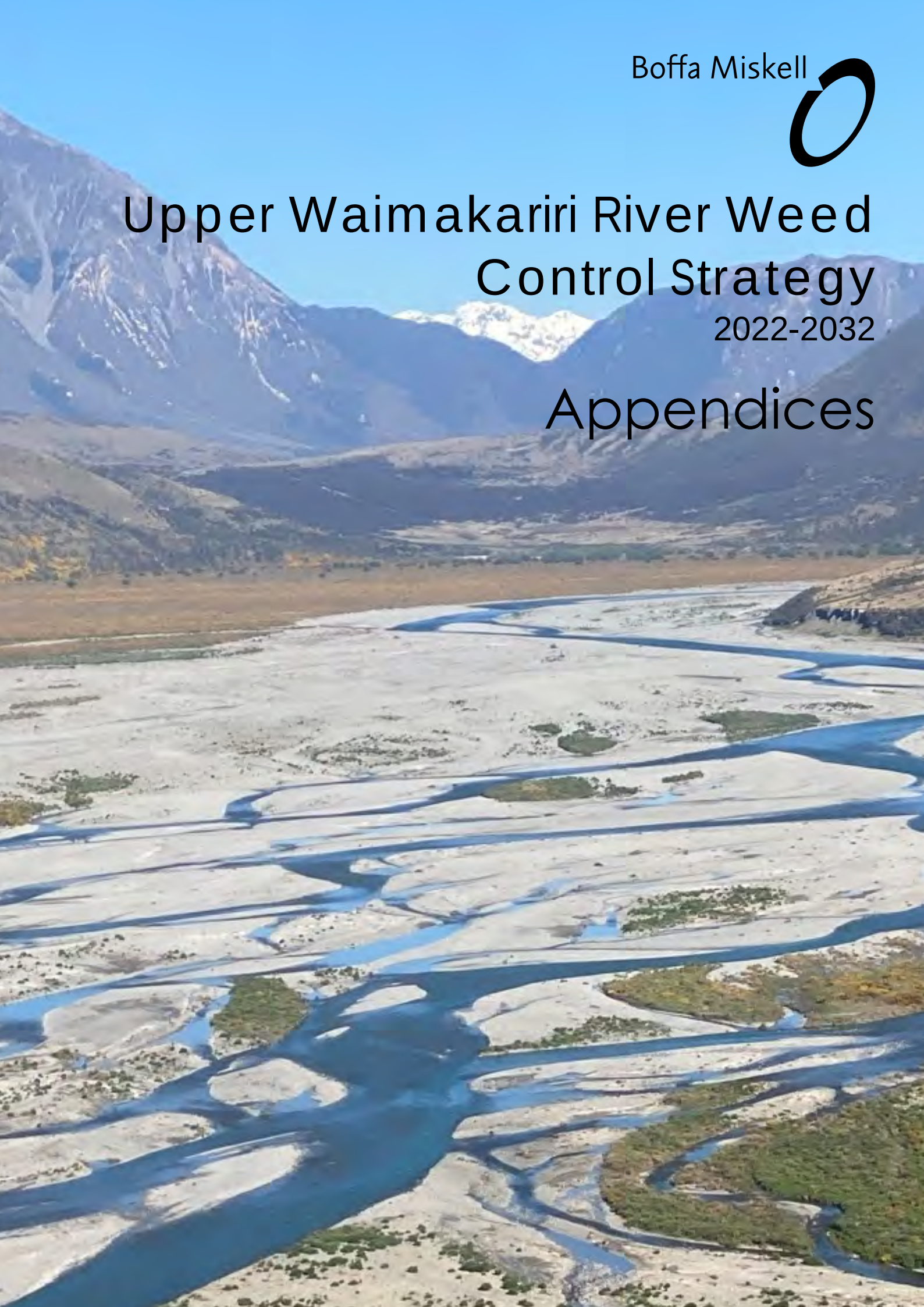
Boffa Miskell

Upper Waimakariri River Weed Control Strategy

2022-2032

Appendices



Appendix 1: Weed Abundance Profile Comparisons

Appendix 1: Weed Abundance Profile Comparisons

Abundance profiles used within this Strategy were modified based on those used in the Rakaia and Rangitata Rivers.

Weed Abundance

Comparison of scales used in this and prior reports.

Rakaia (Harding 2018)		**Rangitata** (Boffa Miskell 2019)		**Waimakariri** (this study)			
Categories (mapped as polygons)	**Individuals (mapped as points)**	**Categories (mapped as polygons)**	**Individuals (mapped as points)**	**Categories (mapped as polygons)**	**Individuals (mapped as points)**	**Notes**	**Meaning**
Not Recorded	N/A	N/A	N/A	N/A	N/A	-	
Dominant	N/A	Dominant	N/A	Dominant	N/A	-	e.g. >50% coverage
Abundant		Abundant		Abundant		(includes 'Common')	Large patches commonly found, weed forms prominent cover
Common		Common					
Frequent		Frequent		Frequent		(includes 'Occasional')	Small patches commonly found, or some consistent cover - but other species are much more prominent in terms of cover
Occasional		Occasional					
Scarce		Scarce		Scarce		-	Individual plants or isolated small patches scattered across area
N/A	Live	N/A	1	Very Scarce	1	-	Individuals so scarce they can practically be mapped where found
			2 to 5		2 to 5	-	
			6+		6+	-	
	Dead		Historic		Historic	Previously controlled dead plant	
	Treated		N/A		N/A		

Appendix 2: Field Survey Protocols

Field Survey Protocols

1.0 Introduction

This document outlines how we will conduct weed and ecological surveys as part of the Upper Waimakariri Basin Weed Strategy project.

It has been prepared for:

- Boffa Miskell staff;
- Subcontractors; and
- Volunteers.

The data collection tools and survey methods for these different groups are slightly different, but the purpose of the survey is the same: to obtain information that will enable the development of a weed strategy for the Upper Waimakariri catchment. This information includes:

- The locations, extents, and density of problem ecological weeds (these species are discussed in Section 3.1 below) in each sub-catchment of the river; and
- The locations, extents, and key ecological values of the habitats within which those weeds occur, especially distinct / important habitat types or locations of At Risk / Threatened flora and fauna species (defined in Section 4.1 below). This includes areas adjacent to weed locations that may be at risk due to spread of those weeds.

2.0 Geographic Scope

You will be assigned a catchment area to survey, and the survey extent should be discussed at this time.

