the raw record contains exceedances, the consented maximum has been specified as the maximum recorded rate of take for exceedances within the margin of error, and these exceedances are acknowledged. Where justifiable exceedances have occurred due to taking of winter flows and higher flows, where this has occurred within the irrigation season or reasonable period for filling storage, the consent maximum has been applied. Here, the instantaneous record contained exceedances most likely related to freshes in Neds Creek, and therefore the record shows this as use of water for filling storage. The 10% margin of error is consistent with the margin of error associated to an open channel flow meter; this approach also accounts somewhat for metering outliers, or errors. Data was processed using excel software. The approach is consistent with recent hearing decisions (see: Long Gully Race Society RM17.176; and Queensbury Ridges Ltd (pending appeal) RM19.312); and the method proposed by the Otago Water Resources Users Group[1]. The abstraction records were sourced from the Otago Regional Council directly.

Table 2 summarises monthly, seasonal, and annual abstraction. Figures 1, 2 and 3 show the instantaneous (l/s) abstraction record and the monthly and total annual volumes (m^3).

[1] Submission by Otago Water Users Resource Group on Proposed Water Permits Plan Change (Plan Change 7) to the Regional Plan: Water for Otago.

0800 023 318
13 Pinot Noir Drive
PO Box 302
Cromwell 9342
Central Otago, NZ
info@landpro.co.nz
landpro.co.nz

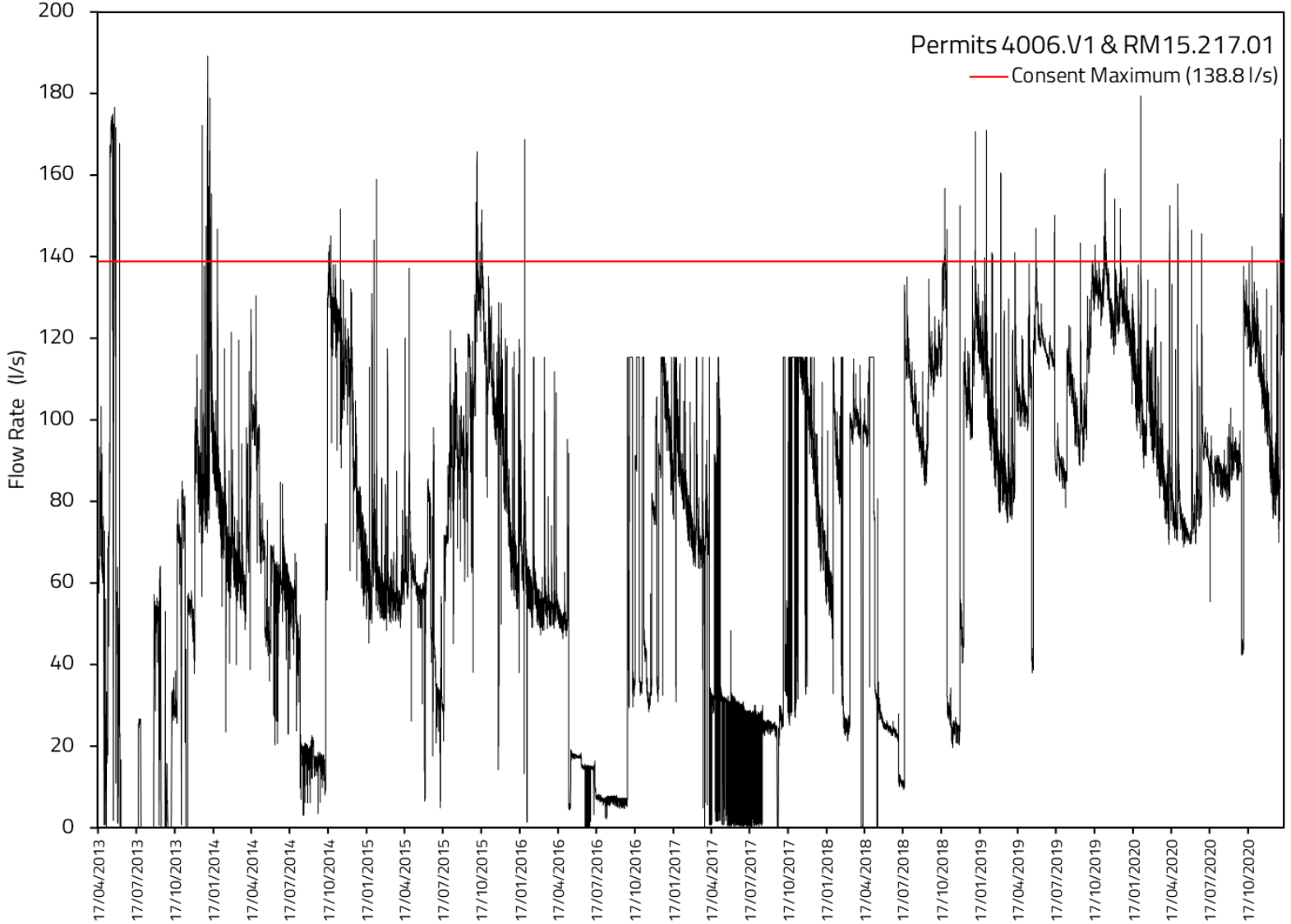
Table 1: Neds Creek – 4006.V1 & RM15.217.01. Summary of historical maximums calculated from a variety of methods.

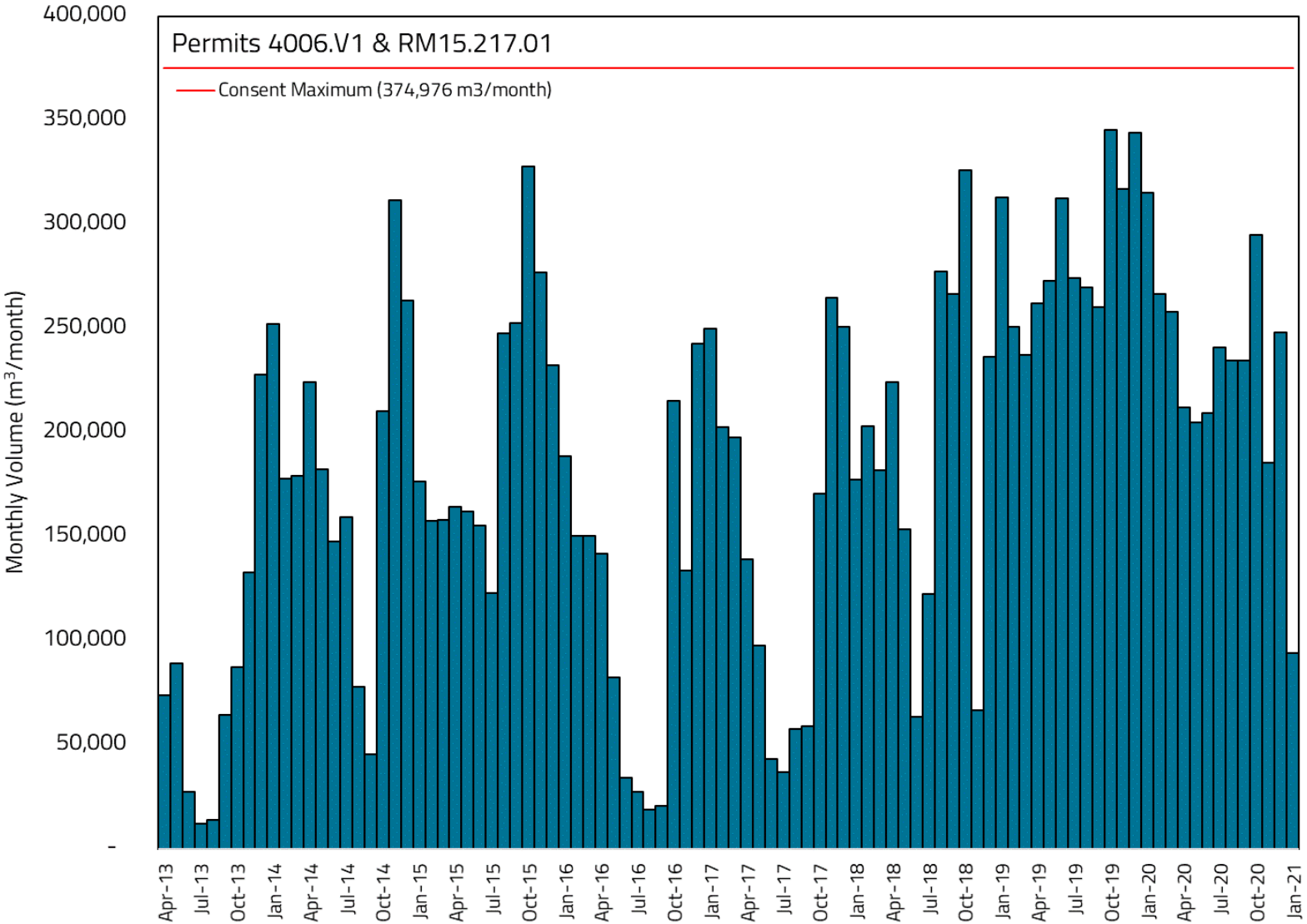
Historical Maximum Permit 4006.V1 & RM15.217.01- WM0505 Neds Creek			
Data record:	Actual Raw Record - full record April 2013 – Jan 2021 Filtered – April 2013 – Jan 2021 for complete seasons		
	Consent[1]	**Actual[2]**	**Filtered[3]**
Rate of Take l/s	138.8	189.2	138.8
Daily m^3	11,995	14,997	11,995
Monthly m^3	347,976	345,418	345,418
Annual m^3	4,608,033	3,303,397	3,299,938

[1] Consent Maximum, i.e., the on-paper allocation

[2] Based on maximum recorded abstraction across full record.

[3] Filtered data have been audited so that justified exceedances have been removed; where exceedances occur within 10% margin of error the consent maximum is given, and exceedances above 10% margin of where removed where justified.


Permits 4006.V1 & RM15.217.01
Consent Maximum (138.8 l/s)
Flow Rate (l/s)
200
180
160
140
120
100
80
60
40
20
0
17/04/2013
17/07/2013
17/10/2013
17/01/2014
17/04/2014
17/07/2014
17/10/2014
17/01/2015
17/04/2015
17/07/2015
17/10/2015
17/01/2016
17/04/2016
17/07/2016
17/10/2016
17/01/2017
17/04/2017
17/07/2017
17/10/2017
17/01/2018
17/04/2018
17/07/2018
17/10/2018
17/01/2019
17/04/2019
17/07/2019
17/10/2019
17/01/2020
17/04/2020
17/07/2020
17/10/2020


Permits 4006.V1 & RM15.217.01
Consent Maximum (374,976 m3/month)
Monthly Volume (m³/month)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
-
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Jan-20
Apr-20
Jul-20
Oct-20
Jan-21

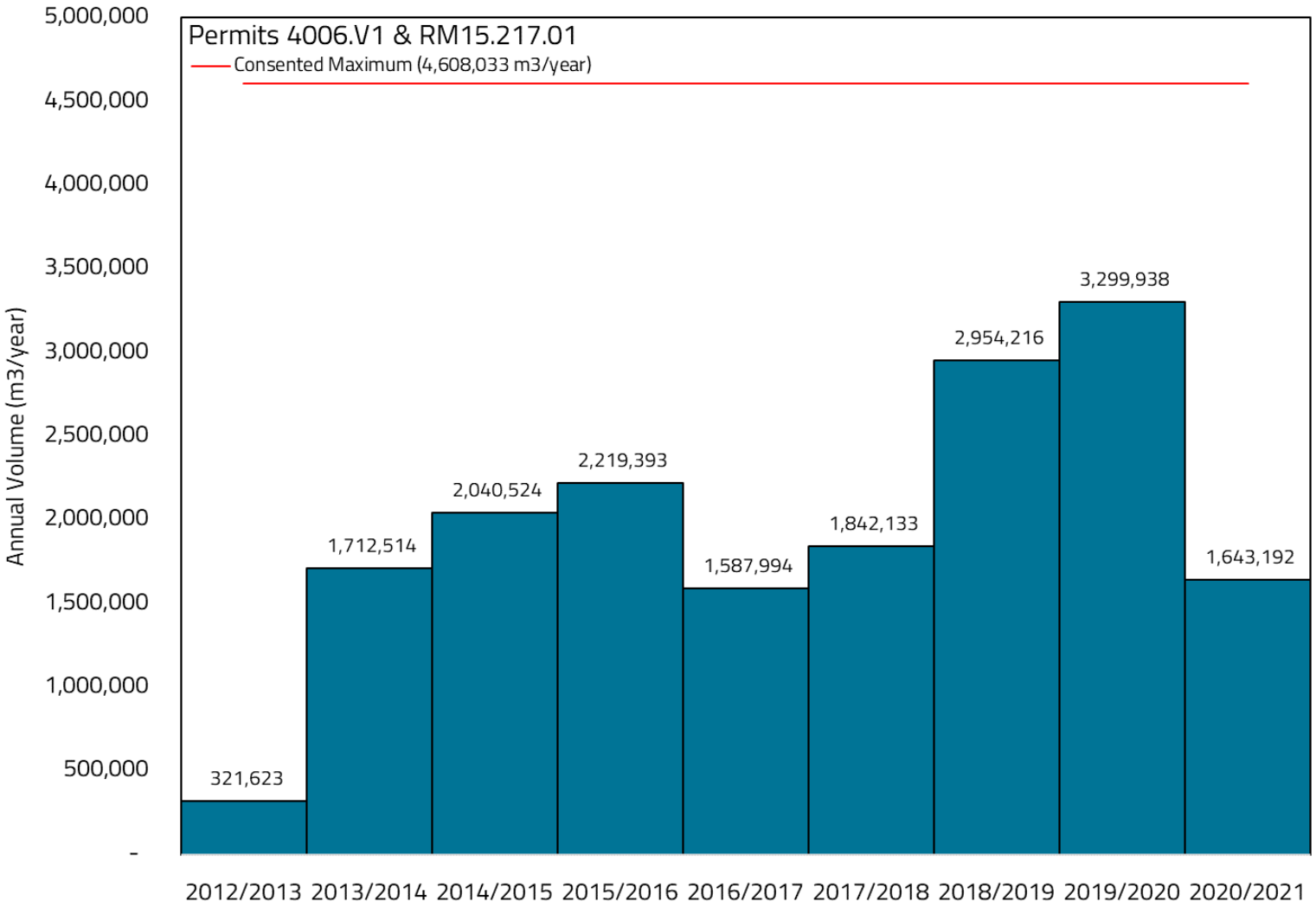

Permits 4006.V1 & RM15.217.01
Consented Maximum (4,608,033 m3/year)
Annual Volume (m3/year)
5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
-
321,623
1,712,514
2,040,524
2,219,393
1,587,994
1,842,133
2,954,216
3,299,938
1,643,192
2012/2013
2013/2014
2014/2015
2015/2016
2016/2017
2017/2018
2018/2019
2019/2020
2020/2021

Table 2: Historical maximums sorted by month, hydrological year total, and irrigation season (1 Oct – 30 April) for Matakanui Station – 4006.V1 & RM15.217.01. Data is filtered abstraction record where raw abstraction record is capped at 10% over the consented rate.

WM0506 & WM0505 – Matakanui Station (April 2013 – Oct 2020) Ned Creek Permits 4006.V1 & RM15.217.01														
Monthly, Annual and Seasonal Volumes (m^3) – Filtered abstraction record at 10% over the consent maximum daily volume (m^3) based on the consented maximum rate in l/s.														
	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	Annual Total	Season total
2012/2013										73,658	220,883	27,082	321,623	73,658
2013/2014	12,017	13,974	64,086	87,003	132,813	227,565	264,226	177,800	179,222	224,265	182,114	147,431	1,712,514	1,292,892
2014/2015	159,489	77,922	45,530	210,018	311,429	263,170	176,256	157,377	157,982	164,204	162,023	155,124	2,040,524	1,440,437
2015/2016	122,675	247,366	252,654	339,878	276,790	232,406	188,667	150,468	150,388	141,681	82,420	34,001	2,219,393	1,480,278
2016/2017	27,396	18,873	20,703	215,066	133,695	242,763	249,773	202,585	197,669	138,905	97,618	42,947	1,587,994	1,380,457
2017/2018	36,816	57,587	58,654	170,741	264,891	250,854	177,251	202,882	181,738	224,149	153,307	63,264	1,842,133	1,472,505
2018/2019	122,438	277,225	266,421	325,730	66,551	236,379	325,066	250,597	237,060	261,863	272,577	312,307	2,954,216	1,703,247
2019/2020	273,908	269,605	260,017	345,418	340,767	344,034	315,329	266,673	258,003	212,051	204,816	209,317	3,299,938	2,082,274
2020/2021	240,758	234,307	234,666	295,061	296,310	248,012	94,079						1,190,070	480,339
MAXIMUM	***273,908***	***277,225***	***266,421***	***345,418***	***340,767***	***344,034***	***325,066***	***266,673***	***258,003***	***261,863***	***272,577***	***312,307***	***3,299,938***	***2,082,274***

Appendix D: Copy of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **OT405/60**

Land Registration District **Otago**

Date Issued 15 October 1958

Prior References
OTPR27/210

Estate Fee Simple

Area 3986.8618 hectares more or less

Legal Description Section 6-7 Block I Lauder Survey District, Section 3 Block XIV Wakefield Survey District, Section 10 Block III Tiger Hill Survey District and Section 10 Block X Tiger Hill Survey District

Registered Owners
Matakanui Station Limited

Interests

Saving and excepting all minerals within the meaning of the Land Act 1924 on or under the land and reserving always to Her Majesty the Queen and all persons lawfully entitled to work the said minerals a right of ingress egress and regress over the said land

Subject to Section 315 Land Act 1924

Subject to Section 230 (c) Land Act 1924

883950 Transfer creating the following easements in gross - 12.6.1995 at 9.10 am

Type	Servient Tenement	Easement Area	Grantee	Statutory Restriction
Convey water	Section 6-7 Block I Lauder Survey District, Section 3 Block XIV Wakefield Survey District, Section 10 Block III Tiger Hill Survey District and Section 10 Block X Tiger Hill Survey District - herein	Black line Transfer 883950	Omakau Area Irrigation Company Limited	

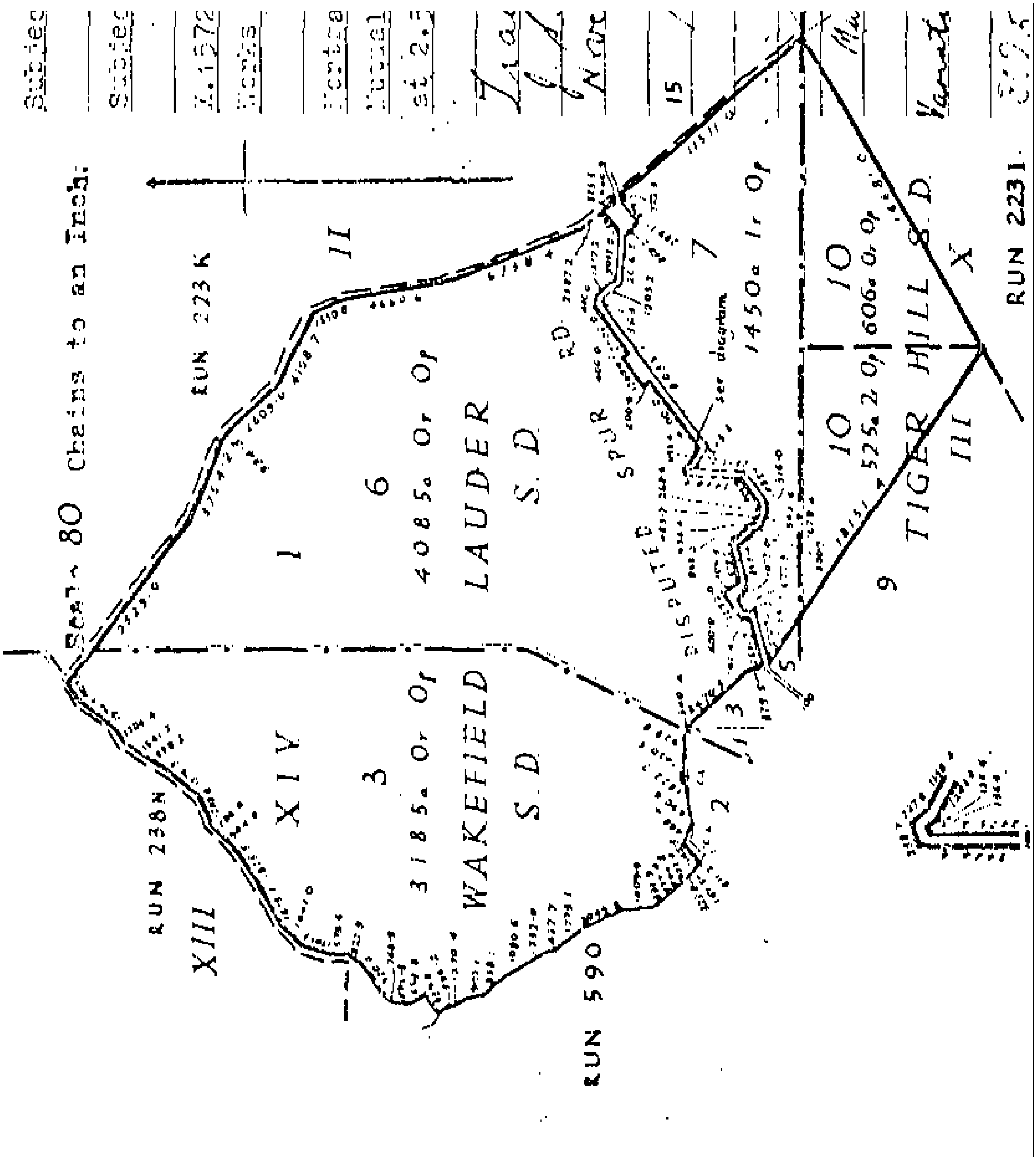
6405548.1 Mortgage to Rabobank New Zealand Limited - 4.5.2005 at 9:00 am

9863550.2 Variation of Mortgage 6405548.1 - 29.10.2014 at 11:34 am

10662461.1 Mining Certificate pursuant to Section 417 Resource Management Act 1991 to Moutere Station Limited - 19.12.2016 at 9:39 am (Affects Section 3 Block XIV Wakefield SD and Section 6 Block I Lauder SD)

11407264.1 Variation of Mortgage 6405548.1 - 12.4.2019 at 11:59 am

11552977.1 CAVEAT BY AURORA ENERGY LIMITED - 18.9.2019 at 10:23 am


Scale 80 Chains to an Inch
RUN 223 K
II
1
6
4085a 0r 0p
LAUDER
S.D
XIV
3
3185a 0r 0p
WAKEFIELD
S.D
RUN 238N
XIII
RUN 590
SPUR RD
DISPUTED
7
1450a 1r 0p
see diagram
10
606a 0r 0p
10
525a 2r 0p
TIGER HILL S.D
X
III
9
RUN 2231
5
2

Appendix E: Winter Water Chatto Creek Memo from Matt Hickey

memo

To: Chatto Creek water User Group

From: Matt Hickey (WRM Ltd)

Date: 04/11/2020

Re: Reliability of winter water with a 250 l/s residual flow at the Chatto Creek Confluence.

Table 1 below is an assessment of available water over winter/spring (1st May to 30th Sept) based on recorded flows at the Chatto Creek confluence Flow Site. The data shows flows recorded at the confluence have always exceeded 254 l/s with flows exceeding 580 l/s 90% of the time between May and Sept.

With a winter residual flow of 250 l/s at the confluence there would still be 330 l/s available 90% of the time between May and Sept on average for taking.

There are 152 days between 1st May to 30th Sept therefore for 137 days (90% of the time) at least 330 l/s could be taken which is 3.9Mm^3 of storage.

Table 1. % time flow is exceeded at the Chatto Creek confluence (1st May to 30th Sept) and the water that could be taken with a residual flow of 250 l/s (data covers winters of 2009/10 and 2016-20).

Exceedance frequency (%)	Chatto Creek at Confluence (l/s)	Available water for taking (l/s)
0	12261	12011
10	1892	1642
20	1508	1258
30	1276	1026
40	1111	861
50	967	717
60	840	590
70	741	491
80	670	420
90	580	330
91	576	326
92	562	312
93	555	305
94	544	294
95	522	272
96	515	265
97	468	218
98	433	183
99	295	45
100	254	4

Appendix F: Chatto Creek AEE - Assessment of Environmental Effects of Water Abstraction from the Chatto Creek Catchment

Assessment of Environmental Effects of water abstraction from the Chatto Creek catchment

By:

Matt Hickey, (Water Resource Management Ltd.)

Dean Olsen, Freshwater Scientist (Freestone Freshwater Ltd.)

freestone
freshwater science

WATER
RESOURCE MANAGEMENT LTD

Prepared for Chatto Catchment Group

October 2020

by Matt Hickey & Dean Olsen

Executive summary

Chatto Creek is a significant tributary of the Manuherikia River entering on the true right bank above Galloway. The estimated natural 7-day MALF at the confluence is ~360 l/s. Observed flows below all water takes shows that Chatto Creek at the confluence can be less than 70 l/s in dry seasons.

Monitoring indicates that there is little surface/groundwater interaction along the mainstem of Chatto Creek, unlike other Manuherikia tributaries.

The existing primary water take permits in the catchment are consented to take up to 1,567 l/s. Historically there have been few takes in the catchment with residual flows set to provide for ecological values and there has been no agreement between water users to roster to maintain flows in the lower reaches of Chatto Creek.

Based on the NIWA freshwater fish database Chatto Creek has one species of threatened fish, the central Otago roundhead galaxias and two other species of native fish that have been recorded more than once (upland bully and longfin eel). The introduced sports fish brown and rainbow trout have also been recorded in the catchment.

This report proposes residual flows (summarised in Table 1), a water sharing regime and a change in water take infrastructure to provide a flow regime to provide for the ecological values present in Chatto Creek.

Table 1. Summary of Consents and proposed residual flows for ecological values.