Work is to be completed on areas within / adjacent to the river, rail and Craigieburn Road corridors within the ECan Upper Waimakariri Operational Area in the first instance (including main tributary rivers). This means that:

The geographical scope of this work is:

- The riverbed and the landscape immediately adjacent, not the surrounding hill country;
- The midland rail corridor from the Broken River Viaduct to Greyneys Shelter and the landscape immediately adjacent, not the surrounding hill country; and
- The Craigieburn Road and the landscape immediately adjacent, not the surrounding hill country.

The key river corridors within the Upper Waimakariri Operational Area that are the focus of the study include:

- Upper Waimakariri River (headwaters to bottom of gorge) and the main stems of the:
- Bealey River;

- Hawdon River;
- Poulter River;
- Cox River;
- Esk River;
- Broken River;
- Porter River; and the
- Cass River.

Practically, this means your survey (unless of a road or rail corridor) should focus on **riverbeds, including the floodplain, and adjacent wetland and low terrace habitats**. Landowner permission has been sought from all adjacent landowners, so unless otherwise informed you are able to assume that you have access to investigate weeds / areas across fences, etc., should this be necessary. Please exercise usual courtesy and leave gates as you find them.

3.0 Weed Species

3.1 Main Species

There are a million weed species to choose from, but at this stage, we think the main species to focus on (and the ones built into our data collection tools) for this survey are:

Alder	**French (Montpellier) Broom**	**Russell Lupin**
Blackberry	**Gorse**	**Scotch Broom**
Buddleia	**Grey Willow**	**Silver Birch**
Cotoneaster (all species)	**Hawthorn**	**Silver Poplar**
Crack Willow	**Poplar**	**Spanish Heath**
Elder	**Prunus spp. (all species)**	**Sycamore**
False Tamarisk	**Rowan**	**Yellow Tree Lupin**

Please note, **wilding conifers are not the focus of this survey** and are being dealt with separately.

3.2 What If I See Something Else?

All data collection tools will have an '**Other'** category where you can note other species.

This survey provides an important opportunity to identify emerging issues. We absolutely want you to **exercise your discretion** and note the presence / extent of any other plant species you think is or could be spreading, altering habitat, and displacing important indigenous species. Your knowledge and judgement in this matter is appreciated and will be a critical part of the success of this survey.

4.0 Ecological Values

One of the key outcomes of this work is an improved understanding of the way in which weeds in the Upper Waimakariri are currently affecting the special ecological values of this area. However, many special habitats or strongholds for rare species may not be spatially mapped, and one of the purposes of this work is to obtain new information about ecological values.

As you know, weed species can invade and alter habitat, and / or displace particularly sensitive indigenous species. Apart from pasture weeds that can affect farms and livelihoods (etc.), protection of ecological values is the key reason to undertake pest surveillance and control.

Of course, future weed control efforts will need to balance the risk of weed spread against the risk of secondary effects to native species (especially from control methods using aerial herbicide), and against the relative priority of protection of that indigenous species / habitat. This means that **during the survey, we need you to keep in mind the habitat 'backdrop' at the location of weeds** you may observe. This could be the immediate area ('this lupin is in a great cushionfield!;), or considering adjacent areas ('this grey willow in the riverbed could get into that wetland over there'). On the flipside, if a weed is in an area of highly modified or exotic-dominated landscape, we want to know that too.

4.1 I Like the Look of That! OR: That Area is Trashed!

Where you come across a habitat or species you like the look of (intact indigenous vegetation, At Risk / Threatened species, naturally uncommon habitat type e.g., wetlands), then please:

- Record its GPS location (waypoint) (see also Section 5.2);
- Take photos (especially if you are unsure about what you're seeing)
- Record the key species / traits (the things that made you take note of it); and
- Make notes regarding the relative risk (in your mind) that any weeds pose to those values.

And, on the flipside, make similar notes if weeds occur against a highly modified ecological backdrop. In these places, weed control may therefore be of lower priority and resources could be freed up to deal with issues elsewhere.

This information is as important as the locations of weeds!

4.2 Examples of Ecological Values

As described above, there is a focus on areas of relatively intact indigenous vegetation, the locations of At Risk / Threatened species, and naturally uncommon habitat types.

Examples of important habitat types **include**:

Boulderfield, cushionfield, forest, indigenous grassland / tussockland, indigenous shrubland, riverbed, and wetlands.

Examples of rare (At Risk / Threatened) species you may encounter **include** (courtesy of DOC Bioweb data – by no means exhaustive or recently ground-truthed):

Upper Waimakariri main stem: *Helichrysum dimorphum*, *Carmichaelia kirkii*, *Coprosma wallii* (Poulter Confluence, Smugglers Cove, Staircase Creek [also Turkey Flat]), *Luzula celata* – Whale Hill wetted areas, C*armichaelia uniflora*, *Myosotis uniflora*

Poulter River: *Helichrysum dimorphum*, *Carmichaelia kirkii*, *Coprosma wallii*, *Olearia lineata* (McArthur Gorge), *Raoulia* spp. (Broad stream – Poulter confluence)

Cox River: *Isolepis basilaris,* Turf cress (*Cardamine* sp.), *Pittosporum patulum*, *Veronica armstrongii* (Flora Terraces – stronghold, 1 of 2 sites)

Esk River: *Helichrysum dimorphum*, *Carmichaelia kirkii*

Broken River: *Helichrysum dimorphum*, *Cardamine magnifica* (stronghold on private land), *Lepidium solandri*, *Myosotis traversii* (extinct? Last known location), *Veronica cuppressoides*, *Myosotis colensoi*, *Pachycladon cheesemanii*, *Chenopodium detestans*, *Coprosma wallii*, *Carmichaelia kirkii*,

Porter River: *Helichrysum dimorphum*, *Lepidium solandri*, *Veronica cuppressoides*, *Myosotis colenso*i,

Cass River: *Coprosma intertexta*

Feel free to look these species up and become familiar with them – if you aren't already. Of course, this is what is known already – keep an eye out for anything new!

Figure 1. Outstanding and intact *Raoulia* spp. cushionfield in the upper Waimakariri near Turkey Flat – just upstream of (and potentially at risk from) a Russell lupin infestation.

5.0 Survey Methods and Data Capture

5.1 Survey Methods

Strap on the gaiters and jump on Shank's pony – it's time for a walk. We can't tell you how to do this but suggest that a fine mix of scanning with binoculars from high points, checking each side of the river, and getting down and dirty in the scrub / wetland / forest / river gravels is the way to go. Dense infestations will of course be obvious, but for the scarce weeds, special care should be paid to areas of disturbance such as fresh slips / bank slumping, 4WD tracks, areas where stock congregate, and around structures – these areas are likely focal points for new weeds. Keep safe with wasps and river crossings, both of which can get a lot worse very quickly!