Existing Consent Number	Take location	Recommended Residual Flow(s) Oct – April.
RM16.235.01	Young hill Creek	10 l/s at intake and 100 l/s at Chatto Creek Confluence
RM16.235.01	Turnipy Creek	Flows as in the consents Galaxiid Management Plan
RM16.235.01	Centre Creek	Flows as in the consents Galaxiid Management Plan
RM16.243.01[1]	Campbell Creek	Flows as in the consents Galaxiid Management Plan
RM16.243.01	Laheys Creek	Flows as in the consents Galaxiid Management Plan
97109	Young Hill Creek	10 l/s at intake and 100 l/s at Chatto Creek Confluence
RM15.217.01 4006.V1	Neds Creek	15 l/s at intake and 100 l/s at Chatto Creek Confluence
2001.712.V1 2001.713.V2	Buster Creek	20 l/s at intake and 100 l/s at Chatto Creek Confluence
2001.714.V1	Coal Creek	5 l/s at intake and 100 l/s at Chatto Creek Confluence
2001.715.V1	Scotts Creek	5 l/s at intake and 100 l/s at Chatto Creek Confluence
2001.716.V1 2001.717.V1 2001.718.V1	Devonshire Creek	10 l/s at intake and 100 l/s at Chatto Creek Confluence
RM15.127.01 Winter Take Only	Devonshire Creek	25 l/s at intake and 100 l/s at Chatto Creek Confluence
93320	Devonshire Creek	15 l/s at intake and 100 l/s at Chatto Creek Confluence

Table of Contents

Table of Figures

List of Tables

1. Introduction

There are 19[2] primary water take consents from the Chatto Creek Catchment that are consented to take up to 1,567 l/s. Two consents to take water from seven locations with a combined maximum rate of take of 526 l/s have recently been granted. These two consents are from the Younghill and Laheys Creek catchments.

The Laheys Creek catchment takes have been granted with no residual flow conditions[3] as part of the a galaxiid management plan to protect a population of Central Otago roundhead galaxias that are essentially sandwiched between trout populations both above and below them[4]. This focus on galaxias habitat has been carried through for the wider Chatto Creek catchment.

Currently, a minimum flow of 820 l/s applies to takes in the Manuherikia catchment upstream of the Ophir flow site, but no minimum flow applies to takes from the catchment downstream of this site (including the Chatto Creek catchment). However, even if a minimum flow did apply to the lower catchment, residual flows are the key mechanism for protecting ecological and natural character values in tributaries with different hydrological characteristics to the mainstem. A residual flow is the amount of water that must be left at a point of take to provide for ecological values and natural character of that waterbody. Residual flows apply at the point of take and apply in concert with a minimum flow, i.e. both the minimum and residual flow must be met for water to be taken.

When determining a residual flow, it is important to determine the ecological values to be protected, the natural hydrology of the stream at the point of take and the potential effects of the proposed take on those flows, and subsequently the ecological values. A key focus of this report is the requirement for residual flows at the point at which the water is taken from the Chatto Creek catchment.

1.1. Scope of this assessments

The scope of this report is to provide an assessment of hydrology and aquatic ecology of Chatto Creek (a tributary of the Manuherikia River), including consideration of potential mitigation options (e.g. residual flows, fish screens, flow sharing).

1.2. Available information

This assessment relies on the following information:

1. Certified flow records collected by Otago Regional Council (ORC) from the Chatto Creek at SH85 (for the period 2009-10 and 2016-2020).
2. Water metering data supplied by ORC
3. Information from the recently issued Moutere and Moutere Airdire Water Company water permits.
4. Information from NIWA's Freshwater Fish Database.
5. Longitudinal gaugings and photos by ORC.
6. Observations by water users.

[2] One of these is a retake for 28 l/s from an unnamed tributary.

[3] There is a condition that if needed 5 l/s will be released from a dam to the creek to provide for Central Otago roundhead galaxias.

[4] Galaxiids are better able to survive low flows than trout.

7. State of the Environment monitoring data from ORC.
8. Habitat modelling by Jowett Consulting.
9. Water quality reporting from NIWA and ORC.
10. The NPSFM (2020).

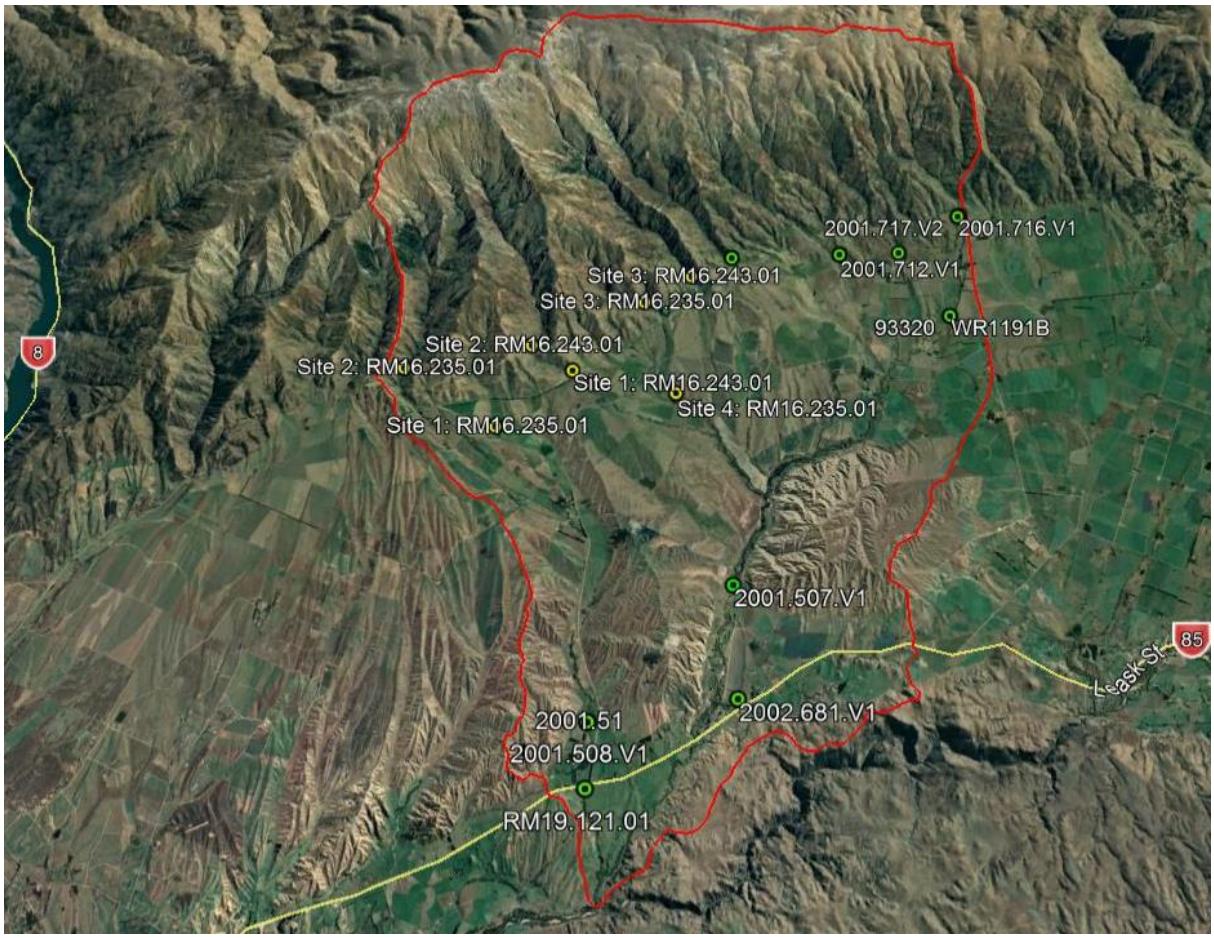


Figure 1 ***Location of water takes in the Chatto Creek catchment (red outline). Yellow circles are recently granted consents (in the Young Hill and Lahey's Creek catchments) and green circles indicate consents to be renewed.***

2. Catchment Description

2.1. Climate

The climate of the Chatto Creek catchment is typified by long, hot, dry summers and very cold, dry winters. The highest temperature recorded at Alexandra is 38.7°C and experiences an average of 7 days a year where maximum temperatures exceed 30°C, and an average of 35 days per year where maximum temperatures exceed 25°C (Macara 2015). Similarly, the highest temperature recorded at NIWA's Lauder research station is 35.0°C and it experiences an average of 3 days a year where maximum temperatures exceed 30°C, and an average of 33 days per year where maximum temperatures exceed 25°C (Macara 2015). In contrast, winters in the area are the coldest in the country. The lowest temperature recorded at Alexandra is -11.7°C and at Lauder is -19.7°C, and

Alexandra experiences an average of 86 days and Lauder 104 days with the minimum temperature below 0°C (Macara 2015).

The mean annual rainfall at Alexandra is 363 mm and 439 mm at the Lauder Research Station with highest rainfall in December and January and lowest rainfall in late winter (Macara 2015). Rainfall increases from the valley floor (350-400 mm) to the top of the Dunstan Ranges (650 mm) (Figure 2).

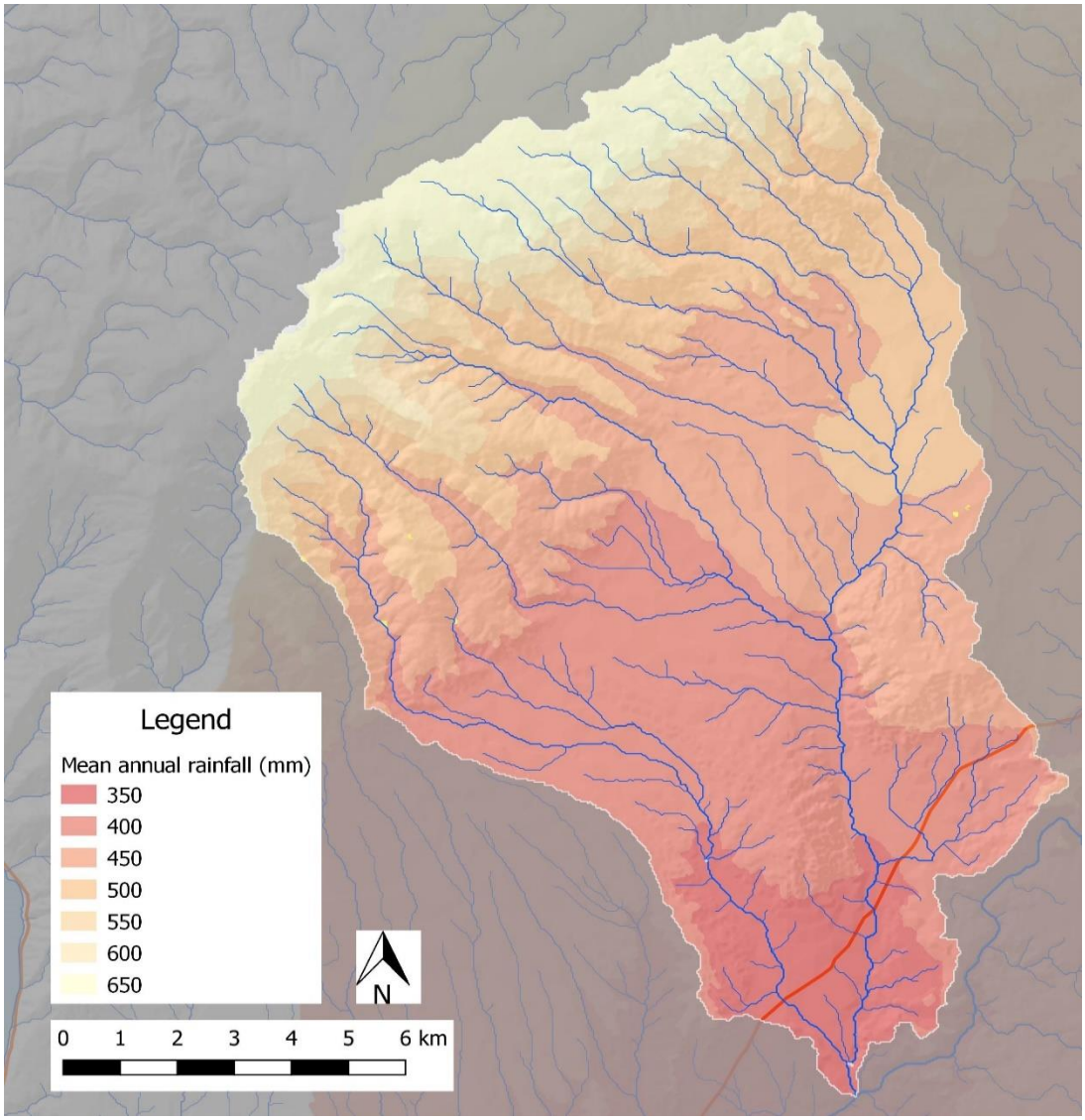


Figure 2 ***Rainfall in the Chatto Creek catchment based on Grow Otago (courtesy of Otago Regional Council).***

2.2. Geology and geomorphology

The upper reaches of Chatto Creek flow from the Dunstan Range through a steep, catchment, before flowing out onto the Manuherikia Valley, where the gradient is markedly lower (Figure 3).

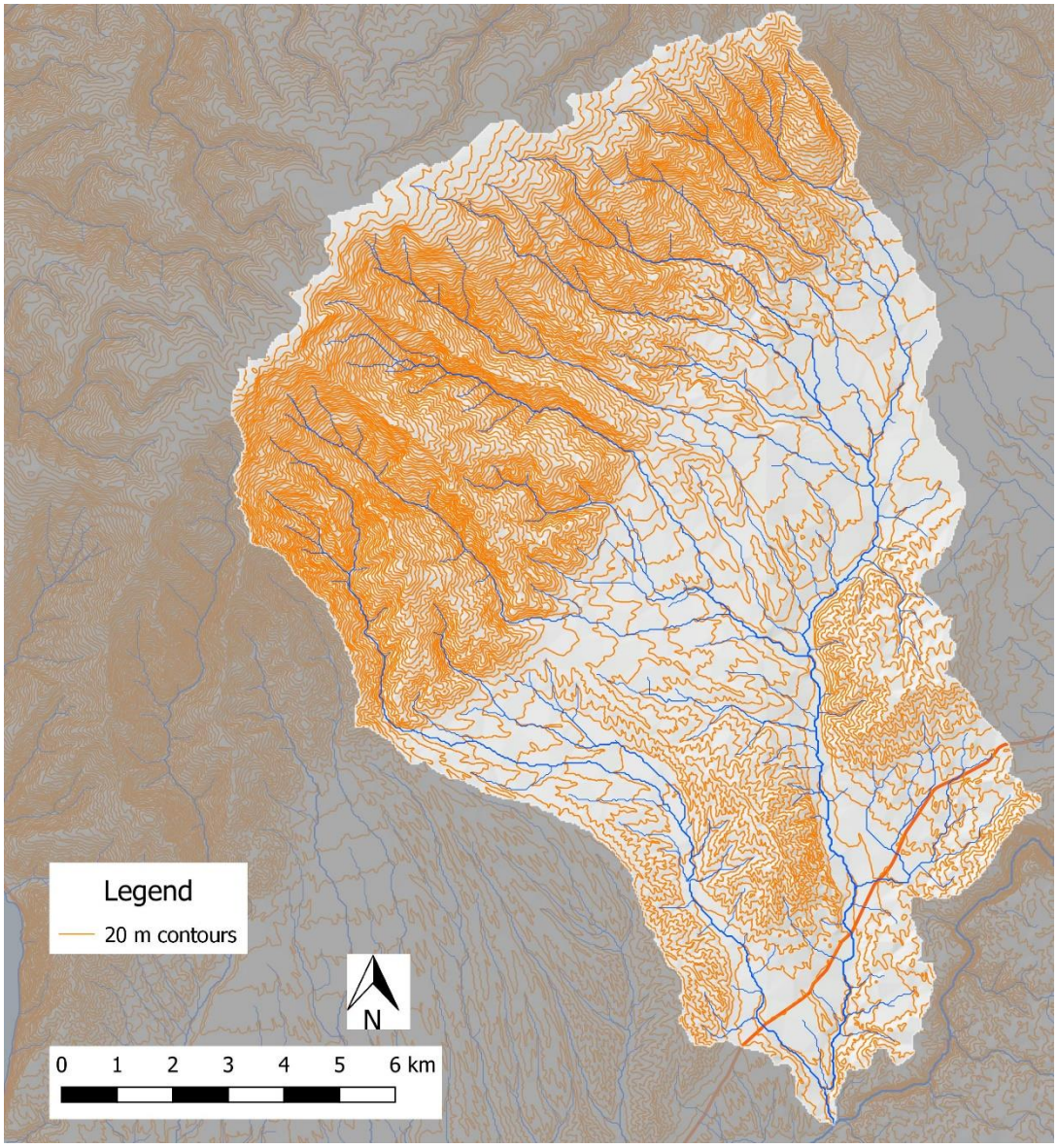


Figure 3 ***Topography of the Chatto Creek catchment based on 1:150,000 scale contours. Contour spacing is 20 m.***

This transition from the steep valley of the upper catchment to the low gradient of the valley floor coincides with the Dunstan Fault, which runs along the eastern edge of the Dunstan Ranges (Figure 4). To the west of the Dunstan Fault, the basement rocks are schist , while to the east the valley floor is dominated by deposits of lacusturine clay, silt and oil shale with minor lignite seams, quartz sand and conglomerate with patches of quaternary outwash gravels of various ages (Figure 4).

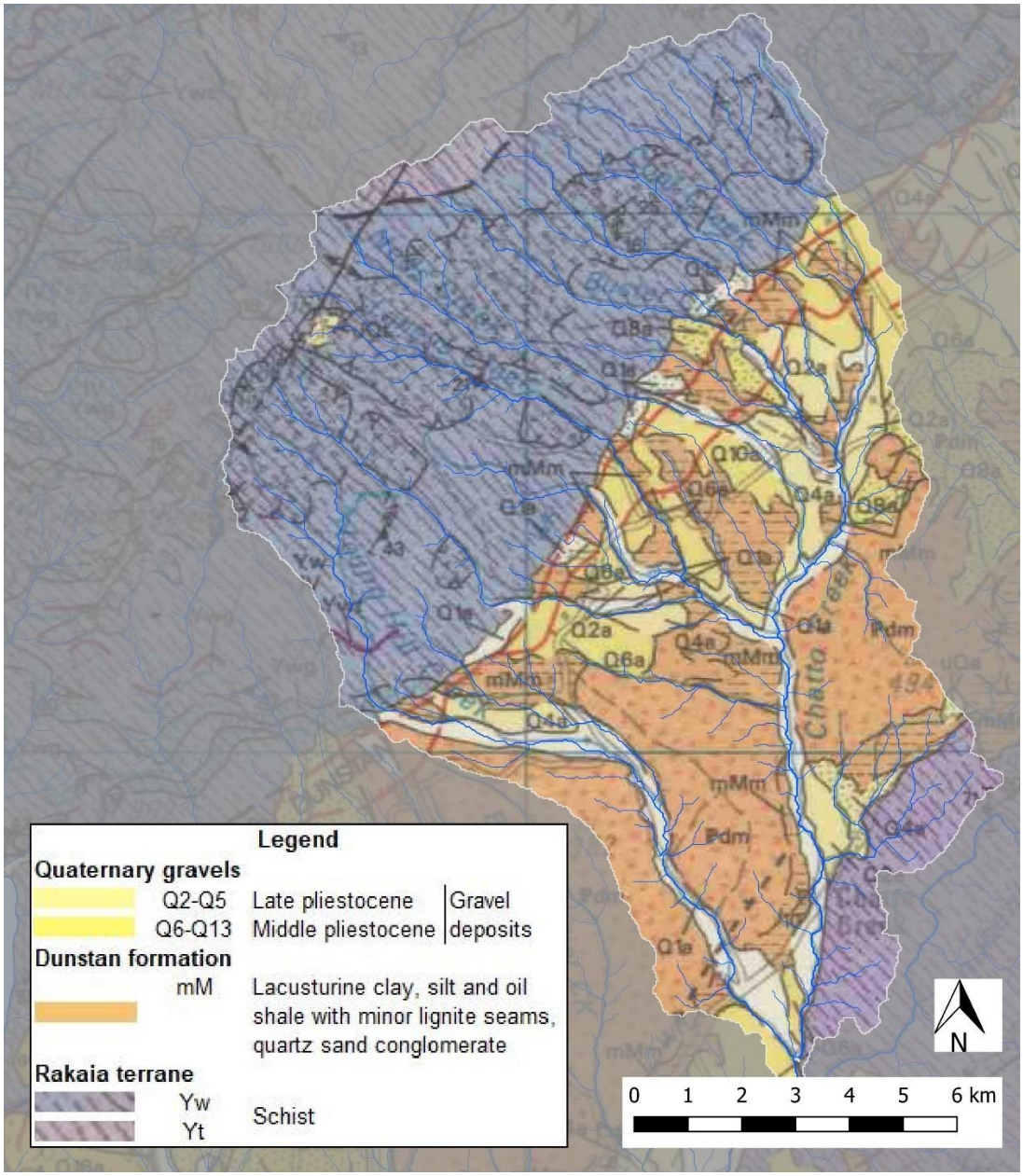


Figure 4 ***Geology of the Chatto Creek catchment based on QMap Wakatipu (Turnbull 2000).***

2.3. Catchment landuse

The majority of the Chatto Creek catchment consists of agricultural grasslands with tall tussock (2,583 ha; 16%) and low producing grassland (8,977 ha; 54%) dominating the hill country and high-producing pasture grasslands (3,275.8 ha; 20%) dominate areas in the valley floors (Figure 5).

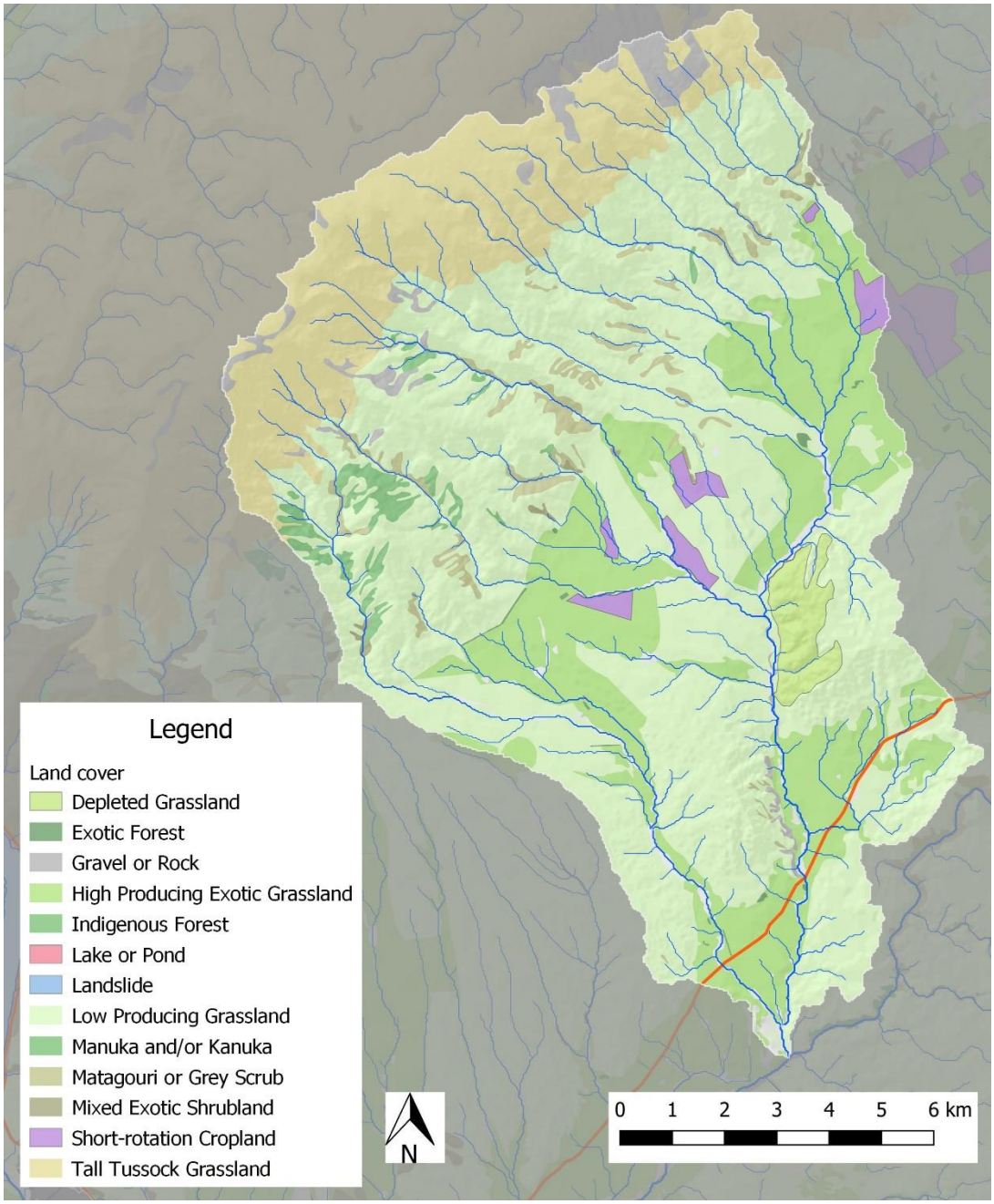


Figure 5 ***Land cover of the Chatto Creek catchment based on the Land Cover Database (LCDB, version 4.1)***

3. Hydrology

ORC has maintained a flow site since 2016 in Chatto Creek immediately above the confluence with the Manuherikia River. This site is downstream of all abstractions from the catchment. In addition to this continuous site, ORC has carried out longitudinal gauging's along Chatto Creek and Young Hill Creek to try determine any losses and gains. Matakanui Station with Manuherikia Catchment Group (MCG) have a flow site on Neds Creek (significant headwater tributary of Chatto Creek) to gain an appreciation of natural flows. In addition to the Neds Creek flow site, gaugings have also been completed on other headwater creeks in the catchment.

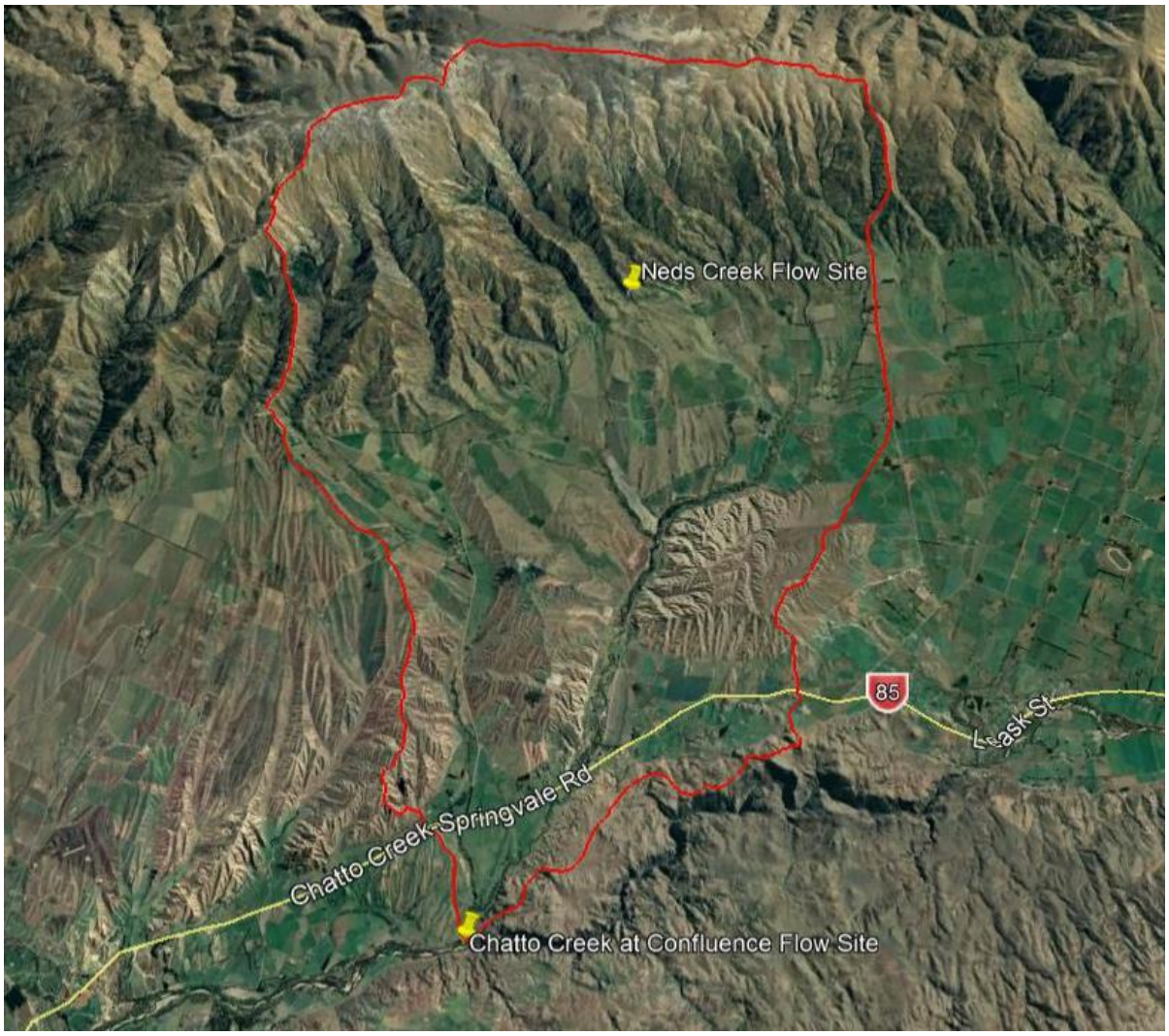


Figure 6 ***ORC's Chatto Creek at the Confluence Flow Site as well as Matakanui Stations Neds Creek Flow Site.***

The hydrology of Chatto Creek is complex mainly because traditionally the water use in the catchment was border dyke and flood irrigation but in recent times there has been a significant shift to spray irrigation methods. The high application rates associated with contour flood and border dyke irrigation means historically there has been significant return flows to Chatto Creek which has meant flows at the confluence have been higher than would be expected with the lack of existing residual flows and the current levels of allocation.

3.1. Low flow statistics

Continuous flow monitoring has been carried out at two sites in the Chatto Creek catchment: Neds Creek and Chatto Creek at the confluence. Neds Creek is unaffected by abstraction and has one irrigation season of flow record 2019 -2020.

Chatto Creek at confluence is downstream of all abstractions in the catchment and has five irrigation seasons of flow record 2009/10 and 2016 – 2020.

In order to get an understanding of the natural flow regime of Chatto Creek, Landpro Ltd were contracted by the MCG to run the continuous flow site on Neds Creek and carry out gaugings of headwater streams to enable the creation of a naturalised synthetic flow[5] for December 2019 to June 2020.

The naturalised flow record generated for the 2019/20 irrigation season for Chatto Creek followed a very similar flow pattern to those observed in Thomsons and Lauder Creek (Figure 7).

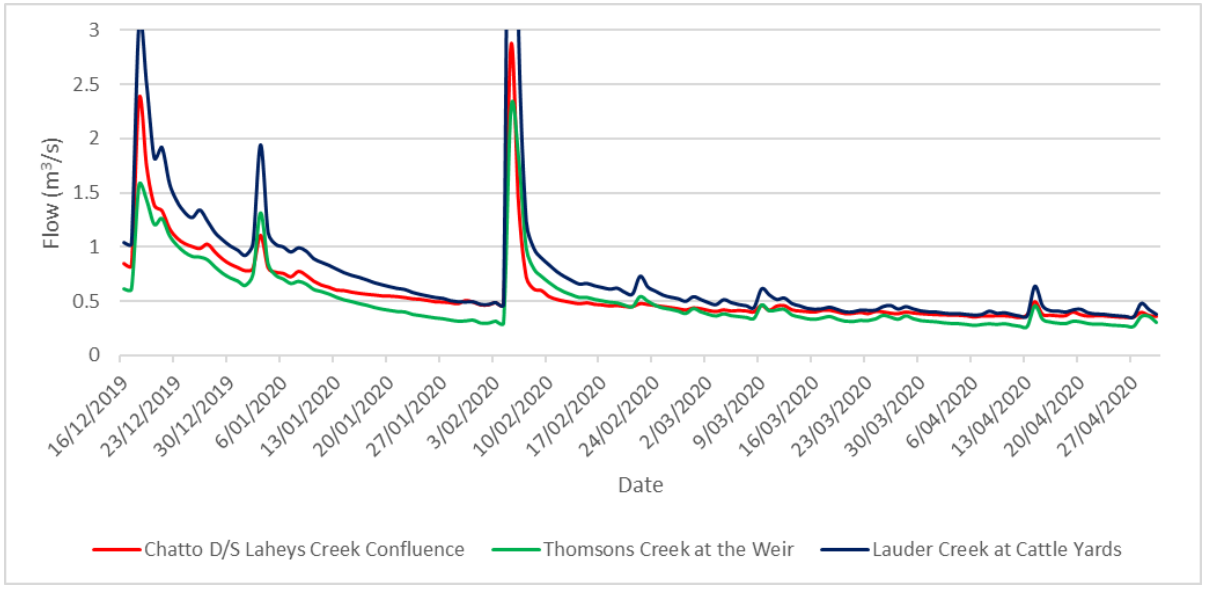


Figure 7. Synthetic naturalised flows for Chatto Creek downstream of the Laheys Creek confluence compared to observed flows for Thomsons Creek above the Weir and Lauder Creek at the Cattle yards (both sites unimpacted by abstraction).

Table 2 provides summary statistics of observed flows for the Chatto Creek confluence site over five irrigation seasons.

[5] Refer to Appendix 1 for the methodology used.

Table 2 Summary Statistics based on daily average flows for Chatto Creek at the confluence (2009-10 , 2016-2020).

Site	Catchment Area Above Recorder (km^2)	Lowest Daily Flow (m^3/s)	1-Day MALF (m^3/s)	7-Day MALF (m^3/s)	Median (m^3/s)	Mean (m^3/s)	Maximum (m^3/s)
Chatto Creek at confluence observed [6]	166	0.069	0.172	0.199	0.756	1.010	19.726

Table 3 below compares the observed flow at the Chatto Creek confluence flow site with the naturalised flow at the period December 2019 – June 2020.

Table 3. Observed and Naturalised daily minimum and 7-day low flows for Chatto Creek at the confluence for December 2019 to June 2020.

Site	Catchment Area Above Recorder (km^2)	Lowest Daily Flow (m^3/s)	7-Day ALF (m^3/s)
Observed Flow at Chatto Creek confluence	166	0.277	0.306
Natural Flow at Chatto Creek confluence		0.400	0.410

Observations for the Lauder Creek and Thomsons Creek catchment at their natural continuous flow sites indicate that their 2019-2020 7-day ALF's were 13% and 16% higher than their respective observed long-term 7-day MALF's.

Based on the apparent agreement in flows between Chatto Creek and Thomsons and Lauder Creek (Figure 7) to gain an estimate of the long-term natural 7-day MALF at the Chatto Creek confluence we have reduced the observed 7-day ALF of 410 l/s for the 2019/20 irrigation season by 15% to reach a natural 7-day MALF for Chatto Creek at the confluence of ~350 l/s.

Table 4 below provides the lowest daily average flow and the 7-day annual low flow (7-day ALF) for the hydrological years that data is available for the Chatto Creek at the confluence site.

[6] Based on 5 seasons of record.

Table 4 ***Daily average minimum and 7-day ALF's observed at the Chatto Creek confluence site for the hydrological years with record (2009-10 , 2016-2020).***

Hydro Year (July – June)	Daily Minimum (m^3/s)	7 day ALF (m^3/s)
2009/10	0.174	0.180
2016/17	0.168	0.206
2017/18	0.069	0.080
2018/19	0.172	0.225
2019/20	0.277	0.306

Table 4 suggests historically lows flows have not been a significant issue for Chatto Creek, except for the 2017/18 season[7]. Also, it is worth noting that in 2019/20 the observed flows were significantly higher than for any other season with record. This is because the Manuherikia Irrigation Company Society (MICS) trialled not taking water from Chatto Creek during 2019/20. The MICS take is consented to take up to 283 l/s and is the largest take in the Chatto Creek catchment.

3.2. Longitudinal Flows

Four sets of longitudinal gaugings have been completed by ORC and Landpro Ltd (on behalf of ORC) to gain an appreciation of gains and losses along Chatto Creek. The results of these gaugings are provided in Figure 8.

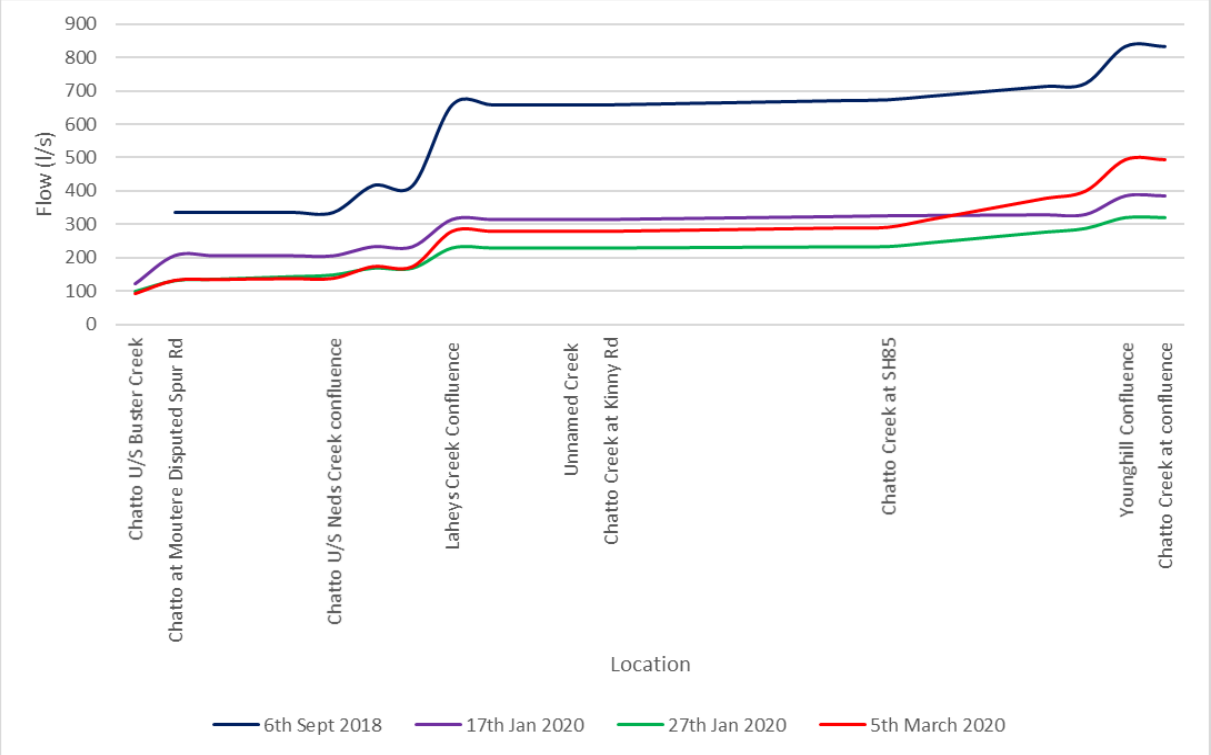


Figure 8. Longitudinal gaugings on four different occasions along Chatto Creek. It is 13Km from the Moutere Disputed Spur Rd to the Chatto Creek confluence.

[7] January 2018 had very low flows with Falls Dam calling for 50% restrictions.

During two of the gauging runs during the irrigation season (27th of January and 5th of March), flows notably increase between SH85 and Young Hill Creek despite there being no tributaries. Interestingly this pattern was not evident on the 17th of January. Field notes at the time of the gauging on the 5th of March note that flood irrigation was occurring in the lower reaches of Young Hill Creek.

Also, of note is that Laheys Creek is often dry at the Moutere Disputed Spur Road but always has a flow at its confluence with Chatto Creek of up to 50 l/s (Figure 9).

Figure 9. Laheys Creek at Moutere Disputed Spur Rd (Left) and Laheys Creek at confluence with Chatto Creek on the 24th of February 2020.

Our observations and the data from the longitudinal gaugings indicate that return flows from flood irrigation are likely to significantly affect observed flows in Chatto Creek. It is expected that with a shift to more efficient application methods these returns will reduce in future.

3.3. Flow Exceedance

Figure 10 below provides flow exceedance curves for flows of less than $5m^3/s$ at the Chatto Creek Confluence Flow Site which is below all abstraction.

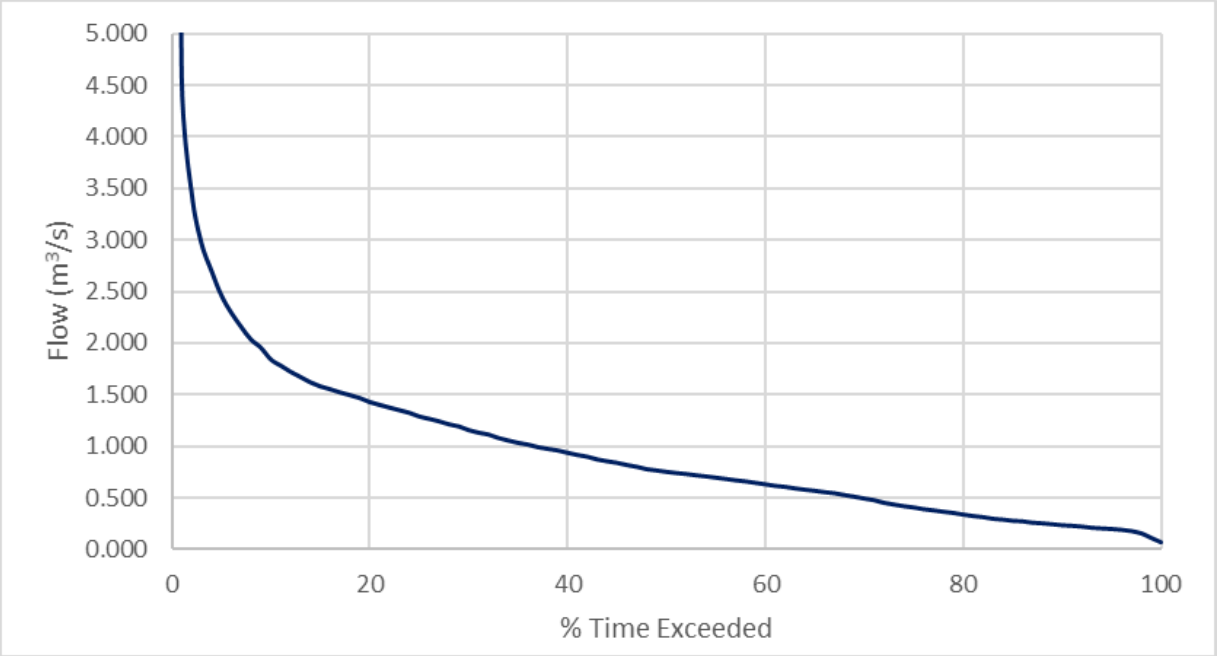


Figure 10 Flow exceedance curves for Chatto Creek at the Confluence flow site.

Figure 10 shows that flows of less than 200 l/s at the confluence only occur less than 6% of the time. However, when assessing historic flow data in the Chatto Creek catchment it needs to be done in the context of the irrigation area being dominated by overland flow irrigation with water also being introduced from outside the catchment.

3.4. Existing water use

Currently up to 809 l/s is taken at any given time form the Chatto Creek catchment, though a large proportion of this can return due to irrigation run-off or seepage. Also, water sourced from outside the catchment is used to irrigate land in Chatto Creek catchment from both the Omakau Area Irrigation Company main race and the Manuherikia Irrigation Company Society main race.

Historically there has been few residual flows on takes in the catchment and no flow that the water users operate to try to maintain in the lower reaches of Chatto Creek to provide for ecological values.

4. Current Physical State

4.1. Water quality

A review of water quality in the Manuherikia catchment conducted by NIWA for the Otago Regional Council (Hudson & Shelley 2019) included one site in the Chatto Creek catchment: Chatto Creek upstream Manuherikia.

Ammoniacal nitrogen, dissolved reactive phosphorus and nitrate-nitrite nitrogen (NNN) were measured fortnightly in Chatto Creek between 8 September 2009 and 8 September 2010 and monthly ammoniacal nitrogen, DRP, *Escherichia coli*, NNN and turbidity between 27 October 2016 and 27

September 2017. The available water quality data are insufficient to allow trend analysis for the Chatto Creek catchment.

Each water quality variable was compared to the water quality limits/targets (Schedule 15) contained in the Regional Plan: Water (RPW) (Schedule 15; Receiving Water Group 2; Table 5) as well as the National Objective Framework (NOF) contained in the National Policy Statement for Freshwater Management (NPSFM). The following section summarises the results of the analyses presented in Hudson & Shelley 2019).

Table 5 ***Receiving water numerical limits and timeframe for achieving 'good' water quality in the Manuherikia catchment***

		Nitrate-nitrite nitrogen	Dissolved reactive phosphorus	Ammoniacal nitrogen	*Escherichia coli*	Turbidity
Manuherikia	Limit/target	0.075 mg/l	0.01 mg/l	0.1 mg/l	260 cfu/100 ml	5 NTU
	Target date	31 March 2012	31 March 2025	31 March 2012	31 March 2012	31 March 2012

4.1.1. Comparison to regulatory limits

Nitrate-nitrite nitrogen

The Hudson & Shelley (2019) review assessed the proportion of values in multiple 5-year periods that complied with the Schedule 15 limits contained in the Regional Plan: Water. For nitrate-nitrite nitrogen, 94-100% of values exceeded Schedule 15 limit of 0.075 mg/L (Table 3-4 of Hudson & Shelley 2019). Given that the Schedule 15 limit applies as an 80th percentile, a site would exceed the limit if more than 20% of values recorded when flows were below median flow were higher than the numerical limit[8].

The 95th percentile of NNN concentrations over the periods 2013-2019 were in Attribute state A of the NOF (toxicity) at both sites in Chatto Creek (Hudson & Shelley 2019). NNN concentrations in the A-band of the nitrate (toxicity) attribute table in the NOF are unlikely to toxic to sensitive aquatic life.

Ammoniacal nitrogen

Ammoniacal nitrogen concentrations at the site in Chatto Creek were within the Schedule 15 limit (0.01 mg/L) in all 5-year periods considered (Table 3-5 of Hudson & Shelley 2019).

Median and maximum ammoniacal nitrogen concentrations in Chatto Creek u/s Manuherikia were in Attribute state A of the NOF over the period between 8 September 2009 and 8 September 2010 and 27 October 2016 and 27 September 2017). Ammoniacal nitrogen concentrations in the A-band of the

[8] Note – In Tables 3-4 – 3-8 of Hudson & Shelley (2019) *"Where concentrations in more than 80% of water samples collected in a five-year period (when flows are less than median at an associated flow monitoring site) exceed 0.075 mg/L, the cell is shaded magenta"*. This appears to be a misunderstanding of Schedule 15, as the Schedule 15 limit is exceeded when more than 20% of samples collected in a five-year period (when flows are less than median at an associated flow monitoring site) exceed 0.075 mg/L.

NOF are equivalent to a 99% species protection level, meaning that they are not expected to be toxic to aquatic life.

Phosphorus

Hudson & Shelley (2019) report that 100% of the recorded concentrations of dissolved reactive phosphorus (DRP) exceeded the Schedule 15 limit of 0.01 mg/L (Table 3-6 of Hudson & Shelley 2019). This is in keeping with the target date for compliance with Schedule 15 of the RPW being 31 March 2025.

The NPSFM that came into effect in September 2020 includes a DRP attribute based on median and 95th percentile values, although this table does not include a national bottom line for DRP. The median DRP concentration in Chatto Creek u/s Manuherikia over the period between 8 September 2009 and 8 September 2010 and 27 October 2016 and 27 September 2017 (0.021 mg/L) was in Attribute state D of the NOF (>0.018 mg/L[9]). The 95th percentile of DRP concentrations in Chatto Creek u/s Manuherikia over the same period (0.040 mg/L[9]) was in Attribute state C of the NOF (>0.030 and ≤0.054 mg/L).). If other conditions also favour eutrophication, DRP concentrations in the C-band may be associated with an increased risk of enhanced algal and plant growth, loss of sensitive macroinvertebrate taxa, and higher respiration and decay rates. DRP concentrations in D-band are expected to be associated with "*Ecological communities impacted by substantial DRP elevation above natural reference conditions. In combination with other conditions favouring eutrophication, DRP enrichment drives excessive primary production and significant changes in macroinvertebrate and fish communities, as taxa sensitive to hypoxia are lost."*

Escherichia coli

Hudson & Shelley 2019 did not compare concentrations of the faecal indicator bacterium *Escherichia coli* in Chatto Creek with the Schedule 15 limit due to a lack of *E. coli* data for this site. However, of the twelve *E. coli* readings over the October 2016 – September 2017 period, two values exceeded 550 cfu/100 mL and a further two values exceeded 260 cfu/100 mL. Most of these high values occurred over the period January-March, while the other occurred in late October. The timing of these high values coincided with the irrigation season.

Comparison of *E. coli* concentrations for a waterbody with the NOF attribute table for *E. coli* requires a minimum of 60 samples collected over a maximum of 5 years collected on a regular basis irrespective of weather and flow conditions. The available data for Chatto Creek falls well short of these requirements, so it is not possible to compare data for either site on Chatto Creek with the NOF attribute table for *E. coli*.

Turbidity

Hudson & Shelley 2019 did not present an analysis of turbidity readings from Chatto Creek with the Schedule 15 limit, due to a lack of data for this site. Turbidity readings are available for the

[9] Calculated from data from 18 February 2014 – 18 February 2019. Data courtesy of ORC.

period 27 October 2016 – 27 September 2017 (n=12). The median turbidity over this period is 2.9 NTU and the 95th percentile was 5.9 NTU.

The NPSFM includes a proposed attribute for water clarity (horizontal black disc visibility, m) based on Suspended Sediment class (based on the River Environment Classification of climate, topography and geology). The attribute state is based on the median value based on at least five years, either from a record from a continuous turbidity logger, or based on at least 5 years of monthly data.

Chatto Creek is classified as having a cool-dry climate (CD), hill source (H), and hard sedimentary geology (HS). This means that Chatto Creek is in Suspended Sediment Class 3 for comparison with the Suspended Sediment attribute table in the NOF (Table 23 of Appendix 2C of the NPSFM). ORC do not have clarity data for Chatto Creek, meaning that it is not possible to formally assess the compliance of this site with the suspended sediment attribute.

Using a turbidity-clarity relationship developed using data from two sites on the Manuherikia River[10], turbidity data for Chatto Creek were converted to water clarity to allow the estimation of median water clarity for this site. The estimated median value for the one-year period for Chatto Creek u/s Manuherikia was 2.9 m, which would place this site in the B-band of the NOF. The description of B-band for water clarity in the NOF states "*Low to moderate impact of suspended sediment on instream biota. Abundance of sensitive fish species may be reduced.".*

4.1.2. Water quality summary

Concentrations of NNN and ammoniacal nitrogen concentrations in Chatto Creek are below levels that are expected to be toxic to aquatic life.

Nitrate-nitrite nitrogen and DRP concentrations observed in the lower Chatto Creek are very elevated. As a result, there is a high risk of nuisance growths of periphyton developing.

Concentrations of *E. coli* in Chatto Creek indicate levels of faecal contamination that makes it unsuitable for contact recreation at times.

Water clarity at in Chatto Creek was moderate, meaning that levels of fine sediment are being carried by Chatto Creek at times, which may be affecting aspects of the stream ecosystem at times (e.g. shading the stream bed, changing instream habitat by smothering the streambed, directly damaging the gills of macroinvertebrates and/or fish).