Think about efficiency and make notes about unknowns in the distance you can't get to – we would rather get back there with a drone / helicopter later than have you lose hours of blood, sweat and tears to find out a single grey willow over yonder is really a harmless ribbonwood.

5.2 Data Capture

5.2.1 BML Staff – Collector

BML staff will capture weed data using the ArcGIS Collector app. Weed data will be captured as points (a spot record for individual weeds) and as polygons (areas of weeds whether scattered or dense). You must download the offline map before leaving cell / wifi cover!

5.2.1.1 Weed Areas

Weed abundance (polygons) is to be recorded, by weed species, as follows:

Abundance	Commentary
Dominant	**e.g. >50% coverage**
Abundant	**Large patches commonly found, weed forms prominent cover**
Frequent	**Small patches commonly found, or some consistent cover - but other species are much more prominent in terms of cover**
Scarce	**Individual plants or isolated small patches scattered across area**
Very Scarce	**Individuals so scarce they can practically be mapped where found**

5.2.1.2 Weed Points

'Very Scarce' weeds may additionally / alternatively be captured as point data, where each point corresponds to 1, 2-5, 6+ plants, or an 'historic' point – i.e., a previously treated dead weed. If you are freshly treating a weed on site during the survey, the point data collection tool should record control method as follows:

Cut and paste glyphosate / picloram

Cut only

Hand pulled

Other

5.2.1.3 Ecological Value Areas

Ecological values data is to be captured similarly to weeds (i.e. polygon or point data). Ecological values polygons are recorded as follows:

Habitat Type

Boulderfield

Cushionfield

Forest

Indigenous Grassland / Tussockland

Indigenous Shrubland

Riverbed

Wetland

Other

Habitat type information should be further described using a free-text description field, and supported with photos.

5.2.1.4 Ecological Values Points

Ecological values points are recorded as:

Feature Type

Habitat

Plant Species

Fauna Species

Other

Feature type information should also include detailed notes about what has been seen, along with photos. Take plenty of photos of unknown species you think could be interesting.

5.2.2 Subcontractors – Collector / GPS

Subcontractors can either capture data **using the Collector app** as above (you will need to co-opt a Boffa account), **or by old-fashioned GPS and notebook**, as you prefer. Subcontractors are less likely to use the LINZ app as this is aimed at recording weed point data only.

If recording data manually, data must be captured by recording GPS waypoints and making detailed notes so that the above information can be mapped and uploaded down the line. Recording a start point and walking the boundary of the feature is a good option if an area is small and 'tracking' on your GPS is turned on. Later on, this can easily be turned into a polygon. **We will need the raw waypoints and tracking files (.gpx) data from your GPS.**

It is important that your notes capture all the above information points, so that data consistency can be maintained. Ecological values data should likewise be captured based on GPS locations and notes as above.

5.2.3 Volunteers – LINZ App / GPS

5.2.3.1 Weed Data

Volunteers can collect weed data using an app developed by LINZ, or (by prior agreement please) by old-fashioned GPS and notebook . This uses the ArcGIS tool QuickCapture and is easy to use. It records point data (single weed or multi-weed points). **Jenny Ladley has prepared PDF instructions on how to record weeds using the LINZ app.**

5.2.3.2 Ecological Values Data

Ecological values can be captured by **GPS (see also: Section 4.0) or georeferenced photos (with your smartphone)** along with notes such as:

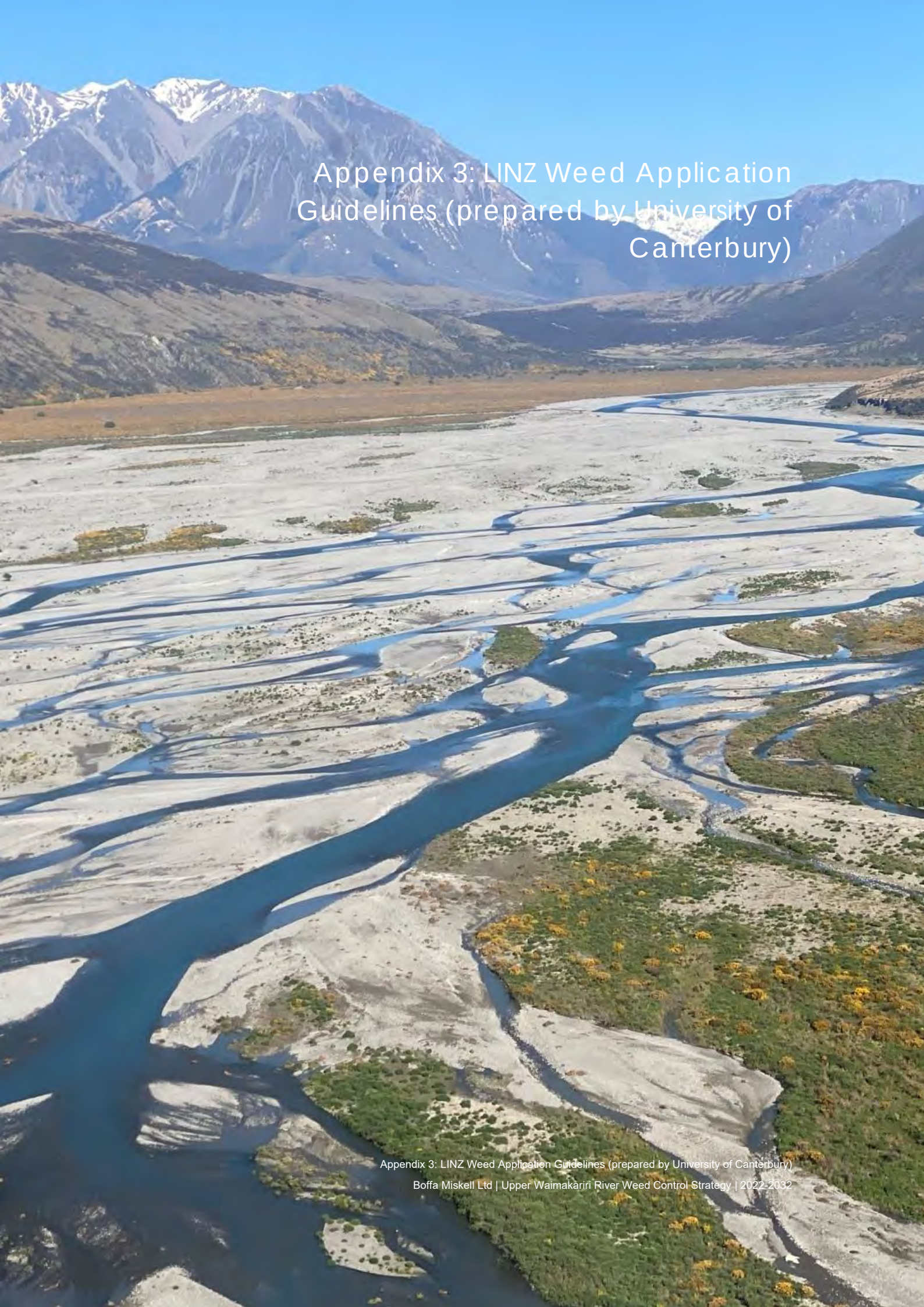
Habitat type (boulderfield, cushionfield, forest, indigenous grassland / tussockland, indigenous shrubland, riverbed, wetland, other)

Feature type (habitat, plant species, fauna species).