The water quality observed in Chatto Creek in the study of ORC (2006) and more recent water quality sampling reflects the dominance of flood irrigation methods within the Chatto Creek catchment. The conversion of irrigation from flood to spray methods is expected to result in significant improvements to water quality in the Chatto Creek catchment, with substantial reductions in phosphorus, sediment and microbial contamination anticipated.

4.2. Periphyton

No periphyton data is available for Chatto Creek.

[10] Water clarity = 2.8149*Turbidity$^{-0.669}$ This relationship is based on concurrent black disc and turbidity readings from Manuherikia at Blackstone Hill (n=35) and Manuherikia at Galloway (n=41) over the period 23 July 1997-14 March 2005.

4.3. Macroinvertebrates

Kitto (2011) presents the results of macroinvertebrate sampling at sites in the Manuherikia catchment, including a site in Chatto Creek.

Based on 3 Surber samples taken at each site in December 2010, the macroinvertebrate community at the Chatto Creek site was dominated by EPT[11] taxa, with EPT taxa representing approximately 55% of taxa.

The Macroinvertebrate Community Index (MCI) and its quantitative variant (QMCI) uses the composition of the macroinvertebrate community (as well as the abundance of different taxa in the case of the QMCI) as a measure of water and habitat quality. High scores indicate clean water quality and high habitat quality (MCI > 120, QMCI > 6), while low scores indicate poor water and/or habitat quality (MCI < 80, QMCI < 4) (Stark & Maxted 2007).

The MCI (~90) for the Chatto Creek site was indicative of fair water and/or habitat quality, while the QMCI (6.00) score for this site was consistent with good-excellent water and habitat quality (Kitto 2011).

4.4. Fish

Six fish species have been recorded from the Chatto Creek catchment(Table 6). Brown trout and upland bully are widespread in the catchment (Figure 11). Rainbow trout have been recorded from the lower reaches of Chatto Creek

Central Otago roundhead galaxias (CORG) have been recorded from the middle and lower reaches of Chatto Creek and Laheys Creek and there is a record of a single kōaro from the middle reaches of the catchment from a survey by Otago Regional Council in 2003 (Figure 11). Longfin eels have been recorded from the mainstem of Chatto Creek, from the lower to upper reaches, along with a record of an unidentified eel from Young Hill Creek (Figure 11).

Table 6 Fish species recorded from Chatto Creek. Threat status based on Dunn* et al. *(2018).

Common name	Species	Source	Threat status
Longfin eel	*Anguilla dieffenbachii*	Hudson & Shelley 2019	Declining
Upland bully	*Gobiomorphus brevipinnis*	NZFFDB, Hudson & Shelley 2019	Not threatened
Central Otago Roundhead galaxias	*Galaxias anomolus*	NZFFDB	Nationally endangered
Kōaro	*Galaxias brevipinnis*	NZFFDB	Declining
Brown trout	*Salmo trutta*	NZFFDB, Hudson & Shelley 2019	Introduced & naturalised
Rainbow trout	*Oncorhynchus mykiss*	Hudson & Shelley 2019	Introduced & naturalised

[11] E = Ephemeroptera (mayflies), P = Plecoptera (stoneflies) and T = Trichoptera (caddis flies). These three orders are typically associated with clean, oxygenated water (with the exception of some caddis flies).

4.4.1. Trout-galaxiid interactions

The impact of trout on native fishes has been recognised since the early 1990's, particularly since the study of Townsend & Crowl (1991), which documented the distribution of non-migratory galaxiids in the Taieri catchment, with galaxiids usually limited to reaches upstream of waterfalls that excluded trout. Since that time, an increasing appreciation of the impacts of trout on freshwater ecosystems has become apparent (McIntosh *et al.* 2009)

The interactions between trout and galaxiids are relevant to flow-setting in Chatto Creek, as any change to flows affects habitat availability and quality for both trout and galaxiids, meaning that any change in flow has the potential to affect the interactions between these species. The study of Leprieur *et al*. (2006) was conducted in the Manuherikia catchment and is particularly relevant to , concluded that *"Trout are more susceptible than the native fish to stresses associated with low flows, and seem to be prevented from eliminating galaxiid populations from sites in low gradient streams where there is a high level of water abstraction."*

The implication of the results of the Leprieur *et al.* study is that higher flows are expected to favour trout, resulting in an increase in trout abundance and/or size and increasing the risk of local extinctions of populations of CORG. Given that the environment of Chatto Creek has been heavily influenced by historic water use and irrigation practices, it is to be expected that the changes that have already occurred and that are proposed will result in changes in the flow regime that have the potential to alter the balance of trout-galaxiid interactions. This informs the consideration of potential residual flows.

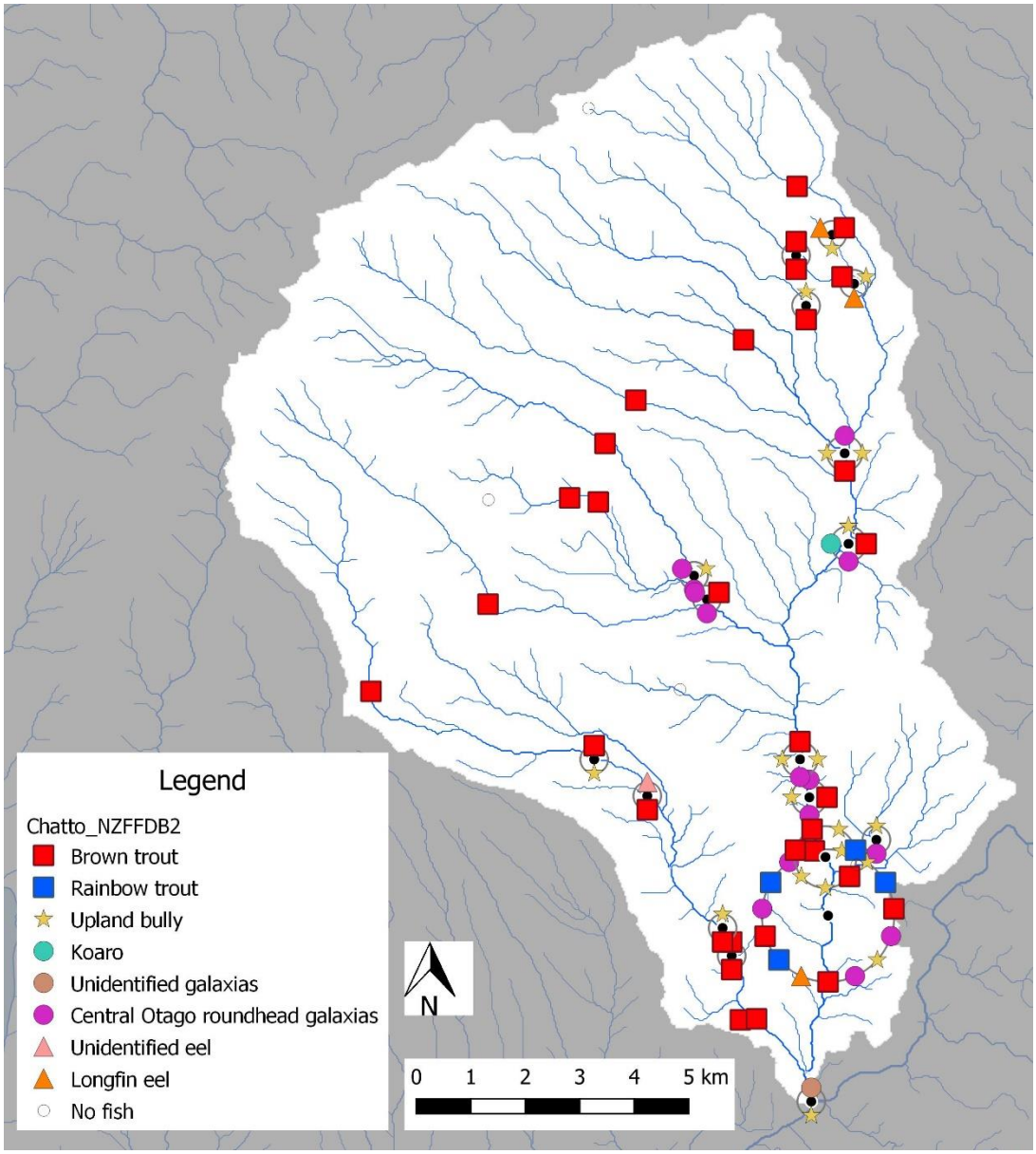


Figure 11 ***Fish distribution in the Chatto Creek catchment based on the NZ Freshwater Fish Database (NZFFDB, downloaded 15 July 2020)***

5. Mitigation measures

5.1. Residual flows

5.1.1. Fish habitat modelling

Ian Jowett (Jowett Consulting Ltd.) has undertaken instream habitat modelling for two sites in Chatto Creek, one below SH85 and the other below the Moutere Disputed Spur Road. These models can be used to inform decisions regarding environmental flows. However, the level at which environmental flows are set depends on management objectives, such as the species for which flows are set and the level of habitat retention sought.

It is important to keep in mind that habitat modelling does not take a number of other factors into consideration, including the disturbance and mortality caused by flooding, physical barriers to the presence of a species and biological interactions (such as predation), which can have a significant influence on the distribution of aquatic species.

5.1.2. Lower Chatto Creek Habitat Modelling Results

Longfin eel, Central Otago roundhead galaxias, upland bully, brown trout and rainbow trout have been recorded from the Chatto Creek catchment on more than one occasion, while kōaro is known from single records (see Section 4.4). Of the species consistently recorded in Chatto Creek, brown trout have the highest flow requirement, whilst Central Otago roundhead galaxias and upland bully are expected to have the lowest optimum flows (Figure 12 and Table 7).

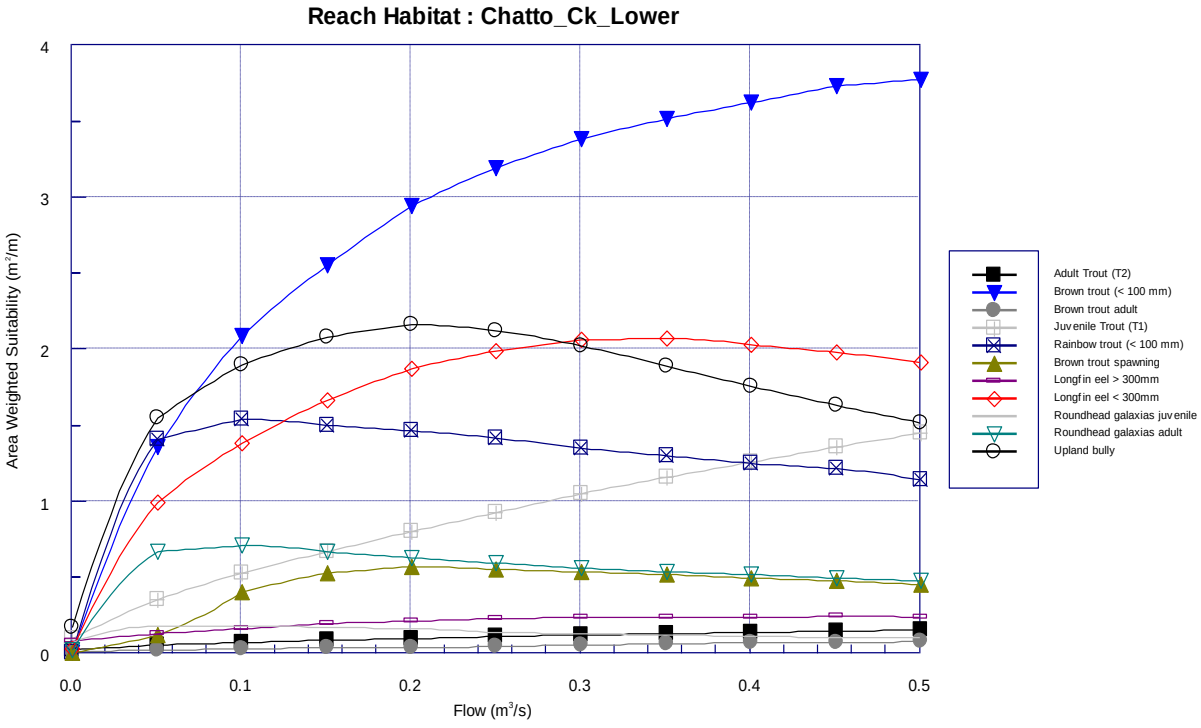


Figure 12 ***Relationship between area weighted suitability (AWS, a measure of potential habitat) for selected fish species and flow in the lower Chatto Creek (below SH85). Analysis courtesy of Ian Jowett (Jowett Consulting Ltd.).***

Table 7. Flows that provide various levels of habitat retention levels relative to the naturalised 7-d MALF in the lower Chatto Creek. Analysis courtesy of Ian Jowett (Jowett Consulting Ltd.).

Species/life stage	Optimum flow (m^3/s)	% Habitat retention			
		90%	80%	70%	60%
Adult Trout T2	>0.500	0.292	0.234	0.182	0.135
Brown trout (<100 mm)	>0.500	0.249	0.186	0.142	0.104
Brown trout adult (H&J)	>0.500	0.318	0.280	0.242	0.198
Juvenile Trout (T1)	>0.500	0.306	0.256	0.210	0.165
Rainbow trout (<100 mm)	0.100	0.041	0.037	0.032	0.027
Brown trout spawn	0.200	0.126	0.106	0.093	0.084
Longfin eel (>300 mm)	0.450	0.196	0.148	0.111	0.075
Longfin eel (<300 mm)	0.350	0.197	0.147	0.111	0.081
Roundhead galaxias juvenile	0.050	0.017	0.011	0.006	0.001
Roundhead galaxias adult	0.100	0.035	0.031	0.027	0.023
Upland bully	0.200	0.119	0.048	0.041	0.035

Central Otago roundhead galaxias (CORG)

Central Otago roundhead galaxias (CORG) are classified as nationally endangered, the second highest threat classification (Dunn *et al.* 2018) and represent a significant contribution to the indigenous biodiversity of Chatto Creek. The presence of trout is likely to be a more important factor affecting the abundance of CORG than flow alone, although it is possible that flow may mediate the interactions between these species. High flows favour trout, thereby increasing the predation pressure on CORG as well as increasing competition between these species for space and food. This analysis predicts that the optimum flow for CORG habitat is between 50-100 l/s (Table 7).

Longfin eel

Optimum flow for adult longfin eel habitat was >450 l/s, while a flow of 350 l/s was predicted to provide optimum for juvenile (<300 mm) longfin eels (Table 7). However, habitat is also not currently the main factor affecting the distribution and abundance of longfin eels in the Manuherikia catchment. Recruitment of longfin eels in the Manuherikia catchment is low due to the presence of Roxburgh Dam, which blocks the inward migration of juvenile eels that have entered the Clutha/Mata-Au from the ocean. Historically, some of the elvers entering the Clutha/Mata-Au would have migrated up past Roxburgh into the Manuherikia catchment and beyond.

Upland bully

Upland bully are widespread and abundant in many inland waters in the South Island and are classified not threatened (Dunn *et al.* 2018). However, they contribute to the indigenous biodiversity of Chatto Creek. High flows (that favour trout) are expected to increase the predation pressure on upland bully. Instream habitat analysis for the lower reaches of Chatto Creek analysis predict that the optimum flow for upland bully habitat was 200 l/s (Table 7).

Brown trout

Brown trout are widespread in much of the Chatto Creek catchment and it is likely that the Chatto Creek catchment provides some recruitment to the regionally significant[12] Manuherikia River fishery, with Chatto Creek recognised as providing significant habitat for trout and spawning habitat in Schedule 1A of the Regional Plan: Water.

Based on instream habitat analysis for the lower Chatto Creek site, a flow of 200 l/s would provide optimum spawning habitat for brown trout (Table 7). A habitat retention level of 80% would appear to be appropriate for spawning and rearing in Chatto Creek. Based on the juvenile trout (T1) habitat suitability curves of Wilding (2012), a flow of 256 l/s would retain 80% of juvenile trout habitat available at MALF, using the Brown trout (<100 mm) curves of Jowett & Richardson (2008) a flow of 186 l/s would retain 80% of juvenile trout habitat available at MALF (Table 7).

5.1.3. Habitat for macroinvertebrates

Habitat for macroinvertebrates was assessed by modelling the effects of flow on a measure of general macroinvertebrate habitat (Food Producing) and habitat for three common macroinvertebrate taxa: the net-spinning caddis fly *Aoteapsyche*, the common mayfly *Deleatidium*, and the sandy-cased caddis fly *Pycnocentrodes.*

Based on the analysis presented in Figure 13 and Table 8, the optimum flows for all macroinvertebrate taxa considered were well in excess of the estimated MALF: Food Producing (>500 l/s), *Aoteapsyche* (>500 l/s), *Pycnocentrodes* (350 l/s) and *Deleatidium* (300 l/s) (Figure 13, Table 8).

Deleatidium is expected to be among the most abundant macroinvertebrate taxa in Chatto Creek. Flows of more than 113 l/s and 83 l/s are predicted to retain 80% and 70% of the *Deleatidium* habitat at MALF, respectively (Table 8). Whilst expected to be less common than *Deleatidium* in Chatto Creek, both *Aoteapsyche* and *Pycnocentrodes* are expected to be common. Flows of 150 l/s and 114 l/s are predicted to retain 80% and 70% of habitat for *Pycnocentrodes*, respectively, while flows of 266 l/s and 225 l/s are predicted to retain 80% and 70% of habitat for *Aoteapsyche*, respectively (Table 8).

Food producing habitat are predicted to rapidly increase with flow to the maximum modelled flow of 500 l/s (Figure 13), flows of 276 l/s and 237 l/s are predicted to retain 80% and 70% of food producing habitat, respectively (Table 8).

The food producing habitat HSC is based on the work of Waters (1976), which was conducted in the United States on moderate sized trout rivers. On inspection of the habitat suitability curves (HSC), it is apparent that these curves suggest that food production is greatest in areas of moderate water depth (0.2-0.8 m), velocity (0.64-0.85 m/s) with cobble substrate. There is some reason to doubt the applicability of the Food Producing HSC to a small river like Chatto Creek. It is generally preferable to apply HSC that have been developed locally, on rivers of a comparable nature. For this reason, the *Aoteapsyche*, *Deleatidium* and *Pycnocentrodes* HSC developed in the Rainy River (a similar-sized, small river (MALF ~187 l/s) near Nelson), are more applicable to Chatto Creek than the Food Producing HSC.

[12] Otago Fish & Game Council (2015). Sports Fish and Game Management Plan for Otago Fish and Game Region 2015-2025. Otago Fish & Game Council, Dunedin. 98 p.

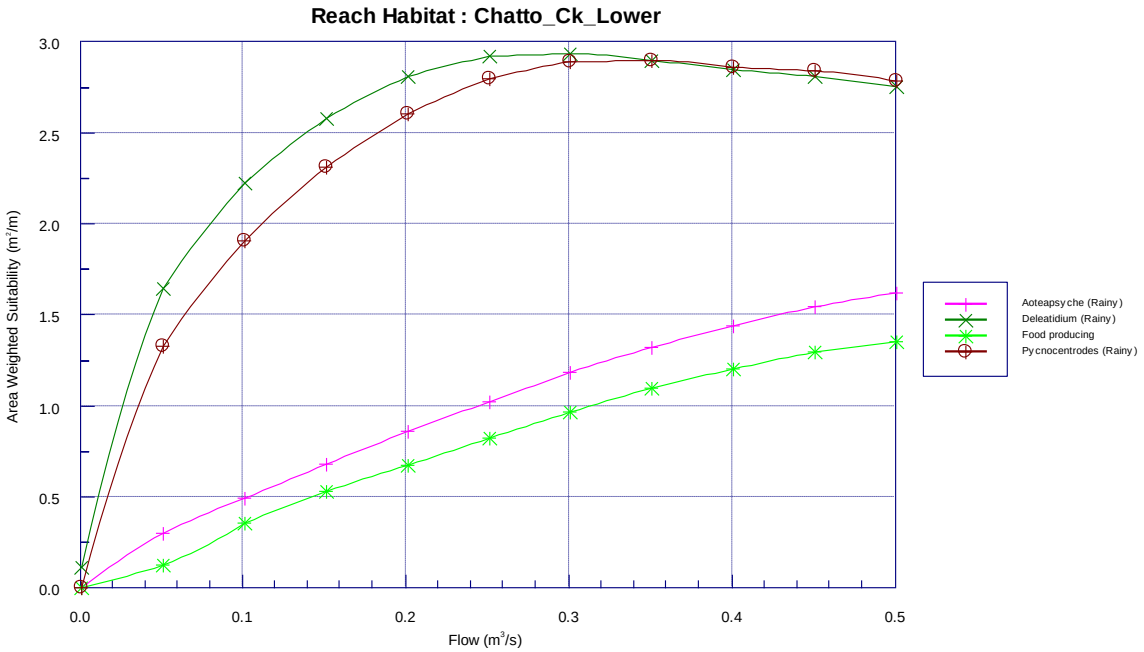


Figure 13 ***Relationship between area weighted suitability (AWS, a measure of potential habitat) for selected macroinvertebrate taxa and flow in Chatto Creek. Analysis courtesy of Ian Jowett (Jowett Consulting Ltd.).***

Table 8. ***Flows that provide various levels of habitat retention levels relative to the naturalised 7-d MALF. Analysis courtesy of Ian Jowett (Jowett Consulting Ltd.).***

Species/life stage	Optimum flow (m^3/s)	% Habitat retention			
		90%	80%	70%	60%
Aoteapsyche (Rainy)	>0.500	0.310	0.266	0.225	0.185
Deleatidium (Rainy)	0.300	0.155	0.113	0.083	0.058
Pycnocentrodes (Rainy)	0.350	0.199	0.150	0.114	0.085
Food producing	>0.500	0.316	0.276	0.237	0.199

5.2. Upper Chatto Creek Habitat Modelling Results

Longfin eel, Central Otago roundhead galaxias, upland bully, brown trout and rainbow trout have been recorded from the Chatto Creek catchment on more than one occasion, while kōaro is known from single records (see Section 4.4). Of the species consistently recorded in Chatto Creek, brown trout have the highest flow requirement, whilst Central Otago roundhead galaxias and upland bully are expected to have the lowest optimum flows (Figure 14 and Table 9).

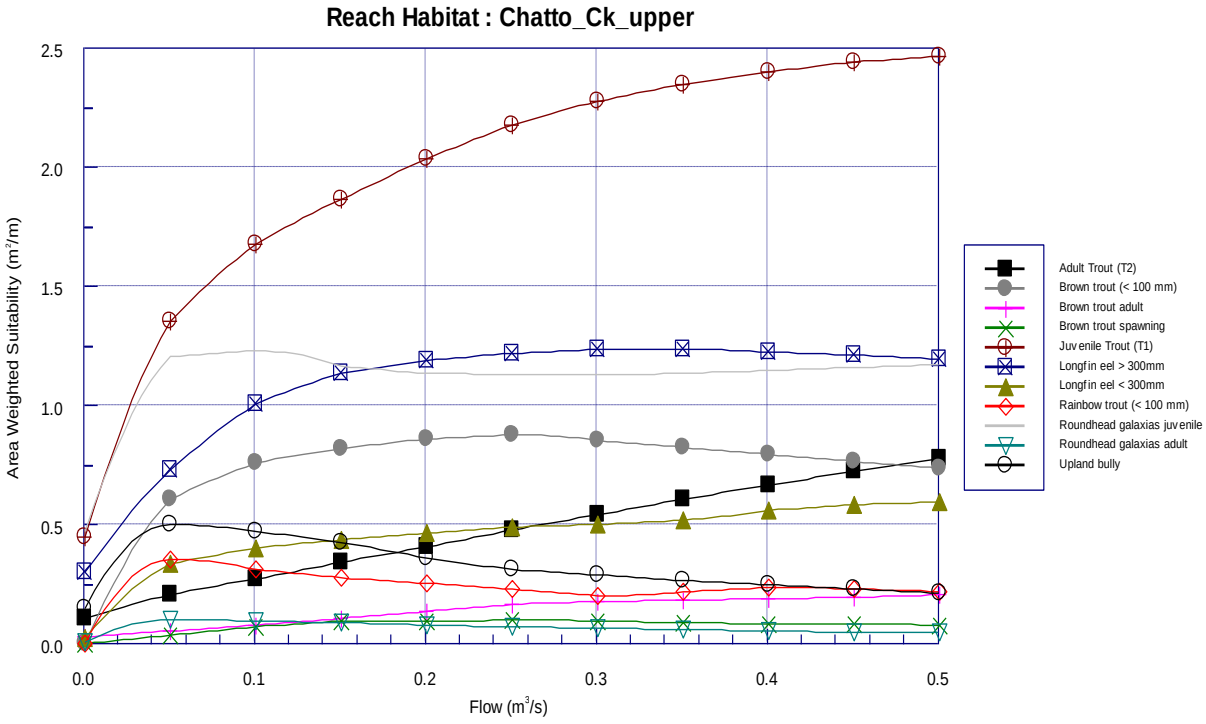


Figure 14 ***Relationship between area weighted suitability (AWS, a measure of potential habitat) for selected fish species and flow in the upper Chatto Creek (Moutere Disputed Spur Road). Analysis courtesy of Ian Jowett (Jowett Consulting Ltd.).***

Table 9. ***Flows that provide various levels of habitat retention levels relative to the naturalised 7-d MALF at the upper Chatto Creek modelling reach. Analysis courtesy of Ian Jowett (Jowett Consulting Ltd.).***

Species/life stage	Optimum flow	% Habitat retention 90%	80%	70%	60%
Adult Trout T2	>0.500	0.139	0.113	0.085	0.057
Brown trout (<100 mm)	0.250	0.097	0.070	0.048	0.041
Brown trout adult (H&J)	>0.500	0.145	0.125	0.105	0.082
Juvenile Trout (T1)	>0.500	0.113	0.078	0.049	0.039
Rainbow trout (<100 mm)	0.050	0.034	0.031	0.027	0.023
Brown trout spawn	0.250	0.129	0.104	0.089	0.076
Longfin eel (>300 mm)	0.350	0.112	0.085	0.064	0.046
Longfin eel (<300 mm)	>0.500	0.101	0.064	0.046	0.039
Roundhead galaxias juvenile	0.100	0.039	0.031	0.023	0.015
Roundhead galaxias adult	0.050	0.036	0.032	0.028	0.023
Upland bully	0.050	0.030	0.024	0.019	0.013

Central Otago roundhead galaxias (CORG)

Central Otago roundhead galaxias (CORG) are classified as nationally endangered, the second highest threat classification (Dunn et al. 2018). This analysis predicts that the optimum flow for CORG habitat is between 50-100 l/s at the upper Chatto Creek habitat modelling site (Table 9).

Longfin eel

Optimum flow for adult longfin eel habitat was >350 l/s, while a flow of >500 l/s was predicted to provide optimum for juvenile (<300 mm) longfin eels at the upper Chatto Creek habitat modelling site (Table 9).

Upland bully

Upland bully are widespread and abundant in many inland waters in the South Island and are classified not threatened (Dunn et al. 2018). However, they contribute to the indigenous biodiversity of Chatto Creek. High flows (that favour trout) are expected to increase the predation pressure on upland bully. Instream habitat analysis for the lower reaches of Chatto Creek analysis predict that the optimum flow for upland bully habitat was 50 l/s (Table 9).

Brown trout

Based on instream habitat analysis for the upper Chatto Creek site, a flow of 250 l/s would provide optimum spawning habitat for brown trout (Table 9). A habitat retention level of 80% would appear to be appropriate for spawning and rearing in Chatto Creek. Based on the juvenile trout (T1) habitat suitability curves of Wilding (2012), a flow of 78 l/s would retain 80% of juvenile trout habitat available at MALF, using the Brown trout (<100 mm) curves of Jowett & Richardson (2008) a flow of 70 l/s would retain 80% of juvenile trout habitat available at MALF (Table 9).

5.2.1. Habitat for macroinvertebrates

Habitat for macroinvertebrates was assessed by modelling the effects of flow on a measure of general macroinvertebrate habitat (Food Producing) and habitat for three common macroinvertebrate taxa: the net-spinning caddis fly *Aoteapsyche*, the common mayfly *Deleatidium*, and the sandy-cased caddis fly *Pycnocentrodes.*

Based on the analysis presented in Figure 15 and Table 10, the optimum flows for all macroinvertebrate taxa considered were well in excess of the estimated MALF with exception of *Deleatidium*: Food Producing (200 l/s), *Aoteapsyche* (400 l/s), *Pycnocentrodes* (>500 l/s) and *Deleatidium* (150 l/s) (Figure 15, Table 10Table 8).

Deleatidium is expected to be among the most abundant macroinvertebrate taxa in Chatto Creek. Flows of more than 42 l/s and 35 l/s are predicted to retain 80% and 70% of the *Deleatidium* habitat at MALF, respectively (Table 10). Whilst expected to be less common than *Deleatidium* in Chatto Creek, both *Aoteapsyche* and *Pycnocentrodes* are expected to be common. Flows of 129 l/s and 113 l/s are predicted to retain 80% and 70% of habitat for *Pycnocentrodes*, respectively, while flows of 112l/s and 90l/s are predicted to retain 80% and 70% of habitat for *Aoteapsyche*, respectively (Figure 15 and Table 10).

Food producing habitat are predicted to rapidly increase with flow to the maximum modelled flow of 500 l/s (Figure 15), flows of 71 l/s and 49 l/s are predicted to retain 80% and 70% of food producing habitat, respectively (Table 10).

The food producing habitat HSC is based on the work of Waters (1976), which was conducted in the United States on moderate sized trout rivers. On inspection of the habitat suitability curves (HSC), it is apparent that these curves suggest that food production is greatest in areas of moderate water depth (0.2-0.8 m), velocity (0.64-0.85 m/s) with cobble substrate. There is some reason to doubt the applicability of the Food Producing HSC to a small river like Chatto Creek. It is generally preferable to apply HSC that have been developed locally, on rivers of a comparable nature. For this reason, the *Aoteapsyche*, *Deleatidium* and *Pycnocentrodes* HSC developed in the Rainy River (a similar-sized, small river (MALF ~187 l/s) near Nelson), are more applicable to Chatto Creek than the Food Producing HSC.

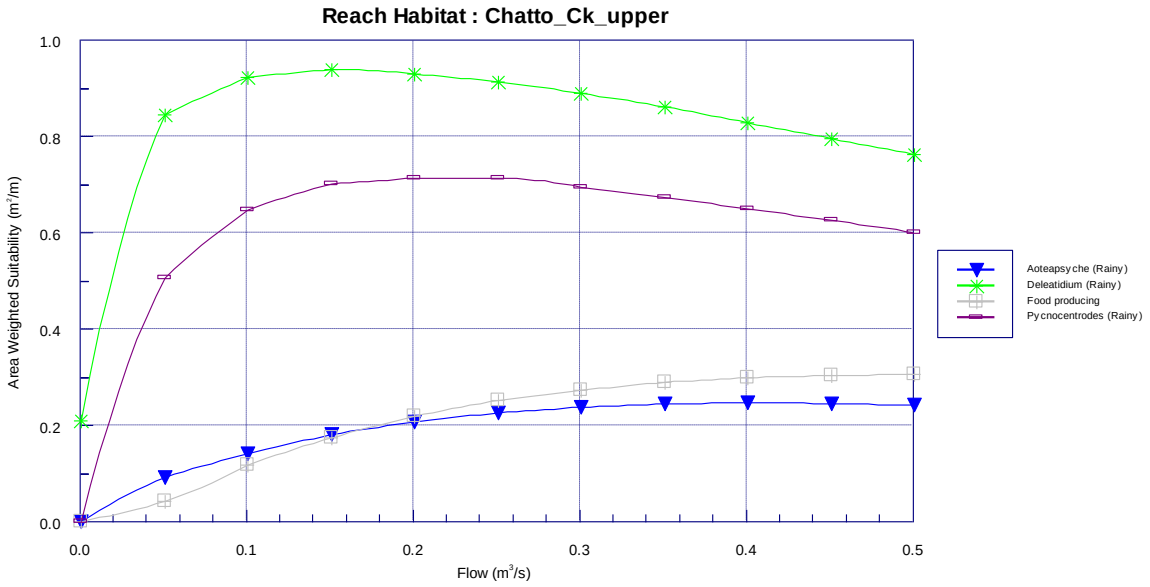


Figure 15. Relationship between area weighted suitability (AWS, a measure of potential habitat) for selected macroinvertebrate taxa and flow in the upper Chatto Creek modelling reach. Analysis courtesy of Ian Jowett (Jowett Consulting Ltd.).

Table 10. Flows that provide various levels of habitat retention levels relative to the naturalised 7-d MALF at the upper Chatto Creek habitat site. Analysis courtesy of Ian Jowett (Jowett Consulting Ltd.).

Species/life stage	Optimum flow	% Habitat retention 90%	80%	70%	60%
Aoteapsyche (Rainy)	0.400	0.136	0.112	0.090	0.071
Deleatidium (Rainy)	0.150	0.050	0.042	0.035	0.028
Food producing	0.200	0.146	0.071	0.049	0.042
Pycnocentrodes (Rainy)	>0.500	0.146	0.129	0.113	0.097

5.2.2. NPSFM (2020) Compulsory Values

The NPSFM includes compulsory values for the following attributes ecosystem health, threatened species and mahinga kai.

Specifically, ecosystem health consists of five biophysical components: water quality, water quantity, habitat, aquatic life, and ecological processes. In a healthy freshwater ecosystem, all five biophysical components are suitable to sustain the indigenous aquatic life expected in the absence of human disturbance or alteration (before providing for other values). However, the NPSFM (2020) does not provide guidance on how the influence of introduced sports fish on indigenous aquatic life and ecological processes should be assessed. Simply, introduced sports fish alter indigenous ecosystem processes and indigenous aquatic life[13].

The threatened species compulsory value directs to the extent to which an FMU or part of an FMU that supports a population of threatened species has the critical habitats and conditions necessary to support the presence, abundance, survival, and recovery of the threatened species. All the components of ecosystem health must be managed, as well as (if appropriate) specialised habitat or conditions needed for only part of the life cycle of the threatened species. Again, this compulsory value has no guidance on implementation when the key threat to the survival and recovery of the threatened species is an introduced sports fish, as is the case for Chatto Creek.

Mahinga Kai Value directs that kai would be safe to harvest and eat. Transfer of knowledge is able to occur about the preparation, storage and cooking of kai. In FMUs or parts of FMUs that are used for providing mahinga kai, the desired species are plentiful enough for long-term harvest and the range of desired species is present across all life stages. In the case of Chatto Creek, longfin eel a highly valued mahinga kai species, is unlikely to meet the requirements of this compulsory value due to recruitment issues caused by the presence of Roxburgh Dam, which blocks the inward migration of juvenile eels that have entered the Clutha/Mata-Au from the ocean.

5.2.3. Management objectives

Because of the complexities highlighted above with the compulsory values of the NPSFM (2020) for Chatto Creek the focus of this report is on water quantity aspects of the ecosystem health attribute and the flow needs of threatened fish and traditional mahinga kai species. In the case of Chatto Creek, a significant focus is on the nationally threatened Central Otago roundhead galaxias (CORG) and the traditional mahinga kai species longfin eel[14]. This is because there are significant non-flow related factors that are influencing ecosystem health, threatened species and mahinga kai species in Chatto Creek.

The flow regime identified to provide for the above compulsory values is also assessed for its expected outcome for the trout life stages present in Chatto Creek.

[13] For example, the presence of trout alters the drift behaviour of indigenous invertebrates, the presence and abundance of indigenous invertebrates as well as the presence and abundance on indigenous fish.

[14] Currently habitat is not limiting longfin eel in the Manuherikia catchment, eel are excluded from the catchment due to Roxburgh Dam with the exception of a few recruits from trap and transfer.

5.2.4. Proposed residual flow regime for Chatto Creek

Based on the management objectives discussed above and the instream habitat modelling of Jowett (2020) the optimum flow for CORG habitat in Chatto Creek is 100 l/s. This flow also provides 98% of habitat retention for upland bully and 67% habitat retention for longfin eels (>300 mm and <300 mm).

Implementing a residual flow in the lower Chatto Creek of 100 l/s from October to April will improve[15] rearing habitat for juvenile brown and rainbow trout with >60% habitat retention and optimum habitat retention respectively based on Jowett & Richardson (2008).

Chatto Creek provides spawning for adult brown trout from the lower Manuherikia mainstem. Therefore, a winter (May – Sept) residual flow of 200 l/s (optimum habitat) at all Chatto Creek intakes would seem appropriate.

5.3. Individual Take Point Residual flows

In conjunction with collectively delivering 100 l/s at the Chatto Confluence flow site (Oct-April) we also recommend residual flows at points of take where takes are from perennial streams. Residual flows on several creeks have recently been set through recent consents of RM16.243.01 and RM16.235.01 which include takes on Young Hill, Turnipy, Campbells, Centre and Laheys Creeks. The focus of these has been on protecting threatened CORG from predation and a management plan has been put in place as a condition of consent.

Table 11 below provides residual flows for each take point that are greater or smaller based on the relative size of the stream. Cumulatively, once Devonshire, Scott's, Coal and Buster Creeks join their combined flows are expected to provide >90% habitat protection at MALF for Central Otago roundhead galaxias at the upper habitat analysis site outlined in Figure 14 and Table 9.

[15] Currently with no residual flow in place flows can be <70 l/s at confluence.

Table 11. Take consents (including those recently granted RM16.235.01 and RM16.243.01), natural 7-day MALF estimate and residual flows both granted and proposed at the point of take.

Existing Consent Number	Take location	Natural 7-day MALF estimate at intake (l/s)	Residual flow granted and recommended (l/s)	Downstream residual flow site
RM16.235.01	Young hill Creek	33	10	Chatto at Confluence
RM16.235.01	Turnipy Creek	2	0	Flows as in the consents Galaxiid Management Plan
RM16.235.01	Centre Creek	3	0	Flows as in the consents Galaxiid Management Plan
RM16.243.01	Campbell Creek	47	0	Flows as in the consents Galaxiid Management Plan
RM16.243.01	Laheys Creek	44	0	Flows as in the consents Galaxiid Management Plan
97109	Young Hill Creek	33	10	Chatto at Confluence
RM15.217.01 4006.V1	Neds Creek	53	15	Chatto at Confluence
2001.712.V1 2001.713.V2	Buster Creek	73	20	Chatto at Confluence
2001.714.V1	Coal Creek	21	5	Chatto at Confluence
2001.715.V1	Scotts Creek	22	5	Chatto at Confluence
2001.716.V1 2001.717.V1 2001.718.V1	Devonshire Creek	37	10	Chatto at Confluence
RM15.127.01 Winter Take Only	Devonshire Creek	45	25	Chatto Confluence winter residual
93320	Devonshire Creek	45	15	Chatto at Confluence

5.3.1. Winter Residual Flow at Confluence

The proposed residual flow conditions will result in reduced surety of supply or access to water by permit holders during the irrigation season. This is anticipated to result in aa greater focus on accessing water for on-farm storage. As a result of this potential shift in accessing water it is important to have winter flow controls on takes. This will address the potential effects of increased taking of water during winter of water.

A winter Residual flow of 250 l/s is recommended for Chatto Creek, which is optimum flow identified for trout spawning.

5.4. Supplementary Residual Flow

A supplementary residual flow of 330 l/s is recommended at SH85 to allow taking to storage. This flow is exceeded 90% of the time during winter (May to Sept) and is also higher than the natural 7-day MALF. It is expected that both the 330 l/s residual flow and the appropriate supplementary block minimum flow at Campground flow site would need to be met to allow for taking.

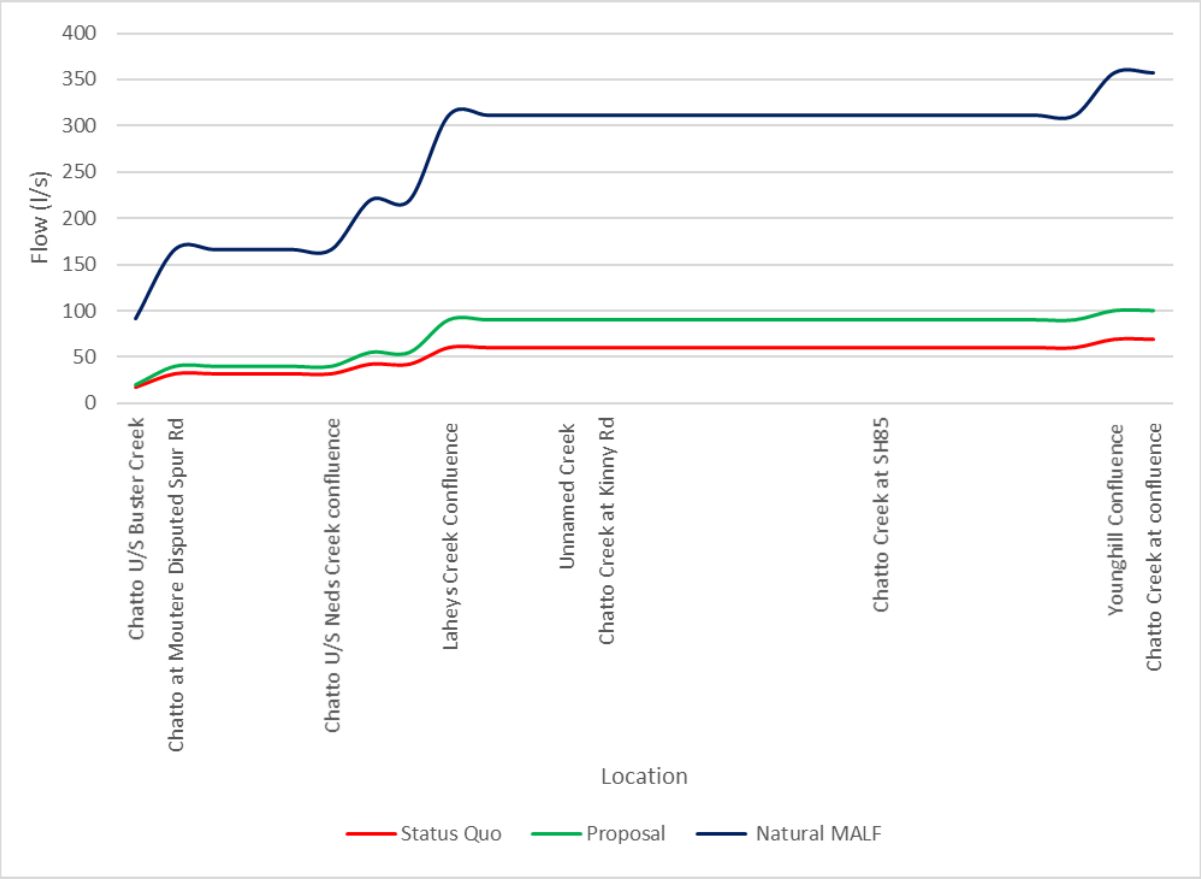
5.5. Change to Water Takes

In addition to the residual flows it is proposed that MICS Chatto Creek and Young Hill Creek races are decommissioned with the Chatto Creek race intake being replaced by a ~5 l/s gallery take. Closing these races results in a reduction in consented take of 419 l/s.

Figure 16 below provides the longitudinal flows expected in Chatto Creek under average low flow conditions comparing natural flow with the status quo and this proposal where the following is proposed:

- Residual flows below each individual intake as documented in Table 11.
- 100 l/s at the Chatto Creek Confluence flow site.
- Decommission the MICS Chatto Creek and Young Hill Creek races.

Figure 16 below provides the longitudinal flows expected in Chatto Creek under the proposed residual flows compared to the natural 7-day MALF and the status quo[16].



[16] We have used the lowest daily flow from January 2018 as the status quo low flow which was ~20% of the natural 7-day MALF.

Figure 16. Longitudinal flows under the proposed residual flow regime, compared to natural and the status quo in Chatto Creek. It is 13 km from the Moutere Disputed Spur Road to the confluence.

Our expectation is that with changes in water use (shift from flood to spray) and the implementation of residual flows and sharing that in reality flows observed in Chatto Creek at times of low flow will range between the blue and green lines in Figure 16.

5.6. Fish screening

Fish screens are typically installed to prevent fish from being into water take infrastructure (e.g. race, pipe) and to return the fish unharmed to the waterway they came from. The design parameters for fish screens vary depending on the setting and the species/life-stage of fish present. In general, screens will be designed to comply with fish screening standards and guidelines (as outlined in Schedule 2 of the Canterbury Land and Water Regional Plan):

(a) The site is located as close to the river source as possible to minimise exposure of fish to the fish screen structure, and minimises the length of stream affected while providing the best possible conditions for (b) - (f) below;
(b) Water velocity through the screen ("approach velocity") is slow enough (generally <0.12 m/s) to allow fish to escape entrainment (being sucked through or washed over the screen) or impingement (being squashed or rubbed against the screen);
(c) Water velocity across (or past) the screen ("sweep velocity") is greater than the approach velocity (b) and is sufficient to sweep the fish past the intake;
(d) An effective bypass system is provided that is easily accessible to entrained fish, and fish are taken away from the intake and back into the source channel, or into water which provides the fish with unimpeded passage back into the source channel;
(e) Screening material (mesh, profile bars or other) on the screen needs to have a smooth surface and openings that prevent any damage to fish from coming into contact with the screening material; and
(f) The intake structure and fish screen are operated to a consistent, appropriate standard with appropriate operation and maintenance procedures, and this operation and maintenance should be regularly checked or monitored. A record should be kept of all the maintenance and monitoring carried out.

Our recommendation would be that on a case by case basis fish screens are investigated as to whether they are firstly needed, and what the best practical option is to deliver the desired outcome for the species present. The above criteria should be amended as required to make them appropriate for screening of off-takes from dams.

5.7. Water quality

As outlined in Section 4.1, water quality in much of the Chatto Creek catchment is affected by contemporary land-use practices and the dominance of flood irrigation which enters the creek at several location but particularly immediately upstream of the monitoring site. The application to renew the deemed permits in the Chatto Creek catchment includes changes from flood irrigation to spray irrigation which are expected to have tangible benefits for water quality in the catchment.

5.8. Water sharing regime

The proposed regime operates on the expectation that the majority of consent holders will maintain their individual residual flows at all times as well as the 100l/s at the Chatto Confluence flow site during the irrigation season. Rostering to maintain the 100 l/s at Chatto Creek Confluence may make Laheys, Campbells and Centre Creeks more favourable to trout which would contradict the site specific galaxiid management plan developed for these consents, as a result we have not recommended the takes from these streams be subject to the 100 l/s at the confluence.

If with anticipated changes in water use the observed gains (Figure 9) in the lower Laheys Creek remain relatively constant then it is expected this contribution would allow the wider catchment to ration to meet the 100 l/s at the confluence.

It is expected that collective rationing by the wider group will only be needed to ensure 100 l/s is always maintained at the confluence. All takes from Chatto Creek will also be subject to the respective downstream minimum flow on the Manuherikia River.

6. Summary

Chatto Creek mainstem is a naturally perennial with no discernible losses to, or gains from, groundwater.

The water quality observed in Chatto Creek appears to be impacted by flood irrigation methods within the catchment. The conversion of irrigation from flood to spray methods is expected to result in significant improvements to water quality, with reductions in phosphorus, sediment and microbial contamination anticipated.

Limited macroinvertebrate data gives an MCI (~90) for Chatto Creek at the confluence which is indicative of fair water and/or habitat quality, while the QMCI (6.00) score for this site was consistent with good-excellent water and habitat quality (Kitto 2011). It is expected that the with the improvements in water use that these scores will improve over time.

Fish monitoring shows that currently there are four species of native fish in the Chatto Creek catchment, one is considered threatened (CORG) while another is a traditional mahinga kai species (longfin eel). Upland bully are common and relatively adapt to low flows while a single kōaro has been recorded. Introduced species, brown and rainbow trout are also found in the Chatto Creek catchment.

A collective residual flow of 100 l/s at the Chatto Creek confluence site during the irrigation season is proposed, this is expected to provide optimum habitat retention for CORGs. A residual flow of 100 l/s at the confluence also provides >60% habitat retention for large (>300mm) and small eels (<300mm) relative to habitat at the natural 7-day MALF.

A residual flow in the lower Chatto Creek of 100 l/s will also provide >60% habitat retention for juvenile brown trout on Jowett & Richardson (2008). The 100 l/s residual flow will also provide >70% habitat retention for the abundant mayfly *Deleatidium*, >60% habitat retention for *Pycnocentrodes*.

A winter residual flow of 250 l/s (optimum spawning habitat for trout) is proposed for the period May to September.

A supplementary residual flow of 330 l/s is also recommended for Chatto Creek at confluence, which in conjunction with the supplementary minimum flow at Campground would allow for taking to storage with less than minor ecological effects.

Takes from tributaries of Chatto Creek will also have residual flows applied at their respective points of take and be expected to adhere to the 100 l/s residual at the Chatto Confluence Flow Site. It is expected that with the implementation of residual flows on all takes, along with a catchment specific sharing regime[17] the ecological values of Chatto Creek will be provided for.

[17] Acknowledging the takes from the Laheys Creek Catchment have a galaxiid management plan in place that does not support releasing flows downstream of the respective takes.

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Project Memorandum

10 January 2021 Landpro Reference: 19467

To: Matt Hickey, Water Resource Management Ltd

From: Nick Boyens, Hydrologist, Landpro Ltd

Subject: Chatto Creek Headwater Catchments Flow Modelling

8. Introduction

This memorandum describes the process taken to develop modelled flows for a selection of the catchments in the Chatto Creek headwaters that have no continuous monitoring. This has been undertaken on behalf of the Chatto Creek water Users Group and the Manuherikia Catchment Group.

The catchments included in this work (Figure 17) are:

- Neds Creek (continuous flow monitoring site)
- Young Hill Creek
- Campbell Creek
- Laheys Creek
- Buster Creek
- Coal Creek
- Scotts Creek
- Devonshire Creek

9. Data collection

The primary data source for this work is the continuous flow monitoring site on Neds Creek upstream of the Matakanui Station takes. This site is run by Landpro on behalf of ORC and provides a quality assured flow record for that catchment above all take points. This site has been operational since 16th December 2019.

Over the 2019/20 summer period Landpro carried out four gauging runs that included spot gaugings of the Young Hill, Campbell, Laheys and Devonshire creeks along with gauging of Neds Creek. At the same time Landpro also undertook longitudinal gaugings on the mainstem of Chatto Creek on behalf of ORC.

All gaugings have been performed with a Sontek Flowtracker 1 or 2 according to National Environmental Standards for measurement of open channel flow.

Refer to Appendix 1 for overview of each gauging site and raw data.

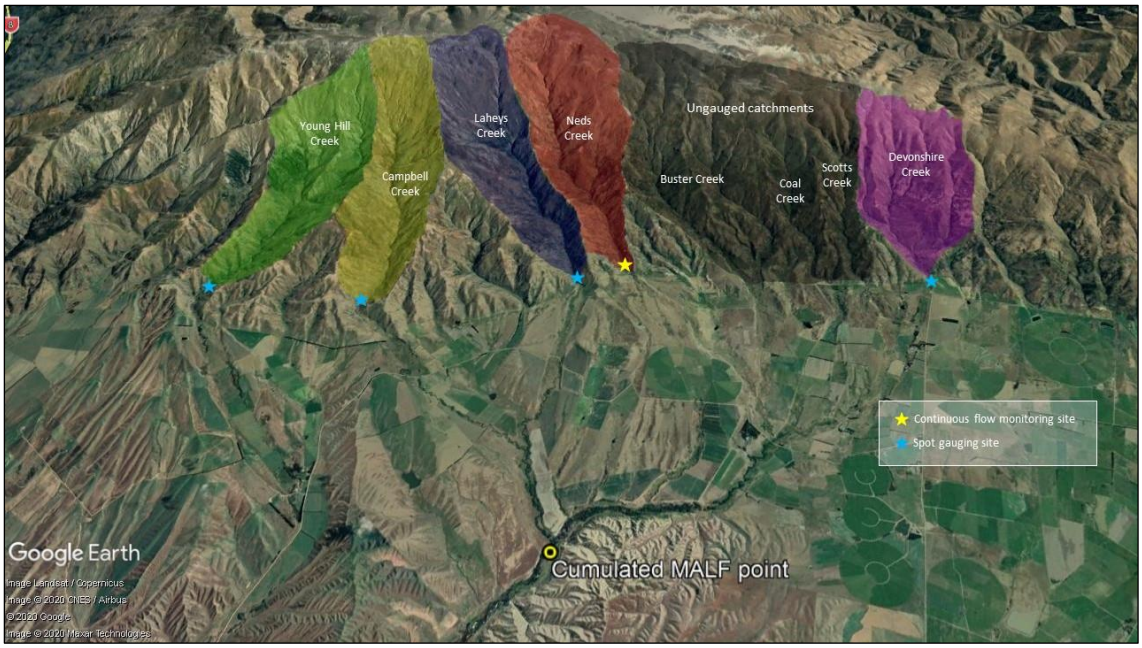


Figure 17: Chatto Creek Headwater Catchment locations (base map provided by WRM)

10. Modelling Process

The development of synthetic modelled flows for the unmonitored catchments has been carried out using two methods:

1. A flow correlation relationship has been built for Young Hill, Campbell, Laheys and Devonshire Creeks based on the four sets of spot gaugings and the continuous flow record at Neds Creek.