6.0 Concluding Note

Thank you for your assistance with this work. Input from a range of stakeholders and the ability to cross reference the knowledge and survey data from everyone in the field will be a key measure of success of this project. If you have any questions about anything you've read, please contact Sian Reynolds or Jaz Morris to discuss. Thanks again!

Figure 2. Very scarce-density Russell lupin invading the upper Waimakariri riverbed near Turkey Flat. This plant is establishing in an otherwise largely intact riverbed habitat with bare gravel / sand areas, At Risk native plant species and breeding habitat for indigenous bird species. Unfortunately, there is a large upstream seed source at Turkey Flat.



Appendix 3: LINZ Weed Application Guidelines (prepared by University of Canterbury)

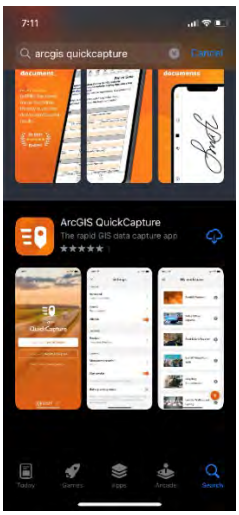
Upper Waimakariri Weed Survey App. 2022

This is for anyone that wants to help with the weed survey in the Upper Waimakariri area over the summer of 2021/2022. Particularly along the roading corridor as it is not part of the weed survey that Boffa Miskell is conducting.

What happens to the data? All the data is added to the LINZ mapping/data layers and will be used as part of the Survey information for Upper Waimakariri Weed Strategy Plan and for future resurvey information etc.

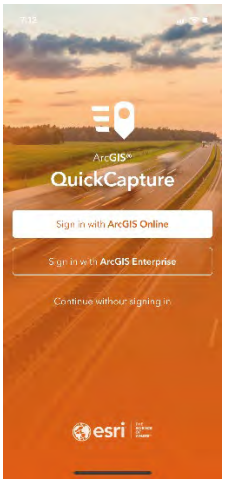
Step 1 – install the App: the App is called ArcGIS Quick capture (most people call it Quick Capture).

It's free to download.



2. Once you've downloaded the App it will open to the initial page:

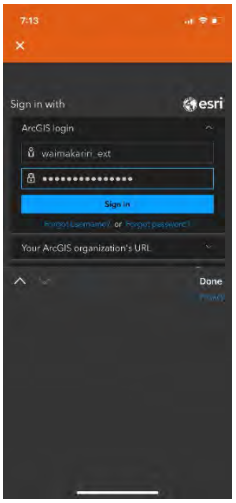
Do option 1 = Sign in with 'ArcGIS Online'



It will then ask you to sign in:

Username: waimakariri_ext

Password: Waimakariri2022



You'll then go to the 'My workspace' page:

There are two things to do in the My workspace page:

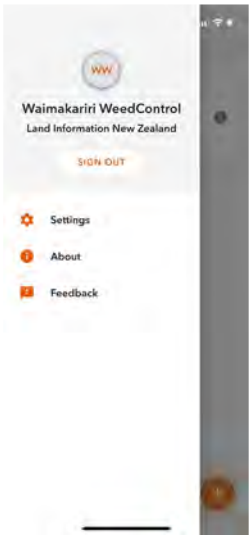
Batter y life on your phone: Changing the settings so you extend the phone battery life:

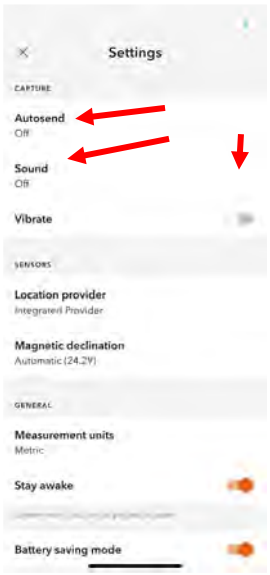
While in the 'my workspace' page.

Tap the WW button (top left).

This will get you to 'Settings':

Under Settings <u>turn off</u> the three options under 'Capture' (red arrows):





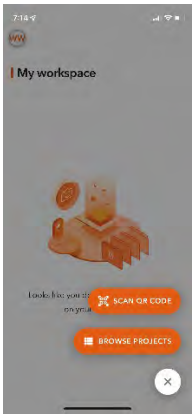
You will only need to do this once

Close 'settings' and you'll go back to the 'My workspace' page

Part two of the 'My workspace' page:

Finding/installing the Upper Waimakariri Weed project:

Tap the + button (bottom right of the screen)



Tap the ‘Browse projects’ option

You then will need to download the Upper Waimakariri Surveillance App (this will take a moment or two)

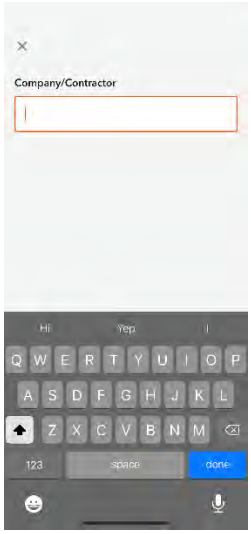
Once downloadeded open/tap on the Upper Waimakariri Surveillance App

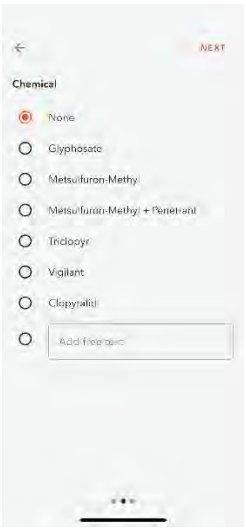
Your will be taken through three pages:

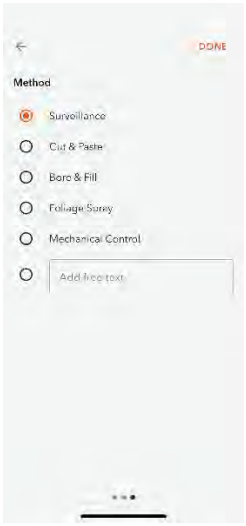
Company/contractor – please use your name – it will remember your name for future sessions

Chemical: ‘None’

Method: ‘Surveillence’



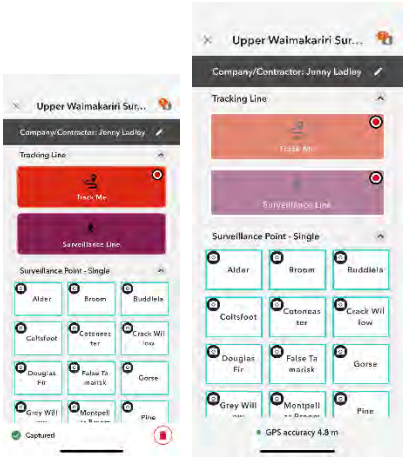




then tap the 'Done' button (top right corner).