2. For Buster, Coal and Scotts Creek synthetic flows have been developed using a specific discharge calculation based on the catchment area of Neds Creek and the Neds Creek continuous flow record.

The calculated flow relationships, that are all based on the Neds Creek continuous flow record, have been used to create synthetic continuous flow records using the Virtual Measurement functions in Hilltop timeseries data management software.

10.1. Neds Creek continuous flow monitoring

The Neds Creek continuous flow site has data since 16th December 2019 and has a quality assured QC500 quality flow record for flows below around 0.5m^3/s based on an appropriate number of gaugings. Above that level the flow has not been gauged but extrapolation of the rating curve is expected to be reasonable. The rating has proven to be stable as evidenced by good fit of gaugings following large flows. This record therefore forms a good basis for the development of relationships with the other catchments.

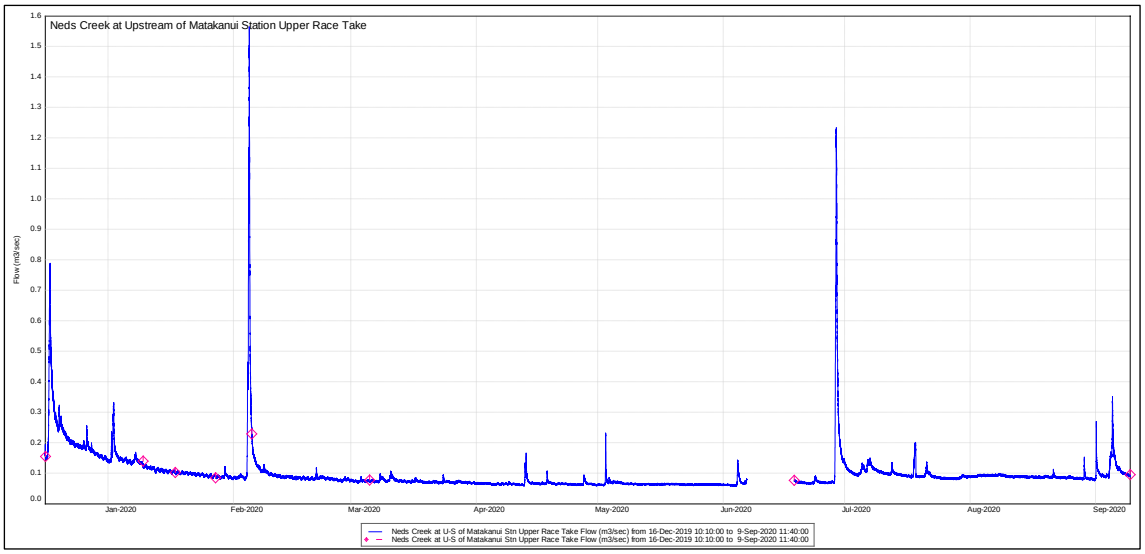


Figure 18: Neds Creek continuous flow record and gaugings

10.2. Modelled flows based on correlated spot gauging

A flow correlation relationship has been built for Young Hill, Campbell, Laheys and Devonshire Creeks based on the four sets of spot gaugings and the continuous flow record at Neds Creek. Gaugings were carried out at all sites on the following dates:

- 9th January 2020
- 17th January 2020
- 27th January 2020
- 5th March 2020

Spot gaugings on the unmonitored catchments were correlated with the flow in Neds Creek at the same time stamp. Gaugings were targeted to cover a range of flows to give a dataset appropriate to identification of a flow relationship between catchments. This approach is considered appropriate in this situation as the catchments are all very similar in aspect, slope, geology, elevation and landcover. Gauging and flow data were plotted in Excel and the linear relationship calculated. The relationships are shown in the following figures:

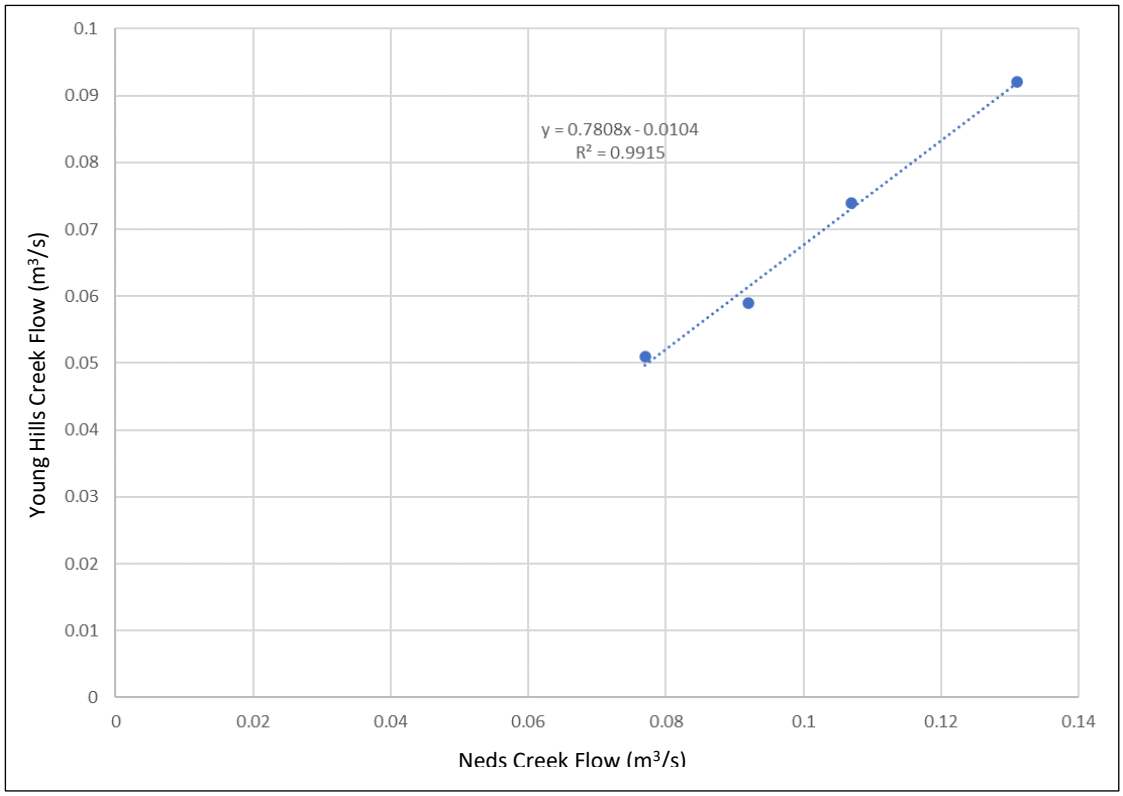


Figure 19: Young Hill Creek flow correlation with Neds Creek flow

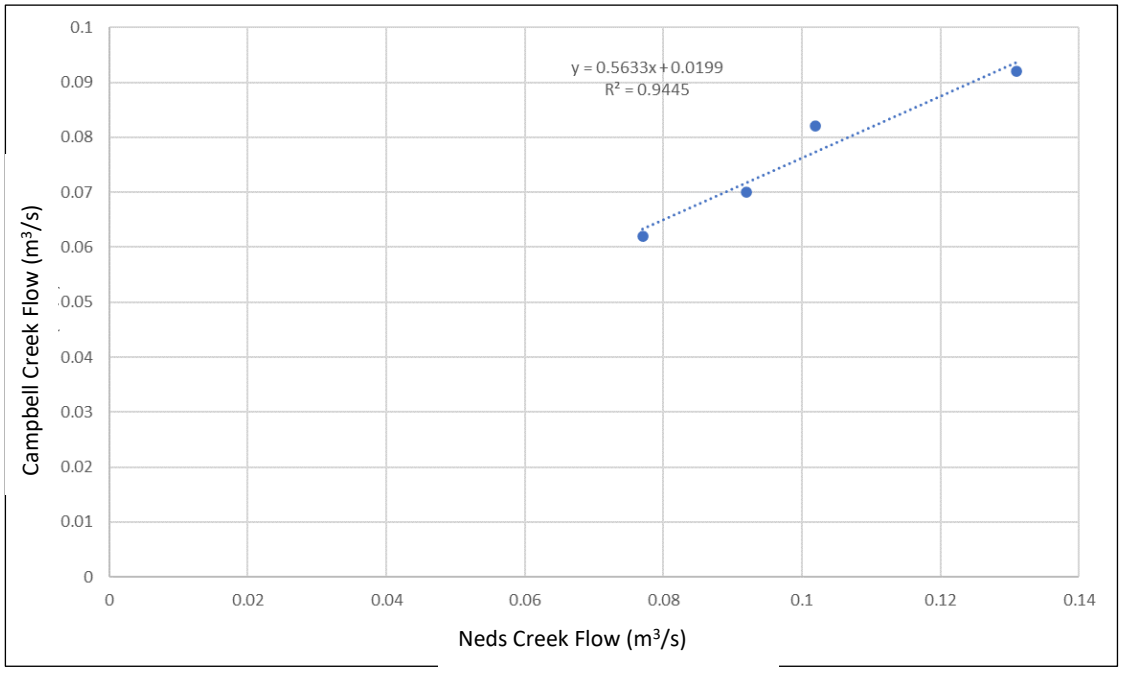


Figure 20: Campbell Creek flow correlation with Neds Creek flow

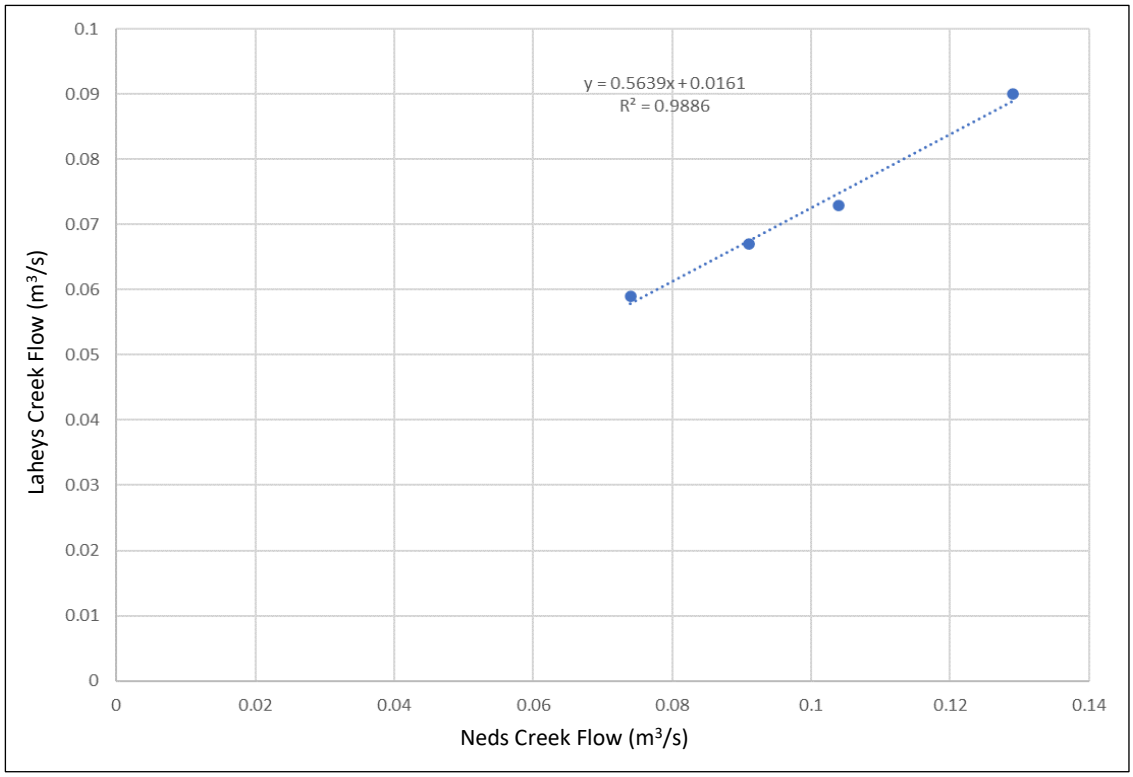


Figure 21: Laheys Creek flow correlation with Neds Creek flow

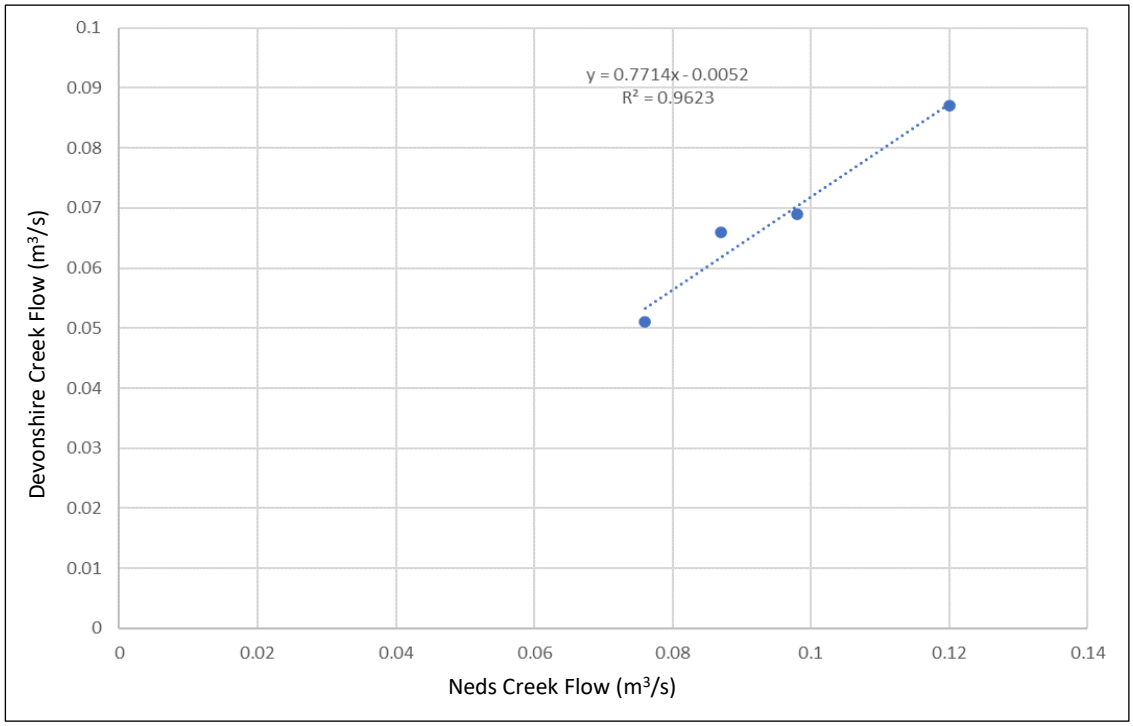


Figure 22: Devonshire Creek flow correlation with Neds Creek flow

As shown in the plots in Figure 19, Figure 20, Figure 21 and Figure 22 the flow relationships between the catchments and Neds Creek have a very strong linear relationship across the range of flows gauged, with R^2 values of between 0.9445 and 0.9915. These linear relationships have been used in Hilltop to create synthetic flow records for each catchment based on the continuous record collected at Neds Creek.

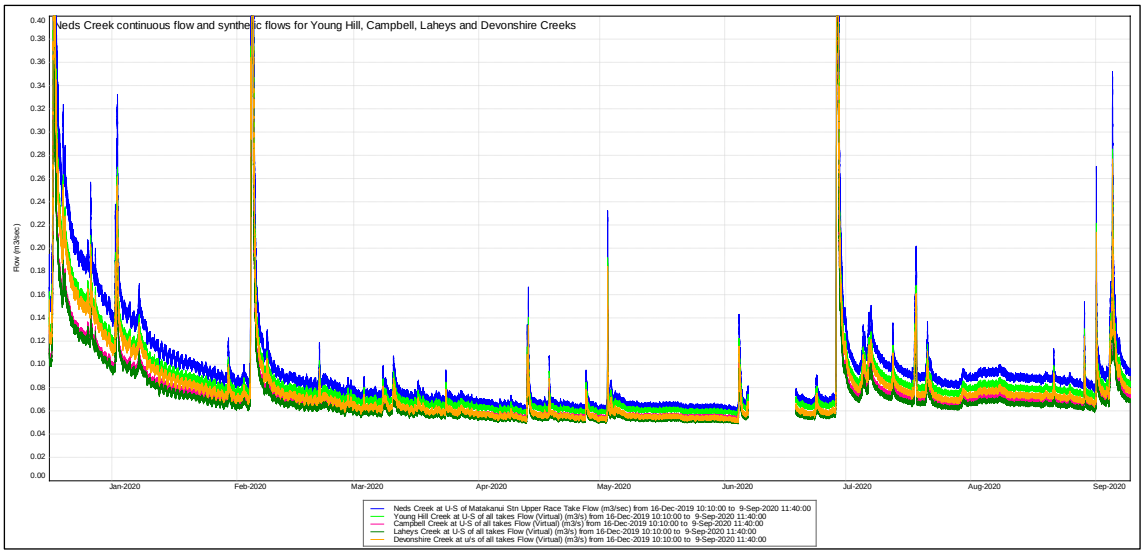


Figure 23: Neds Creek continuous flow and synthetic flows for Young Hill, Campbell, Laheys and Devonshire Creeks

As records for Neds Creek are updated the other catchment records are also updated.

10.3. Modelled flows based on catchment specific discharge relationships

The catchments of Buster Creek, Coal Creek and Scotts Creek were not included in the summer 2019/20 spot gauging programme but there is a requirement to model a flow record for these catchments too. Due to the similar nature of the aspect, geology, elevation, and landcover of the catchments in this part of the south eastern slopes of the Dunstan range the methodology chosen for this modelling is based on simple specific discharge relationship for Neds Creek transferred to the neighbouring catchments. This is calculated based on the known specific discharge from Neds Creek and then scaled to the catchment areas of each sub-catchment upstream of a specified point (Table 12). Specific discharge is calculated as flow units per catchment area unit. Catchment areas were calculated using QGIS.

Table 12: Catchment outlet points and catchment areas

Catchment	Catchment outlet point		Area (Hectares)
	Easting	Northing	
Neds Creek	1322011	5004931	998.048
Buster Creek	1324167	5005889	1374.15
Coal Creek	1324697	5007177	395.556
Scotts Creek	1324908	5007632	418.2

The specific discharge relationship was programmed into Virtual Measurements in Hilltop to calculate a continuous flow record for each of the Buster, Coal and Scotts Creek catchments. The modelled flow records are shown in Figure 24 below.

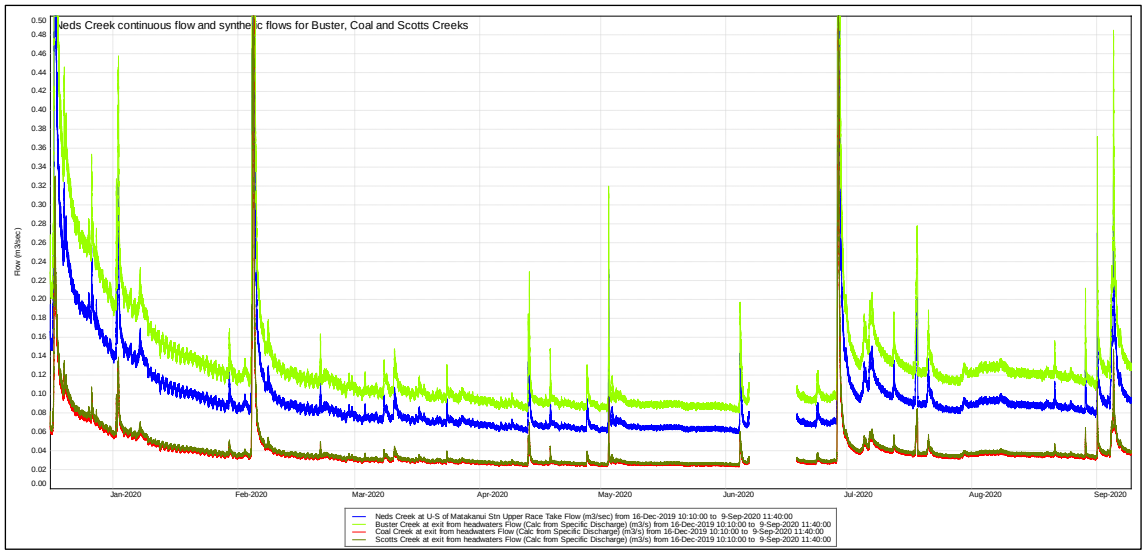


Figure 24: Neds Creek flow record and modelled flow for Buster, Coal and Scotts Creeks

As records for Neds Creek are updated the other catchment records are also updated.

10.4. Accumulated whole of headwater catchment flow record

Following the modelling of the individual catchments the flow records have been combined to provide a synthetic flow at the Accumulated Flow Point shown in Figure 17. This point does not include Young Hill Creek as that joins the main stem of Chatto Creek some distance downstream of the other catchments and therefore is treated separately.

The flow records have been combined using Hilltop Virtual Measurements and a daily average applied to the continuous records. Note that no time lags or allowance for instream losses/gains have been applied to the records and the result is a simple addition of the various flow records. The resultant hydrograph is shown in Figure 25.

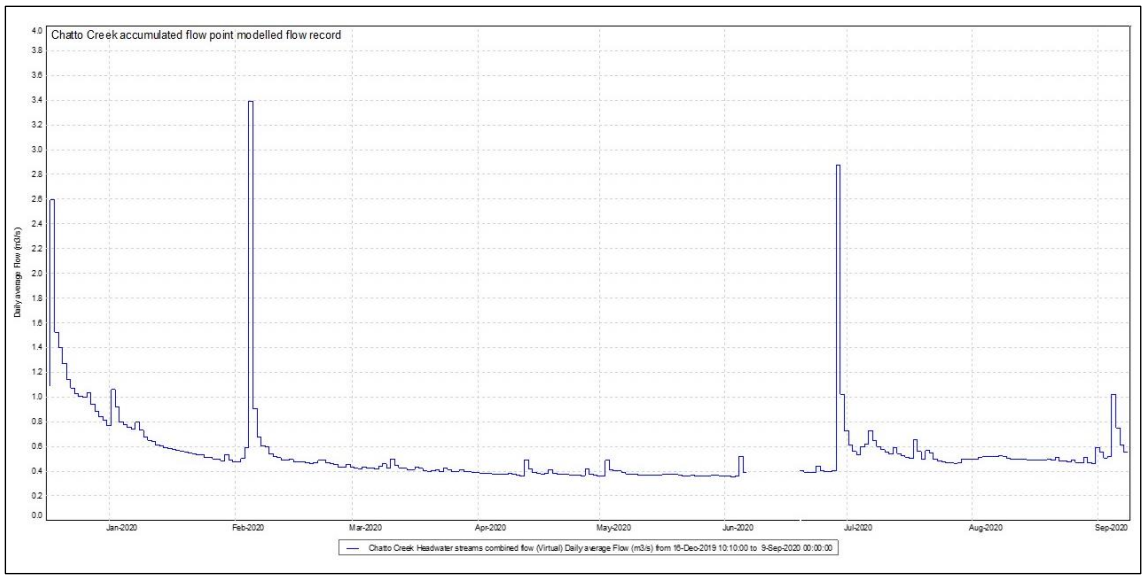


Figure 25: Chatto Creek Accumulated Flow Point modelled daily average flow record

11. Summary

Full data records to date have been provided and can be updated on request. The data is stored in a Hilltop file in the job folder on the Landpro document management system.

Please do not hesitate to contact me if any questions.

Kind Regards

Nick Boyens
Hydrologist

Appendix 1: Catchment sampling point details

Table 13: Neds Creek site details

Catchment:	**Neds Creek**
Site:	Neds Creek at U-S of Matakanui Stn Upper Race Take
Type	Continuous Flow
Easting	1321986
Northing	5004926
Catchment area	998.048 ha

Table 14: Neds Creek gauging results

Gauging results:	Date/Time	Flow (m3/s)
	16/12/2019 11:35	0.156
	9/01/2020 14:30	0.14
	17/01/2020 13:13	0.103
	27/01/2020 12:30	0.086
	5/02/2020 10:51	0.23
	5/03/2020 13:24	0.078
	18/06/2020 11:49	0.078
	9/09/2020 11:40	0.096

Figure 26: Neds Creek gauging location and water level recorder

Table 15: Young Hill Creek site details

Catchment:	**Young Hill Creek**
Site:	Young Hill Creek at U-S of all takes
Type	Spot gauging
Easting	1317097
Northing	4999597
Catchment area	Not calculated

Table 16: Young Hill Creek gauging results

Gauging results:	Date/Time	Flow (m3/s)
	9/01/2020 10:34	0.092
	17/01/2020 10:03	0.074
	27/01/2020 9:18	0.059
	5/03/2020 10:11	0.051

Figure 27: Young Hill Creek gauging location

Table 17: Campbell Creek site details

Catchment:	**Campbell Creek**
Site:	Campbell Creek at U-S of all takes
Type	Spot gauging
Easting	1319223
Northing	5001196
Catchment area	Not calculated

Table 18: Campbell Creek gauging results

Gauging results:	Date/Time	Flow (m3/s)
	9/01/2020 12:04	0.092
	17/01/2020 11:06	0.082
	27/01/2020 10:18	0.07
	5/03/2020 11:14	0.062

Figure 28: Campbell Creek gauging location

Table 19: Laheys Creek site details

Catchment:	**Laheys Creek**
Site:	Laheys Creek at U-S of all takes
Type	Spot gauging
Easting	1321420
Northing	5004140
Catchment area	Not calculated

Table 20: Laheys Creek gauging results

Gauging results:	Date/Time	Flow (m3/s)
	9/01/2020 13:23	0.09
	17/01/2020 12:06	0.073
	27/01/2020 11:25	0.067
	5/03/2020 12:20	0.059

Figure 29: Laheys Creek gauging location

Table 21: Devonshire Creek site details

Catchment:	**Devonshire Creek**
Site:	Devonshire Creek at U-S of all takes
Type	Spot gauging
Easting	1325888
Northing	5008160
Catchment area	697.013 ha

Table 22: Devonshire Creek gauging results

Gauging results:	Date/Time	Flow (m3/s)
	9/01/2020 16:09	0.087
	17/01/2020 16:14	0.069
	27/01/2020 15:00	0.066
	5/03/2020 15:21	0.051

Figure 30: Devonshire Creek gauging location

Table 23: Buster Creek site details

Catchment:	**Buster Creek**
Site:	Buster Creek at exit from headwaters
Type	Modelled
Easting	1324167
Northing	5004931
Catchment area	1374.149 ha

Table 24: Coal Creek site details

Catchment:	**Coal Creek**
Site	Coal Creek at exit from headwaters
Type	Modelled
Easting	1324697
Northing	5007177
Catchment area	395.556 ha

Table 25: Scotts Creek site details

Catchment:	**Scotts Creek**
Site	Scotts Creek at exit from headwaters
Type	Modelled
Easting	1324908
Northing	5007632
Catchment area	418.2 ha

Appendix G: 2015 Ecological Report

Neds Creek, Fish Survey.

Report to Mr A Paterson, Matakanui Station, C/- Martell Letica, Landpro.

Background.

Matakanui Station wishes to change the point of take for irrigation water from Neds Creek, a tributary of Chatto Creek north of Omakau. Neds Creek flows south easterly from the eastern face of Mt Makariri on the Dunstan Range from an altitude of 1606m to an authourised irrigation intake at approximately 480m. An existing take about 2km further downstream at approximately 340m altitude is proposed to be shifted upstream to the 480m take. A fish survey was required as part of the consent application to shift the take point to the already authorised top site.

It was not known if Central Otago roundhead galaxiids were present in Neds Creek. These galaxiids are present in isolated pockets throughout the Manuherikia catchment and are classified as endangered, the second category conservation status. The galaxiids can not survive in the presence of brown trout. Brown trout have been recorded from Chatto Creek, New Zealand Fresh Water Fisheries database, and are widespread throughout the Manuherikia catchment where they form the basis of a regionally significant trout fishery (Otago Sports Fish and Game Management Plan).

There are no obvious barriers to trout migration but low flows and associated high water temperatures sometimes act as barriers in small streams in the Manuherikia catchment protecting upstream galaxiid populations. The section of Neds Creek between the two existing takes is a meandering stream in a relatively deeply incised (~1m deep) channel flowing through grazed pasture-land. There are occasional willows along this section but above the top irrigation take native scrubland (matagouri, coprosma, lawyer) covers much of the catchment through to the tussock covered slopes of the headwaters.

Methods.

A brief aquatic ecological survey was conducted on 29/9/15. Three 50m sections were electrofished using a pack set and downstream stop net. One section above the top take, 1 section approximately midway between the top and bottom takes and 1 section about 100m above the lower take. The 3 sites are spaced at approximately 1km intervals. A check of fish present in the irrigation race adjacent to the top site was also made. Captured fish were identified and measured for length. Notes were recorded describing habitat, stream characteristics, aquatic plants, and stream invertebrates according to a stream survey card format. Photographs of stream habitat and the culverts were taken.

A 50m section of the top irrigation race was checked for fish species as well.

Water quality parameters were measured using a YSI handheld meter.

Results

The survey sites on this unnamed creek are located at GPS sites noted in table 1.

Table 1, GPS location of survey sites.

Section	Easting	Northing
Top	2231881	5566669
Mid	2232810	5566398
Low	2233687	5566082

In the top section 46 brown trout were captured. In the middle section 21 trout were caught and in the lower section 1 trout was captured, all were measured to the nearest millimetre and released, table 2. The brown trout ranged in length from 57-211mm.

Table 2, brown trout sample size, size range, and mean length (mm)

Site	Brown trout	Size range (mm)	Mean Length
Top	46	66-211	96.8
Mid	21	57-132	90.7
Low	1	105	na
Race	3	65-92	77

Based on a rough estimate that 50% of the trout are caught in the first electric fishing run through a section, an estimate of fish density was calculated, table 3.

Table 3, fish numbers and estimated densities within sites.

Section	Brown trout	Section Length (m)	Area m^2	Fish/m^2
Top	46	55	136.9	0.68
Mid	21	50	70.4	0.60
lower	1	50	59.4	0.04
Race	3	60	na	na

No Central Otago Roundhead galaxiids were seen or captured.

Stream invertebrates were noted at each site and from this visual inspection, density and diversity was observed to decline with distance downstream, table 4. Mayfly and stonefly were abundant at the top site, mayfly diversity decreased downstream while annelid and caddis occurrence increased.

Table 4, invertebrate distribution, diversity, and abundance in Neds Creek.

Site	Major groups	Abundance
Top	Stenoperla, Deleatidium, Coloburiscus	High
Mid	Deleatidium, annelids	low
Low	Deleatidium, caddis	moderate

Water quality parameters showed a declining trend with distance downstream and followed the pattern for fish density and invertebrates, table 5.

Table 5, water quality parameters for the Neds Creek, September 2015.

Water Quality Parameter	Top site	Mid site	Low site
Conductivity	74.6	75.3	78.3
Salinity mg/l	0	0	0
TDS mg/l	.0484	.0490	.0510
Temperature ^{0}C	7.5	10.5	13.1

No macrophytes or noticeable algal growths were present although the invertebrate population indicates healthy levels of periphyton on the coarse substrate especially at the top site. Periphyton here is present as a fine, nearly invisible, layer on the surface of stones detectable by touch.

Discussion.

The absence of galaxiids from the sections of Neds Creek surveyed precludes any potential adverse effect on them from the proposed shift of the lower irrigation take to the top site. The brown trout and invertebrate populations above the top site are in very good order and indicative of high quality water and habitat. Below the top take, habitat and therefore carrying capacity, decline as the stream changes from one with an established and relatively stable riparian zone to open pastureland and actively eroding stream banks. Fine sediment on the stream-bed increases with distance down stream. The brown trout of upper Neds Creek are likely to be a self-sustaining resident population. Maximum attainable size limits their suitability as an angling resource. Low summer flows in the stream reaches closer to Chatto Creek confluence, and in Chatto Creek, probably largely preclude this population making a contribution to the Manuherikia fishery except perhaps in periods of unusually high rainfall.

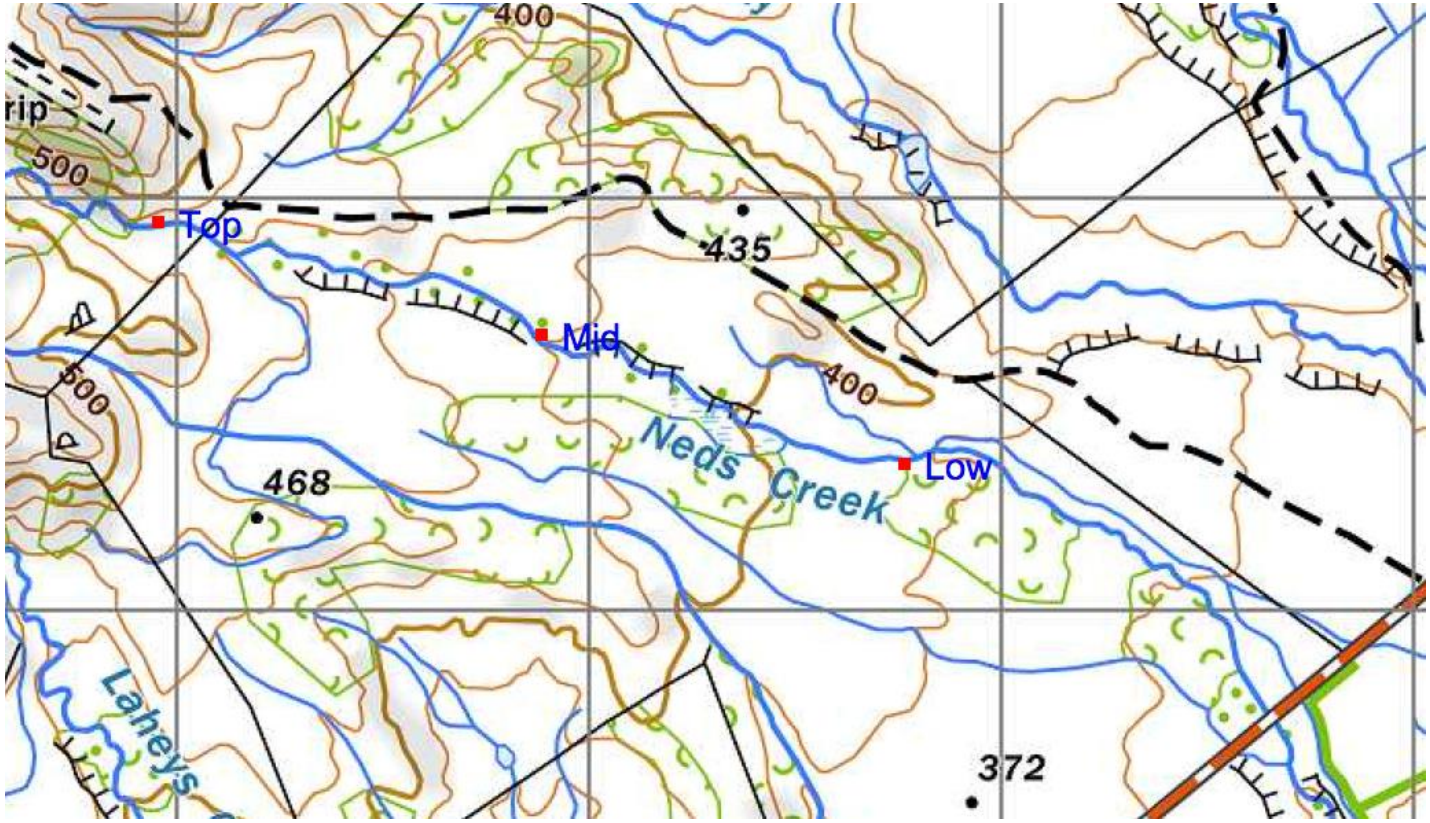
Shifting both irrigation takes to the top site seems unlikely to create any significant additional adverse effect on Neds Creek below the take, assuming a residual flow would be present.

Appendices.

1. Site map.
2. Photographs

Ross Dungey
September 2015.

Appendix 1, layout of survey sites on Neds Creek, Matakanui Station, Top at the junction of foothills and terrace flats, Lower site upstream of Moutere-Disputed Spur Road crossing.



Appendix 2, site photographs.
Neds Creel Photographs

Top Site

Middle Site

Neds Creek Lower Site

Top Irrigation Take.

Appendix H: ORC 2018 Neds Creek Fish Survey Data

Fish spp				
Neds Crk				
4006.v1				
Brown trout	Invertebrates	widths (m)		1.21
218				4.43
105				2.67
61				2.56
64	del,aotea,leech			2.59
69	del,olinga,austro			1.42
77	del,potam			1.27
61	pot,austro			3.34
64	austro,potam			
66	austro			
59	austro	**MEAN W**		**2.44**
68	fgscc,potmo	depths(mm)		375
65	del,aotea,fgscc			231
68	del,aotea,austro			221
55				349
68				234
63				220
65				411
70				214
68				
62				
69		**MEAN D**		**281.88**
61		**AREA**		146.18
72		Distance		60
62				
70		Con		36.6
67		Con T		56.6
74		Sal		0
69		TDS		0.0368
68		Temp		6.5
64				
59		Fish Sp	Bt	
92				
96		**Habitat.%**		
61		Pool		4.2
75		Run		20.5
68		Riffle		6.7
63		Rapid		55.7
101		Cascade		14
76		Waterfall		
75		Swamp		
64		chute		

Substrate

mud	
sand	
F Grav	5
C Grav	15
cobble	70
boulder	10
bedrock	
willow roots	

Fish Cover

Substrate	80
Weed	
Instrm deb	
Bank Veg	10
Un/cut Bank	20
Shade	10

Riparian %

Native For	
Exotic For	
Grass/Tusk	80
Exposd bed	
Shrub-Willow	20
Raupo-flax	

Pollution	lo
Water Level	hi
Lobster	n
Shrimp	n
Mussel	n
Dwnstm Block	?

821
Neds
Creek
Airstrip
009
500
Creek
2001.712.V12001.713.V2
06
saltru
400
Swampy
Gully
Buster
05
4006.V1
RM15.217.01
saltru
435
Swampy
Gully
Laheys
Creek
009
WR1001A
468
saltru
400
Chimney
04
713
Land Information New Zealand, Eagle Technology

Field	Value
FID	16688
Shape	Point
card	114131
m	5
y	2018
catchname	Clutha River
catch	752.632
locality	Neds Creek
time	
org	rdd
map	G41
east	2231894
north	5566667
altitude	483
penet	199
fishmeth	efp
effort	0
pass	0
spcode	saltru
abund	
number	42
minl	0
maxl	0
nzreach	14029128
Preferred_	brown trout
Name_and_A	Salmo trutta Linnaeus, 1758
Category	Introduced and Naturalised
Status	Introduced and Naturalised

Appendix I: Summary of Flow Monitoring Data Collected at Neds Creek

Project Memorandum

11 January 2021 Landpro Reference: 19452

To: Pete Stevenson, Otago Regional Council

Pete Ravenscroft, Otago Regional Council

From: Nick Boyens, Hydrologist, Landpro Ltd

Subject: Summary of flow monitoring data collected at Neds Creek

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1. Background

As requested by Otago Regional Council, Landpro have been running a water level monitoring site and carrying out gaugings at a site on Neds Creek upstream of the uppermost water take (Figure 1).

Figure 1: Monitoring site location.

0800 023 318
13 Pinot Noir Drive
PO Box 302
Cromwell 9342
Central Otago, NZ
info@landpro.co.nz
landpro.co.nz

The site has been collecting water level data since 16th December 2019 and there has been 6 flow gaugings carried out at a range of flows to enable development of a flow rating curve. Prior to installation of this monitoring equipment there has been a water level sensor at the same location run by Matakanui Station. The records overlap and an attempt has been made to backdate the new rating information to the historic record.

2. Monitoring Site configuration

Figure 2 and Figure 3 show the details of the layout of the new site. It has been installed using non-telemetered and non-vented LevelSCOUT water level datalogger paired with a BaroSCOUT barometric pressure sensor. The same location as the old sensor was chosen as there is an adequate pool with a good solid control consisting of some well seated large boulders forming a blockage with a small waterfall on the downstream side. The water level sensor is installed in a small stilling well located adjacent the existing water level sensor location. Water level data are referenced to a local datum with manual inspection readings taken from a staff gauge tied-in to the same datum. There are two benchmarks installed on fenceposts adjacent to the site and the water level control cross-section has been surveyed.

Figure 2: Monitoring site layout.

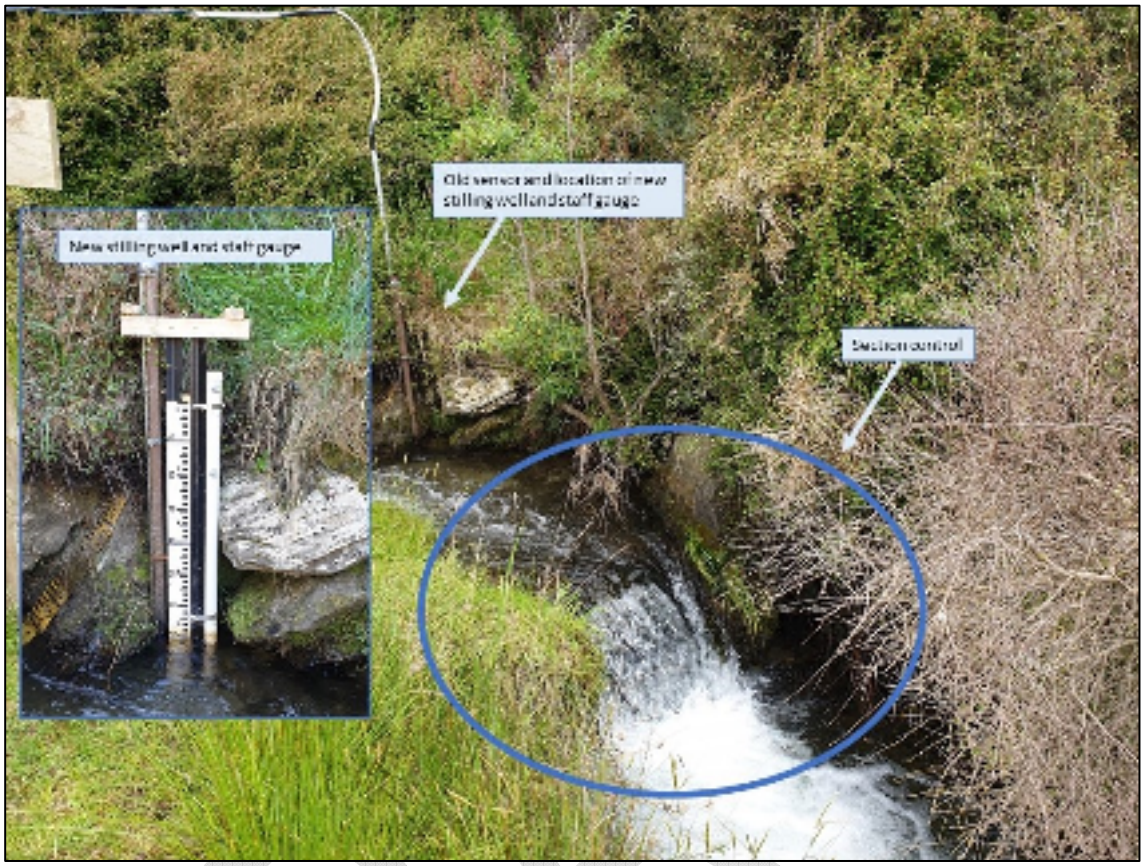

Figure 3: Control section and location of new stilling well and staff gauge.

3. Data Record

3.1 Water Level

Water level and barometric pressure data recording started at 16/12/19 10:10 and are recorded at 5min intervals in New Zealand Standard Time (NZST). Absolute water level data is corrected for barometric pressure variations using the Aqua4Plus software. This has been imported to Hilltop and correction to the staff gauge reference level performed. The water level record to date is shown in Figure 4. The water level record shows a marked diurnal fluctuation in the order of 10mm that may be related to conditions upstream such as the water uptake during the day of riparian vegetation in the upper catchment.

The water level record is classified as Quality Code 500 according to the NEMS for water level recording. This classification is a result of the accuracy of the LevelSCOUT sensor and the error estimates of the manual water level check readings. There is some wave lap on the ESG in most conditions which makes

it difficult to read it to within closer than 5mm. Despite this the site is the best available without needing to install significant infrastructure.

The period of record to date includes the typical summer recession of low flows along with two significant high flow events (see Figure 4 and Table 1).

Table 1: Range of water level data to date.

Neds Creek at U-S Matakanui Stn Upper Race Take	From 16-Dec-2019 10:10:00 to 5-Mar-2020 13:30:00	
	Water level (mm)	Date/time (NZST)
Minimum	272	2/03/20 16:20
Maximum	773	4/02/20 20:20
Mean	321	
Median	303	

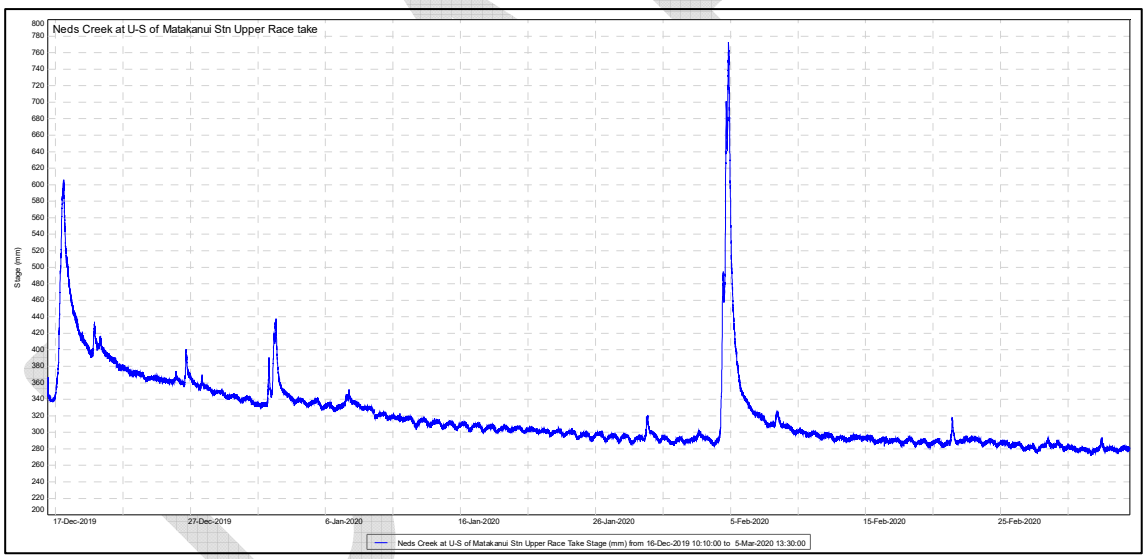

Figure 4: Neds Creek at U-S of Matakanui Stn Upper Race Take water level record.

3.2 Flow Measurements

A total of 6 flow gaugings have been undertaken since the water level record began. Flows targeted for gauging have primarily been at the lower end of the range and taken as the low flow recession continued over early summer. One higher stage gauging was undertaken on the receding limb of the significant fresh of 4th February 2020. Flow gaugings are summarised in Table 2. All gaugings have

been carried out using a SonTek Flowtracker or Flowtracker 2 ADV and adhere to best practice according to NEMS.

Table 2: Flow gaugings at Neds Creek U-S of Matakanui Stn Upper Race Take since 16/12/2019.

Neds Creek at U-S of Matakanui Stn Upper Race Take	From 16-Dec-2019 11:35:00 to 5-Mar-2020 13:24:00	
Survey Time	**Stage (mm)**	**Flow (L/s)**
16-Dec-2019 11:35:00	345	156
09-Jan-2020 14:30:00	325	140
17-Jan-2020 13:13:00	305	103
27-Jan-2020 12:30:00	296	86
05-Feb-2020 10:51:00	394	230
05-Mar-2020 13:24:00	280	78

3.3 Cross-section

In order to provide useful information for the subsequent development of an initial rating curve for the site a survey of the site control cross section was undertaken. The primary aim was to define the theoretical "cease to flow" water level to provide definition of the lower end of the rating curve. It has also been used to help define the change points in the rating curve shape. The cross-section used is shown in Figure 5.

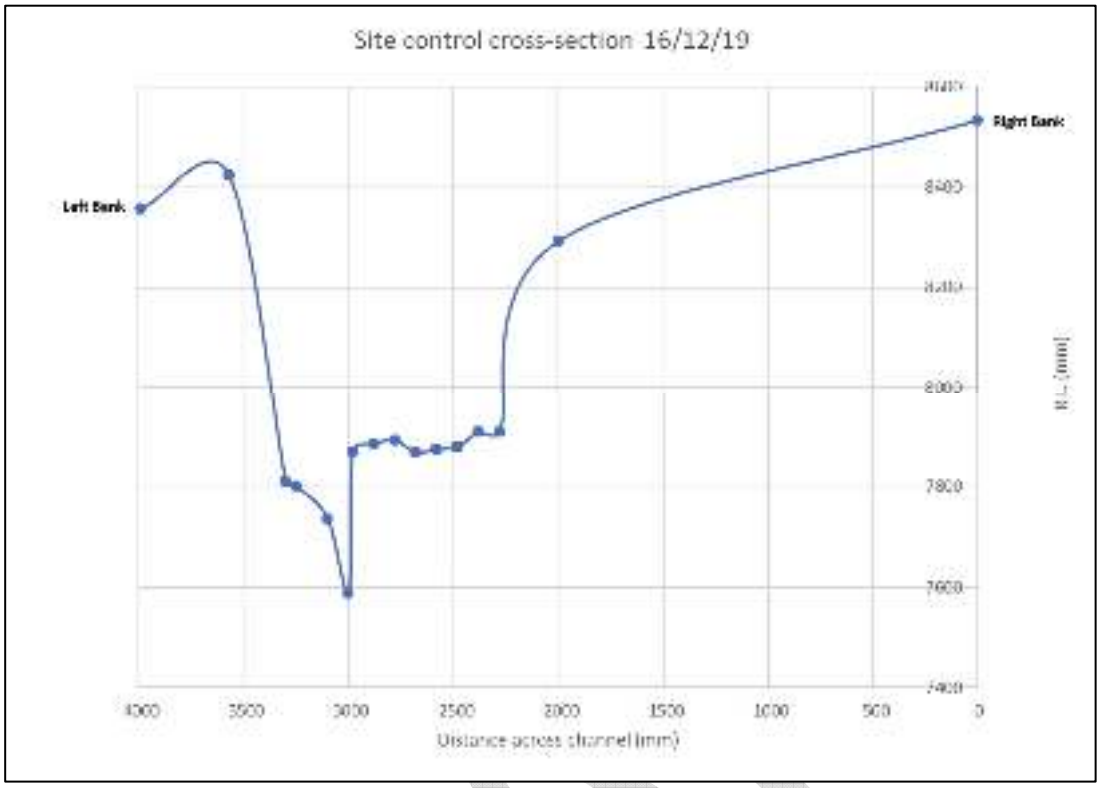

Figure 5: Neds Creek at U-S of Matakanui Upper Race Take site control cross-section.