You'll now be in the working/recording part of the App

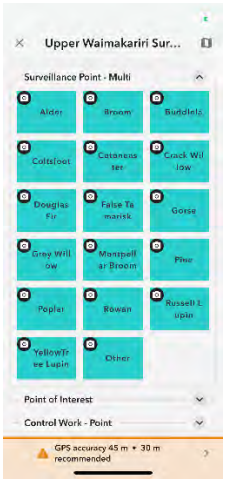
1. Track me – turn this on when you get to the start of your survey session. It means that we can build an accurate database for all the areas surveyed (and not surveyed).
2. Surveillance line – this can be used for an area/line of weeds that is spread out (not just a sinple point) eg the willows along Craigieburn stream from the bottom of Craigieburn cutting to the Flock hill station entrance. You do a line and record a 'multi' point for willows in the middle of the line.
3. Surveillance point – single or Multi (scroll down to see the 'multi' options)
   This is where you record the 1 or many plants of the weed, it will allow you to take a photo as well. There is a 20 second option to delete the record when you initally save the record (comes up as a message along the bottom of the screen).



This is what the app looks like with both the Track Me and Surveillance line (only in second image) turned on (they fade in and out as well as the red botton showing)

Other options – at the bottom of the page (under the surveilienc buttons)

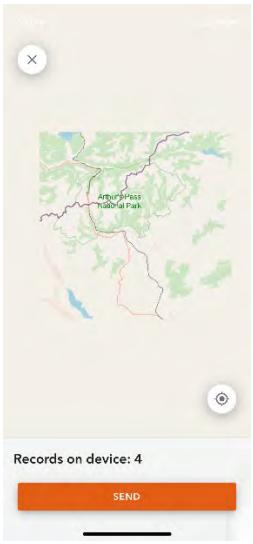
1. Point of interest: this allows your to record something you not sure about/ of interest write a note and take a photo.
2. Control Work – point: this is where you can record small amount of weed control work (you can also change the original settings for weed control rather than 'surveliience' if your undetaking weed control for the session.



FINAL PART - IMPORTANT

Once you've finished for the day you need to <u>manually upload your data</u> (as you've turned off the auto upload in settings).

In the top right of the screen is a flag/map image it will have an orange dot with a number in it – this is all your data records waiting to be uploaded.



In this example I have 4 records on the phone that need to be uploaded. Tap the map/flag and the tap SEND and the info will be automatticaly added to the LINZ mapping database.

Which is another point – while using the App you can tap the flag/map and access map of the area too.

Appendix 4: Maps

Appendix 4: Maps

Boffa Miskell online Upper Waimakariri Weed Map – has ability to filter on individual weed species (among other variables).

For the following maps, data is displayed via the following:

Points:

Points are displayed on the map through a range of sizes that relate to:

- Small – 1 plant
- Medium – 2-5 plants
- Large – 6+ plants

Polygons:

Polygons are displayed on the map via their abundance profiles:

- Dominant: >50% coverage;
- Abundant: Large patches commonly found, weed forms prominent cover;
- Frequent: Small patches commonly found, or some consistent cover – but other species are much more prominent in terms of cover;
- Scarce: Individual plants or isolated small patches scattered across the area; and
- Very Scarce: Individuals so scarce they can practically be mapped where found.

Boffa Miskell

www.boffamiskell.co.nz

0 1.8 km

1:75,000 @ A3

Data Sources:
ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Crow, Weed Distribution
Gorse

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

Project Manager: sian.reynolds@boffamiskell.co.nz | Drawn: BMc

Map 1

Boffa Miskell

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0 2.6 km

1:105,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Bealey-Hawdon, Weed Distribution
Gorse

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

Project Manager: sian.reynolds@boffamiskell.co.nz | Drawn: BMc

Map 2

Bealey-Hawdon

Pearson

Craigieburn

Gorge

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 4 km

1:160,000 @ A3

Data Sources:
ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Poulter-Esk, Weed Distribution
Gorse

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

Project Manager: sian.reynolds@boffamiskell.co.nz | Drawn: BMc

Map 3

Bealey-Hawdon

Poulter-Esk

Craigieburn

Gorge

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 2.4 km

1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Pearson, Weed Distribution
Gorse

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

Project Manager: sian.reynolds@boffamiskell.co.nz | Drawn: BMc

Map 4

Boffa Miskell

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0 1.8 km

1:75,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

Eagle Technology, Land Information New Zealand

WAIMAKARIRI WEED STRATEGY

Craigieburn, Weed Distribution
Gorse

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

Project Manager: sian.reynolds@boffamiskell.co.nz | Drawn: BMc

Map 5

Boffa Miskell

www.boffamiskell.co.nz

0 2.4 km

1:100,000 @ A3

Data Sources:
ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Gorge, Weed Distribution
Gorse

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

Project Manager: sian.reynolds@boffamiskell.co.nz | Drawn: BMc

Map 6

Boffa Miskell

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0 1.8 km

1:75,000 @ A3

Data Sources:
ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Crow, Weed Distribution
Russell lupin / Yellow tree lupin

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

Project Manager: sian.reynolds@boffamiskell.co.nz | Drawn: BMc

Map 1

Poulter-Esk

Crow

Pearson

Craigieburn

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 2.6 km

1:105,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Bealey-Hawdon, Weed Distribution
Russell lupin / Yellow tree lupin

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

Project Manager: sian.reynolds@boffamiskell.co.nz | Drawn: BMc

Map 2

Bealey-Hawdon

Pearson

Craigieburn

Gorge

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 4 km

1:160,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Poulter-Esk, Weed Distribution Russell lupin / Yellow tree lupin

Date: 01 June 2022 | Revision: 0

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Map 3

Bealey-Hawdon

Poulter-Esk

Craigieburn

Gorge

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 2.4 km

1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Pearson, Weed Distribution

Russell lupin / Yellow tree lupin

Date: 01 June 2022 | Revision: 0

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Map 4

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0 1.8 km

1:75,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Craigieburn, Weed Distribution
Russell lupin / Yellow tree lupin