Analysis of the cross-section data and reference to the installed staff gauge that has an R.L Zero of 7727mm results in a Cease-to-Flow level of -138mm on the staff gauge.

3.4 Rating Curve

Using the data from the flow gaugings that were targeted over a range of water levels and the cross-section survey, an initial rating curve has been developed in order to give a continuous flow record. This has been done using only the new data collected since the new site was install on 16th December 2019.

Figure 6 shows the rating curve for the range of flows that have been captured through gauging. The rating has been developed using the gauging data with reference to the cross-section (Figure 5) data that have been used to define where the zero flow end of the rating curve has been drawn to, and to define the point of the change in shape due to where the cross-section breaks out of the narrow slot in the cross-section.

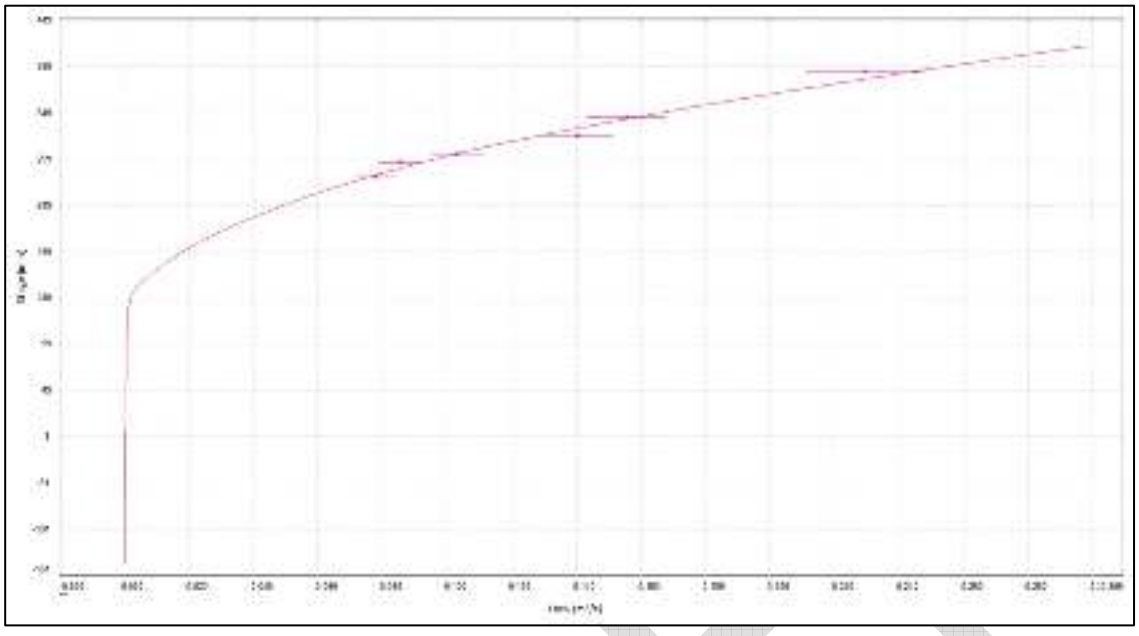

Figure 6: Neds Creek at U-S Matakanui Upper Race Take lower end of rating curve showing all gaugings since 16/12/2019. Note the slope change correlates to where the channel breaksout of the narrow slot in the control cross-section.

The rating has been extrapolated manually to capture the full range of stage that has been recorded to date. This is shown in Figure 7. The extrapolation was done by eye using expert judgement and can be assessed at a later date as more high flow data become available. The resultant flows were given a simple sense check against the calculated bank-full cross-section area to check that the required velocities were within a sensible range. Cross-section area at bank-full stage of approximately 700mm is calculated in Hilltop as 0.744m^2. The corresponding rated flow for this level is 1.164 m^3/s. The calculated average cross-section velocity would be 1.56 m/s, which seems reasonable given the nature of the channel.

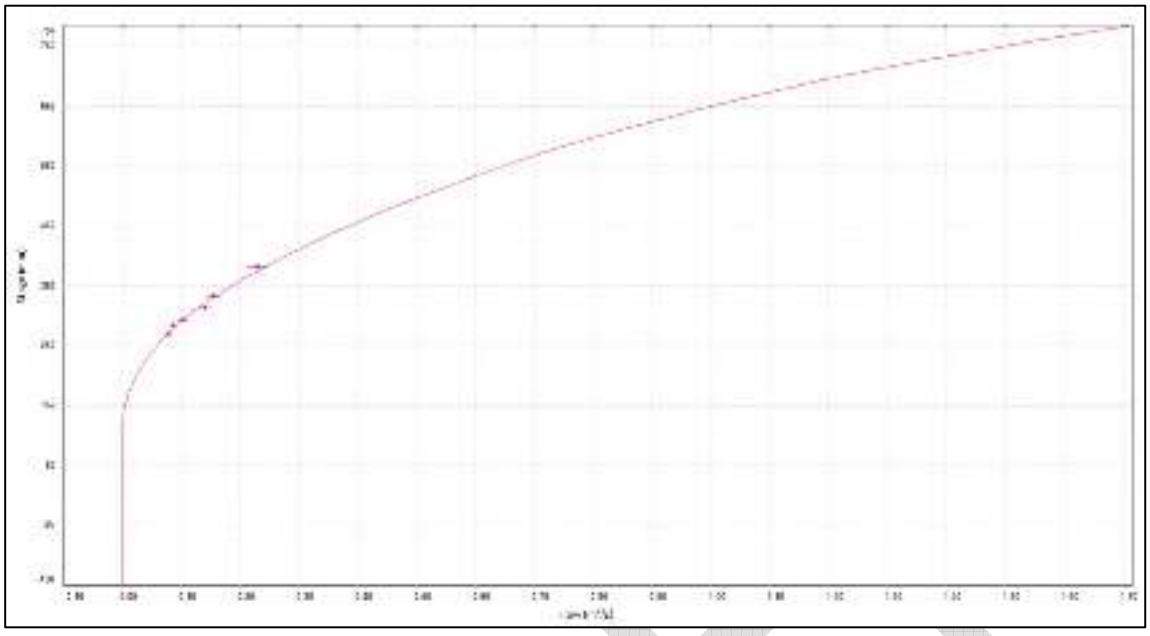

Figure 7: Neds Creek at U-S Matakanui Upper Race Take rating curve showing all gaugings since 16/12/2019 and extrapolation to maximum recorded water level.

The rating curve does not perfectly fit the gaugings, but within the range of flows that have been measured it is a fair representation of the stage to flow relationship. The rating has been assessed as QC500 under NEMS for the range of flows that have been gauged (to stage 394mm) and QC300 for higher stages due to the lack of direct gauging data for those higher flows. Table 3 summarises the rating and gauging data, and the fit between the two.

Table 3: Gauging statistics summary using QRate in Hilltop.

Stage	Flow	Qr *	Date	Deviation ŧ	
mm	m^3/sec	m^3/sec		mm	%
345	0.156	0.159	16-Dec-19	1.966	2
325	0.14	0.129	9-Jan-20	-8.172	-8.5
305	0.103	0.103	17-Jan-20	-0.6731	-0.3
296	0.086	0.092	27-Jan-20	5.877	7.3
394	0.23	0.249	5-Feb-20	7.562	8.6
280	0.078	0.077	5-Mar-20	-2.789	-1.3

* Rated Flow (Qr) computed from the Recorder Stage

ŧ Deviation from the Gaugings: (Qr-Qg)/Qg

The final rating curve pairs and the associated QC classifications are shown in Table 4.

Table 4: Rating curve table.

Stage (mm)	Flow (m3/s)	QC (NEMS)
-138	0	500
133	0.001	500
150	0.002	500
174	0.008	500
197	0.017	500
271	0.067	500
296	0.092	500
321	0.123	500
340	0.151	500
371	0.202	300
586	0.72	300
700	1.164	300
797	1.717	300

4. Assessment of the Historic Record

4.1 Water Level

At this same location Matakanui Station have been recording continuous water level data since 23rd August 2013. Data have been measured using a pressure transducer linked to the Matakanui Upper Race Take water meter datalogger and communications device (WM0505). The transducer was installed by WaterForce and the data is maintained through the WaterCheck Ltd telemetry service. There has been four flow gaugings carried out over the period of this record. These gaugings were not carried out by Landpro.

An assessment has been made of the usefulness of this relatively long period of water level record and whether a rating curve can be backdated to give a corresponding historic flow record. Unfortunately, there appears to have never been any primary reference associated with this sensor nor any calibration checks. At the site there is an old yellow NIWA style staff gauge that is very poorly mounted at an inconsistent angle to a rock (Figure 3) which makes it unusable. There has also only been four gaugings over a long period of time (Table 5). The usefulness of these is further compromised both by the lack

of reference water level and no proper associated inspection data to tie the flow back to a measured or recorded water level. The gauging stage has been estimated off the raw water level record.

Table 5: Summary of historic gaugings

Neds Creek at U-S of Matakanui Stn Upper Race Take (old)	From 29-Mar-2017 15:05:00 to 23-Jul-2019 16:47:00	
Survey Time	**Recorder Stage (mm)**	**Flow (L/s)**
29/03/2017 15:05	163	67
16/08/2017 14:09	193	115
18/08/2017 11:33	272	226
23/07/2019 16:47	272	231

An attempt was made at shifting the historic record to the newly established datum that the LevelSCOUT sensor is referenced to. This was based on the relationship between that and the old sensor records that has been developed during the overlapping period of record. The general track of the record looks sensible but has a large number of spikes. The major low spikes have been filtered from the record, but it was not considered an efficient use of time to spend time grooming the whole record in detail. It is possible to run a moving mean or similar automated method to filter some of this noise from the record. The edited record as it stands is shown in Figure 8.

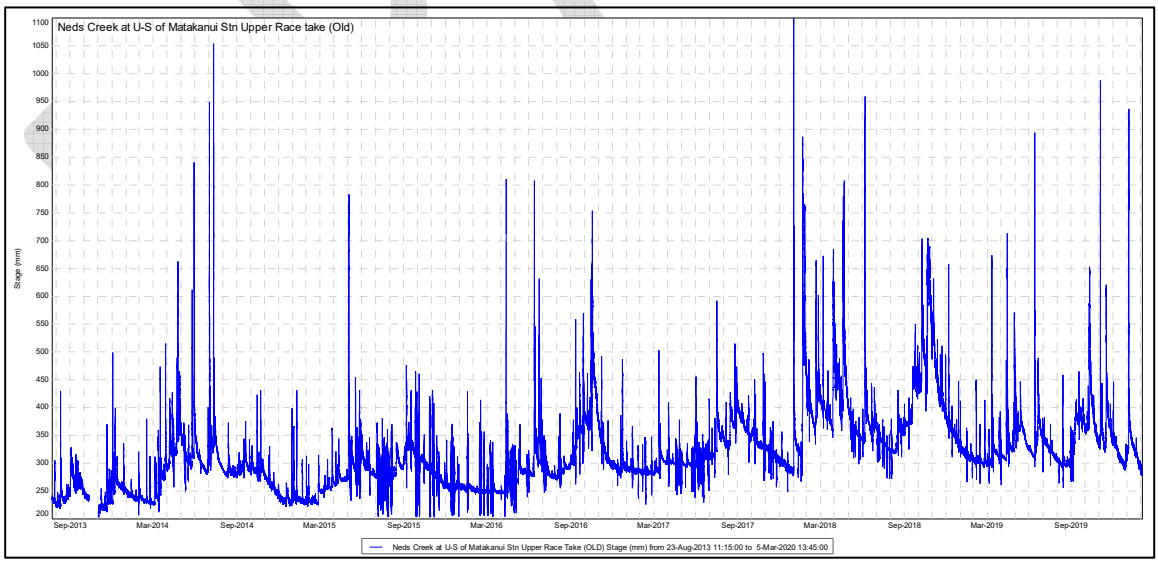

Figure 8: Partially edited water level record from old water level sensor installed by Matakanui Station.

When the partially edited historic water level data set is plotted with the new site record there is some obvious difference in the way that the sensors have reacted over the flood peak of 5th February (Figure 9). This may be an artefact of the way the record has been modified and further editing may remedy this, but it is not considered worthwhile at this point.

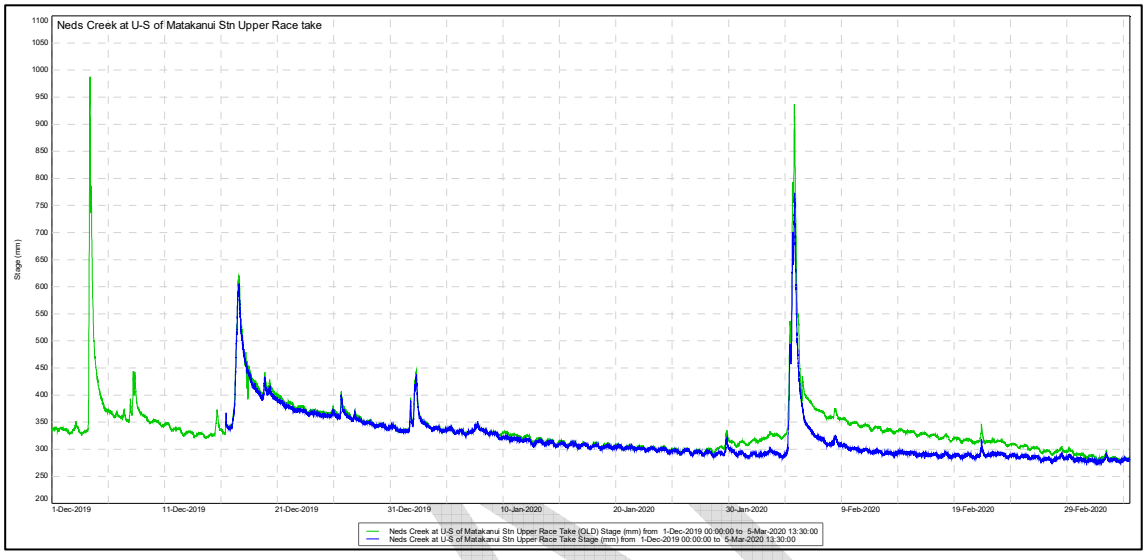

Figure 9: Comparison of historic and new sensor water level records.

4.2 Flow Estimation of Historic Record

An attempt was made to use the historic gauging data and the new information from the new site to develop a rating curve that could be backdated to the historic water level record. However, this was abandoned as the rating curve was obviously going to be significantly different to the new one and it was difficult to provide any justification for a major shape change given the nature of the control. With that in mind, the new rating curve has been applied to the historic data with limited success. Although the gauging statistics (using QRate in Hilltop, Table 6) look reasonable there is still far too few gaugings to have any certainty about the validity of the flow estimation.

Table 6: Historic record gauging statistics summary using QRate in Hilltop.

Stage	Flow	Qr *	Date	Deviation ɬ	
mm	m^3/sec	m^3/sec		mm	%
163	0.067	0.077	29-Mar-17	-108.2	15.3
193	0.115	0.124	16-Aug-17	-122.1	8
272	0.226	0.256	18-Aug-17	-112.6	13.1
272	0.231	0.228	23-Jul-19	-115	-1.1

* Rated Flow (Qr) computed from the Recorder Stage

ɬ Deviation from the Gaugings: (Qr-Qg)/Qg

When the resultant flow record is plotted (Figure 10) it appears that the flow record is too low at times and probably a poor representation of what is actually happening. Further work may refine this further but may not be worthwhile as the value of the outcome is expected to be limited.

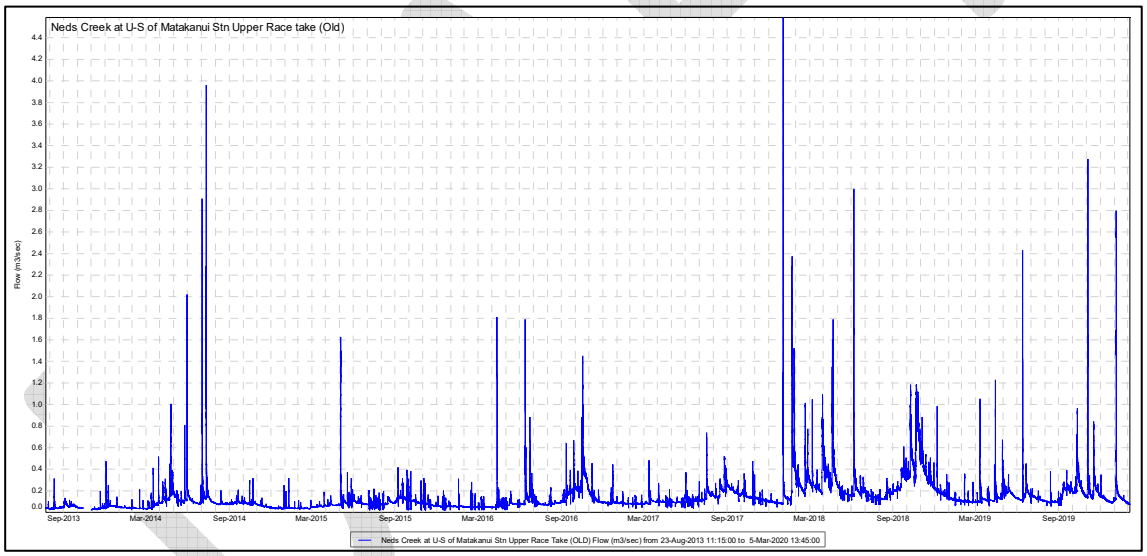

Figure 10: Neds Creek at U-S of Matakanui Upper Race (Old) estimated historic flow record.

4.3 Conclusion and Recommendation

With the obvious limitations of the historic data record in mind, it is recommended that the new site be maintained for several years to collect the necessary length of record to allow for proper analysis. Alternatively, the Matakanui Station site could be upgraded to enable it to collect good data in future.

Appendix J: Aqualinc Calculation and Stock Drinking Water Requirement

APPENDIX J1

Landpro Ref: 18060

LANDPRO
Make the most of your land

Aqualinc Irrigation Requirements

Site: Matakanui Station Limited - Current Irrigation Command Area **Sub-region** Central and Lakes District

Smap Soil Type	Smaps PAW	Irrigation Type	MAR	Aqualinc PAW	Landuse	Area (ha)	Peak Daily Demand (mm/day)	Peak Daily Demand (m^3)	Maximum Monthly Demand (mm/month)	Maximum Monthly Demand (m^3)	90%ile Annual Demand (mm/year)	90%ile Annual Demand (m^3)	100%ile Annual Demand (mm/year)	100%ile Annual Demand (m^3)
Clare_1a.1	51	Fixed & Moveable	450	60	Pasture	9.8	5.1	498	158	15,430	791	77,249	913	89,164
Clare_1a.2	51	Fixed & Moveable	550	60	Pasture	3.5	5.1	180	158	5,579	769	27,153	877	30,967
Flax_105a.1	142	Fixed & Moveable & Overland	450	90	Pasture	0.1	4.8	3	149	101	773	526	883	600
Flax_105a.1	142	Fixed & Moveable & Overland	550	90	Pasture	41.8	4.7	1,967	146	61,097	729	305,065	818	342,308
Flax_108a.1	192	Fixed & Moveable & Overland	450	120	Pasture	1.7	4.2	73	130	2,245	714	12,331	840	14,507
Flax_108a.2	193	Fixed & Moveable & Overland	550	120	Pasture	11.3	4.2	474	130	14,669	672	75,828	777	87,677
Germ_2a.1	108	Moveable & Overland	550	60	Pasture	9.5	5.1	486	158	15,048	769	73,240	877	83,525
Laud_2b.1	54	Fixed & Moveable	550	60	Pasture	0.7	5.1	34	158	1,065	769	5,183	877	5,911
Lindi_10a.1	78	Moveable	550	60	Pasture	0.5	5.1	26	158	807	769	3,930	877	4,481
Omel_2a.1	91	Moveable & Overland	450	60	Pasture	4.4	5.1	223	158	6,914	791	34,614	913	39,953
Omel_2a.1	91	Moveable & Overland	550	60	Pasture	3.9	5.1	200	158	6,198	769	30,168	877	34,405
Pateg_5a.1	142	Moveable & Fixed	450	90	Pasture	3.4	4.8	162	149	5,026	773	26,073	883	29,784
Pateg_5a.1	142	Moveable & Fixed	550	90	Pasture	67.3	4.7	3,162	146	98,214	729	490,398	818	550,269
Pateg_6a.1	147	Fixed & Moveable & Overland	450	90	Pasture	33.5	4.8	1,606	149	49,841	773	258,569	883	295,363
Pateg_6a.1	148	Fixed & Moveable & Overland	550	90	Pasture	71.7	4.7	3,372	146	104,735	729	522,955	818	586,800
Ranf_4a.1	123	Fixed & Moveable & Overland	550	120	Pasture	42.2	4.2	1,772	130	54,847	672	283,517	777	327,816
Tiro_4a.1	60	Fixed & Moveable & Overland	450	60	Pasture	0.9	5.1	44	158	1,352	791	6,771	913	7,815
Tiro_4a.1	61	Fixed & Moveable & Overland	550	60	Pasture	84.4	5.1	4,303	158	133,313	769	648,844	877	739,969
Waen_8a.1	110	Fixed & Moveable & Overland	550	60	Pasture	78.1	5.1	3,984	158	123,441	769	600,797	877	685,174
WaenM_1a.1	136	Fixed & Moveable & Overland	550	90	Pasture	63.0	4.7	2,962	146	92,021	729	459,474	818	515,569
					TOTAL	**531.6**		**25,530**		**791,943**		**3,942,684**		**4,472,058**

Stock Water Requirements

Note: l/day requirement taken from ORC's Resource Consent Application Form 4

Stock drinking water	l/day/cow	Herd	l/day	m3/day	m3/month	m3/yr
Beef Cattle	55	1100	60,500	60.5	1,840	22,083
Sheep	4.5	21000	94,500	94.5	2,874	34,493

APPENDIX J2

Landpro Ref: 18060

Aqualinc Irrigation Requirements

Site: **Matakanui Station Limited - Future New Irrigation** **Sub-region** **Central and Lakes District**

Smap Soil Type	Smaps PAW	Irrigation Type	MAR	Aqualinc PAW	Landuse	Area (ha)	Peak Daily Demand (mm/day)	Peak Daily Demand (m^3)	Maximum Monthly Demand (mm/month)	Maximum Monthly Demand (m^3)	90%ile Annual Demand (mm/year)	90%ile Annual Demand (m^3)	100%ile Annual Demand (mm/year)	100%ile Annual Demand (m^3)
Flax_105a.1	142.3	Fixed & Moveable	450	90	Pasture	2.8	4.8	135	149	4,178	773	21,675	883	24,759
Flax_105a.1	142.3	Fixed & Moveable	550	90	Pasture	1.7	4.7	82	146	2,540	729	12,685	818	14,233
Flax_108a.1	192.3	Fixed & Moveable	450	120	Pasture	12.1	4.2	506	130	15,665	714	86,037	840	101,220
Flax_108a.2	192.3	Fixed & Moveable	550	120	Pasture	10.6	4.2	447	130	13,822	672	71,447	777	82,611
Germ_2a.1	107.7	Fixed & Moveable	450	60	Pasture	0.2	5.1	8	158	246	791	1,234	913	1,424
Germ_2a.1	107.7	Fixed & Moveable	550	60	Pasture	28.3	5.1	1,444	158	44,747	769	217,788	877	248,375
Lindi_10a.1	77.7	Fixed & Moveable	450	60	Pasture	1.4	5.1	69	158	2,149	791	10,758	913	12,417
Lindi_10a.1	77.7	Fixed & Moveable	550	60	Pasture	15.1	5.1	772	158	23,928	769	116,457	877	132,813
Lindi_3a.1	82.4	Fixed	550	60	Pasture	31.8	5.1	1,624	158	50,320	769	244,911	877	279,307
Omel_2a.1	90.9	Fixed & Moveable	450	60	Pasture	1.9	5.1	95	158	2,950	791	14,768	913	17,046
Omel_2a.1	90.9	Fixed & Moveable	550	60	Pasture	3.3	5.1	167	158	5,171	769	25,169	877	28,704
Pateg_6a.1	147.1	Moveable	450	96	Pasture	2.5	4.68	118	145	3,653	761	18,959	874	21,662
Pateg_6a.1	147.1	Moveable	550	90	Pasture	10.1	4.7	475	146	14,756	729	73,680	818	82,675
Patego_6a.1	147.1	Moveable	450	90	Pasture	0.2	4.8	11	149	350	773	1,817	883	2,075
Ranf_4a.1	122.8	Fixed & Moveable	550	120	Pasture	17.7	4.2	743	130	22,988	672	118,830	777	137,397
Rang_63a.1	84.8	Moveable	450	60	Pasture	4.2	5.1	216	158	6,685	791	33,467	913	38,629
Tiro_4a.1	59.7	Fixed & Moveable	450	60	Pasture	41.7	5.1	2,127	158	65,883	791	329,831	913	380,703
Tiro_4a.1	59.7	Fixed & Moveable	550	60	Pasture	92.2	5.1	4,703	158	145,704	769	709,156	877	808,752
Waen_8a.1	109.5	Fixed & Moveable	550	60	Pasture	72.6	5.1	3,702	158	114,681	769	558,163	877	636,553
WaenM_1a.1	135.8	Fixed & Moveable	450	90	Pasture	0.5	4.8	22	149	685	773	3,556	883	4,062
WaenM_1a.1	135.8	Fixed & Moveable	550	90	Pasture	88.163	4.7	4,144	146	128,718	729	642,708	818	721,173
					TOTAL	**439.0**		**21,609**		**669,820**		**3,313,097**		**3,776,590**