Date: 01 June 2022 | Revision: 0

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Map 5

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0 2.4 km

1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Gorge, Weed Distribution

Russell lupin / Yellow tree lupin

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

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Map 6

Other - Group 1
- Apple
- Bindweed
- Blackberry
- California Poppy
- Cotoneaster
- Currant
- Gooseberry
- Hawthorn
- Holly
- Marram Grass
- Mint
- Poplar sp.
- Prunus sp.
- Rowan
- Silver Poplar
- Stonecrop
- Sweet Briar
- Wild Cherry

Bealey-Hawdon

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 1.8 km

1:75,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Crow, Weed Distribution
Other – Group 1

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

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Map 1

Other - Group 1
- Apple
- Bindweed
- Blackberry
- California Poppy
- Cotoneaster
- Currant
- Gooseberry
- Hawthorn
- Holly
- Marram Grass
- Mint
- Poplar sp.
- Prunus sp.
- Rowan
- Silver Poplar
- Stonecrop
- Sweet Briar
- Wild Cherry

Boffa Miskell

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0 2.6 km

1:105,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Bealey-Hawdon, Weed Distribution
Other – Group 1

Date: 01 June 2022 | Revision: 0

Plan prepared for ECan by Boffa Miskell Limited

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Map 2

Other - Group 1
- Apple
- Bindweed
- Blackberry
- California Poppy
- Cotoneaster
- Currant
- Gooseberry
- Hawthorn
- Holly
- Marram Grass
- Mint
- Poplar sp.
- Prunus sp.
- Rowan
- Silver Poplar
- Stonecrop
- Sweet Briar
- Wild Cherry

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 4 km

1:160,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Poulter-Esk, Weed Distribution
Other – Group 1

Date: 01 June 2022 | Revision: 0

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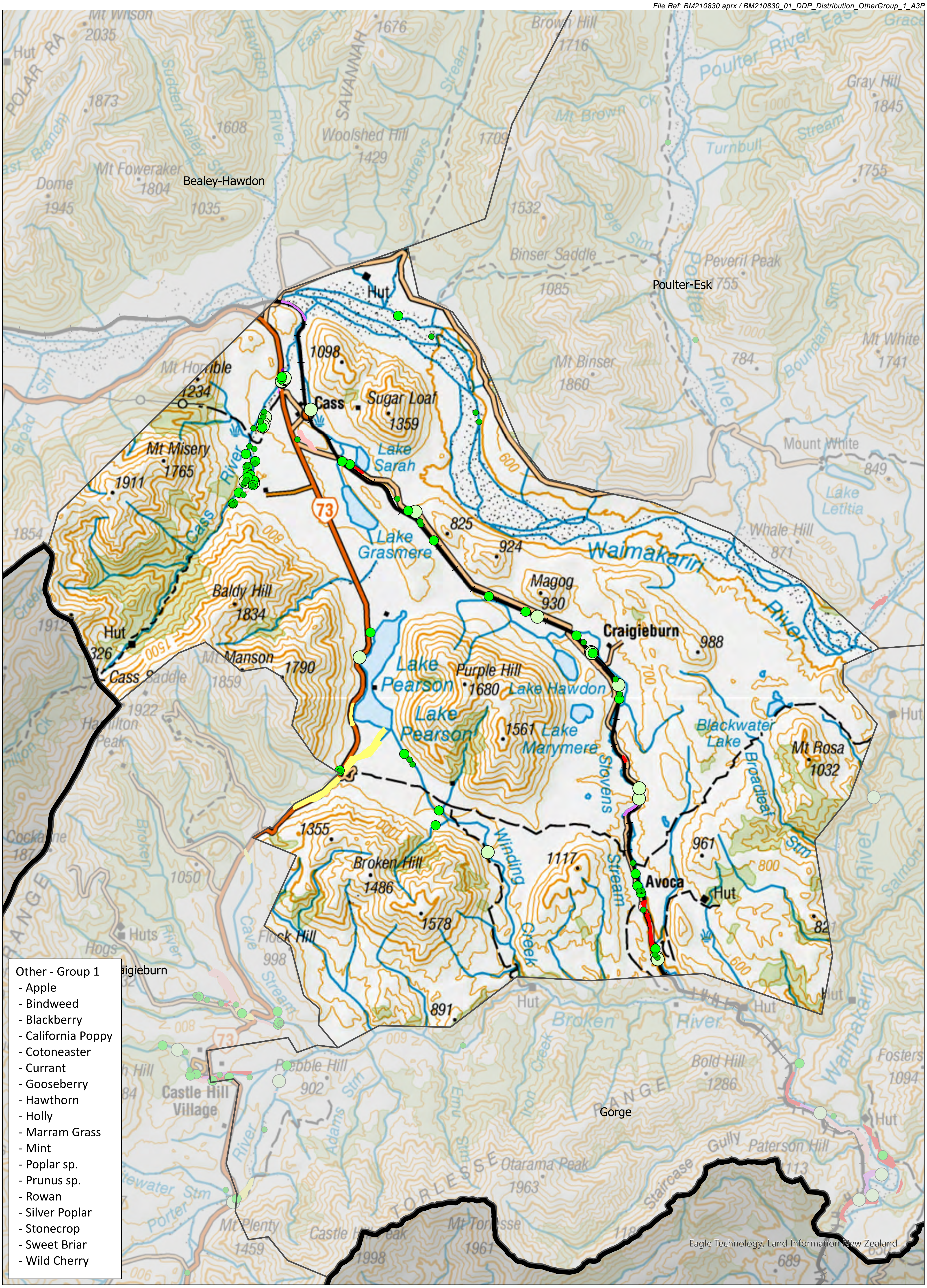
Map 3

File Ref: BM210830.aprx / BM210830_01_DDP_Distribution_OtherGroup_1_A3P



Bealey-Hawdon
Poulter-Esk
Gorge
aigieburn
Cass
Craigieburn
Avoca
Castle Hill Village
Lake Sarah
Lake Grasmere
Lake Pearson
Lake Hawdon
Lake Marymere
Blackwater Lake
Lake Letitia
Waimakariri River
Poulter River
Cass River
Broken River
Winding Creek
Slovens Stream
Broadleaf Stm
Sugar Loaf 1359
Mt Misery 1765
Baldy Hill 1834
Purple Hill 1680
Broken Hill 1486
Mt Binser 1860
Magog 930
Mt Rosa 1032
Mt Horrible 1234
Mt Manson 1859
Peveril Peak 1755
Binser Saddle 1085
Cass Saddle
Mount White
Whale Hill 871
Bold Hill 1286
Paterson Hill
Otarama Peak 1963
Mt Torlesse 1961
Mt Plenty 1459
Pebble Hill 902
Flock Hill 998
TORLESSE RANGE
Hut
73
Other - Group 1
- Apple
- Bindweed
- Blackberry
- California Poppy
- Cotoneaster
- Currant
- Gooseberry
- Hawthorn
- Holly
- Marram Grass
- Mint
- Poplar sp.
- Prunus sp.
- Rowan
- Silver Poplar
- Stonecrop
- Sweet Briar
- Wild Cherry
Eagle Technology, Land Information New Zealand

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0 2.4 km
1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY
Pearson, Weed Distribution
Other – Group 1
Date: 01 June 2022 | Revision: 0
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Map 4

Other - Group 1
- Apple
- Bindweed
- Blackberry
- California Poppy
- Cotoneaster
- Currant
- Gooseberry
- Hawthorn
- Holly
- Marram Grass
- Mint
- Poplar sp.
- Prunus sp.
- Rowan
- Silver Poplar
- Stonecrop
- Sweet Briar
- Wild Cherry

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0 1.8 km

1:75,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Craigieburn, Weed Distribution
Other – Group 1

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Map 5

Eagle Technology, Land Information New Zealand

Other - Group 1
- Apple
- Bindweed
- Blackberry
- California Poppy
- Cotoneaster
- Currant
- Gooseberry
- Hawthorn
- Holly
- Marram Grass
- Mint
- Poplar sp.
- Prunus sp.
- Rowan
- Silver Poplar
- Stonecrop
- Sweet Briar
- Wild Cherry

Eagle Technology, Land Information New Zealand

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0 2.4 km
1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY
Gorge, Weed Distribution
Other – Group 1
Date: 01 June 2022 | Revision: 0
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Map 6

Other - Group 2
- Barberry
- Buddleia
- False Tamarisk
- Himalayan Honeysuckle
- Old Man's Beard
- Spanish Heath
- Sycamore

Bealey-Hawdon

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 1.8 km

1:75,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Crow, Weed Distribution
Other – Group 2

Date: 01 June 2022 | Revision: 0

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Map 1

Other - Group 2
- Barberry
- Buddleia
- False Tamarisk
- Himalayan Honeysuckle
- Old Man's Beard
- Spanish Heath
- Sycamore

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 2.6 km

1:105,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Bealey-Hawdon, Weed Distribution
Other – Group 2

Date: 01 June 2022 | Revision: 0

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Map 2

Other - Group 2
- Barberry
- Buddleia
- False Tamarisk
- Himalayan Honeysuckle
- Old Man's Beard
- Spanish Heath
- Sycamore

Boffa Miskell

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0 4 km

1:160,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Poulter-Esk, Weed Distribution
Other – Group 2

Date: 01 June 2022 | Revision: 0

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Map 3

Bealey-Hawdon

Poulter-Esk

Craigieburn

Gorge

Other - Group 2
- Barberry
- Buddleia
- False Tamarisk
- Himalayan Honeysuckle
- Old Man's Beard
- Spanish Heath
- Sycamore

Boffa Miskell

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0 2.4 km

1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Pearson, Weed Distribution
Other – Group 2

Date: 01 June 2022 | Revision: 0

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Map 4

Other - Group 2
- Barberry
- Buddleia
- False Tamarisk
- Himalayan Honeysuckle
- Old Man's Beard
- Spanish Heath
- Sycamore

Boffa Miskell

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0 1.8 km

1:75,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Craigieburn, Weed Distribution
Other – Group 2

Date: 01 June 2022 | Revision: 0

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Map 5

Other - Group 2
- Barberry
- Buddleia
- False Tamarisk
- Himalayan Honeysuckle
- Old Man's Beard
- Spanish Heath
- Sycamore

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0 2.4 km
1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Gorge, Weed Distribution
Other – Group 2

Date: 01 June 2022 | Revision: 0

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Map 6

Boffa Miskell

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0 1.8 km

1:75,000 @ A3

Data Sources:
ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Crow, Weed Distribution
Scotch Broom

Date: 01 June 2022 | Revision: 0

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Map 1

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0 2.6 km

1:105,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Bealey-Hawdon, Weed Distribution Scotch Broom

Date: 01 June 2022 | Revision: 0

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Map 2

Eagle Technology, Land Information New Zealand

Bealey-Hawdon

Pearson

Craigieburn

Gorge

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 4 km

1:160,000 @ A3

Data Sources:
ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Poulter-Esk, Weed Distribution Scotch Broom

Date: 01 June 2022 | Revision: 0

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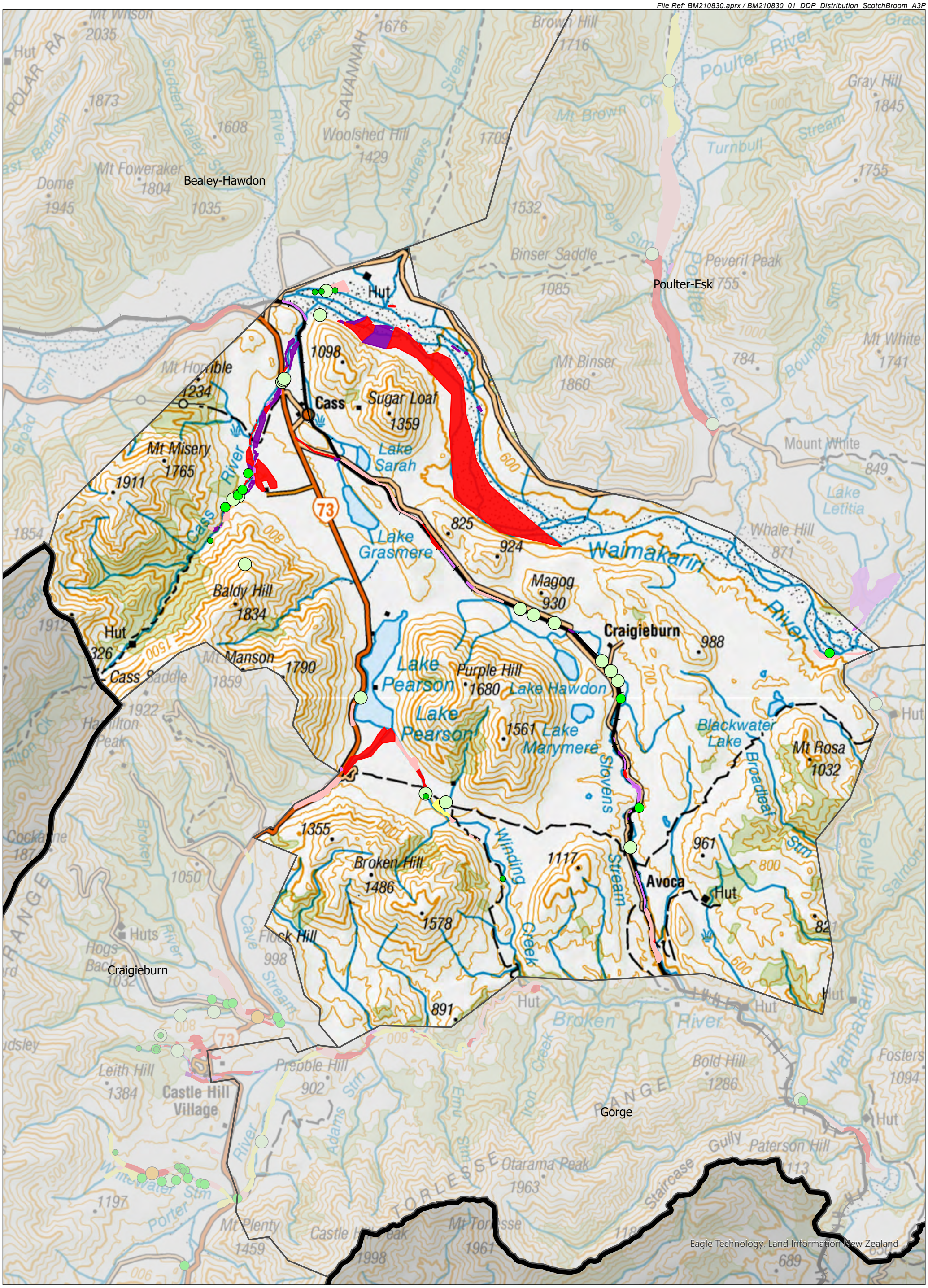
Map 3

File Ref: BM210830.aprx / BM210830_01_DDP_Distribution_ScotchBroom_A3P



Boffa Miskell

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0 2.4 km

1:100,000 @ A3

Data Sources:
ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Pearson, Weed Distribution
Scotch Broom

Date: 01 June 2022 | Revision: 0

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Map 4

Boffa Miskell

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0 1.8 km

1:75,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Craigieburn, Weed Distribution
Scotch Broom

Date: 01 June 2022 | Revision: 0

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Map 5

Boffa Miskell

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0 2.4 km

1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Gorge, Weed Distribution
Scotch Broom

Date: 01 June 2022 | Revision: 0

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Map 6

Boffa Miskell

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0 1.8 km

1:75,000 @ A3

Data Sources:
ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Crow, Weed Distribution
Willows, Alders and Silver Birch

Date: 01 June 2022 | Revision: 0

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Map 1

Boffa Miskell

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0 2.6 km

1:105,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Bealey-Hawdon, Weed Distribution Willows, Alders and Silver Birch

Date: 01 June 2022 | Revision: 0

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Map 2

Eagle Technology, Land Information New Zealand

Bealey-Hawdon

Pearson

Craigieburn

Gorge

Eagle Technology, Land Information New Zealand

Boffa Miskell

www.boffamiskell.co.nz

0 4 km

1:160,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Poulter-Esk, Weed Distribution
Willows, Alders and Silver Birch

Date: 01 June 2022 | Revision: 0

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Map 3

Bealey-Hawdon

Poulter-Esk

Craigieburn

Gorge

Eagle Technology, Land Information New Zealand

Boffa Miskell

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0 2.4 km

1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Pearson, Weed Distribution
Willows, Alders and Silver Birch

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Plan prepared for ECan by Boffa Miskell Limited

Project Manager: sian.reynolds@boffamiskell.co.nz | Drawn: BMc

Map 4

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0 1.8 km

1:75,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

Eagle Technology, Land Information New Zealand

WAIMAKARIRI WEED STRATEGY

Craigieburn, Weed Distribution
Willows, Alders and Silver Birch

Date: 01 June 2022 | Revision: 0

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Map 5

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0 2.4 km

1:100,000 @ A3

Data Sources: ECan, LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Located Plants
- 1
- 2 to 5
- 6+
- Historic
- Management Area

Abundance
- Dominant
- Abundant
- Frequent
- Scarce
- Very Scarce

WAIMAKARIRI WEED STRATEGY

Gorge, Weed Distribution
Willows, Alders and Silver Birch

Date: 01 June 2022 | Revision: 0

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Map 6

Appendix 5: Additional Landscape and Biodiversity Photos

Appendix 5: Additional Landscape and Biodiversity Photos

For an extensive range of pictures from all surveys, please follow this link to the online map showcasing photo points across the Operational Area (see: site photos): Upper Waimakariri Weed Map.

The following photos show examples of notable ecological features or species within each Management Area.

Figure A1: Stable riverbed area of cushionfield and mossfield in the Upper Waimakariri River near Turkey Flat (Crow Management Area).

*Figure A2: Dwarf broom (*Carmichaelia uniflora*, At Risk – Naturally Uncommon) in stable riverbed area near Turkey Flat (Crow Management Area).*

Figure A3: River flats with scattered mountain beech treelands, grasslands, and wetlands along spring channels (Bealey-Hawdon Management Area)

Figure A4: One Tree Swamp wetland near the Hawdon confluence (Bealey-Hawdon Management Area)

Figure A5: 'Hebe Island' Armstrong's whipcord hebe (Threatened – Nationally Critical) site at the Mounds of Misery (Poulter-Esk Management Area)

Figure A6: Large bog rush and pūrei swamp / marsh wetland, with extensive grey scrub east of Little Flora on a terrace near the Esk River (Poulter-Esk Management Area)

Figure A7: Matagouri, korokio and Coprosma intertexta *(At Risk – Declining) near a large wetland in Winding Creek (Pearson Management Area)*

Figure A8: Bog rush wetland with scattered harakeke and grasslands the Cass River (Pearson Management Area)

Figure A9: Limestone gorge in Broken River below the Cave Stream emergence (Craigieburn Management Area)

Figure A10: Matagouri and hard tussock shrubland in the limestone area of Flock Hill (Craigieburn Management Area)

Figure A11: Pittosporum anomalum *(locally uncommon) in grey scrub in Broken River (Gorge Management Area)*

Figure A12: Diverse riverside beech and mixed broadleaf forest in the Waimakariri Gorge (Gorge Management Area)

Appendix 6: Additional Weed Photos

For an extensive range of pictures from all surveys, please follow this link to the online map showcasing photo points across the Operational Area (see: site photos): Upper Waimakariri Weed Map.

The following photos show weed infestations within each Management Area.

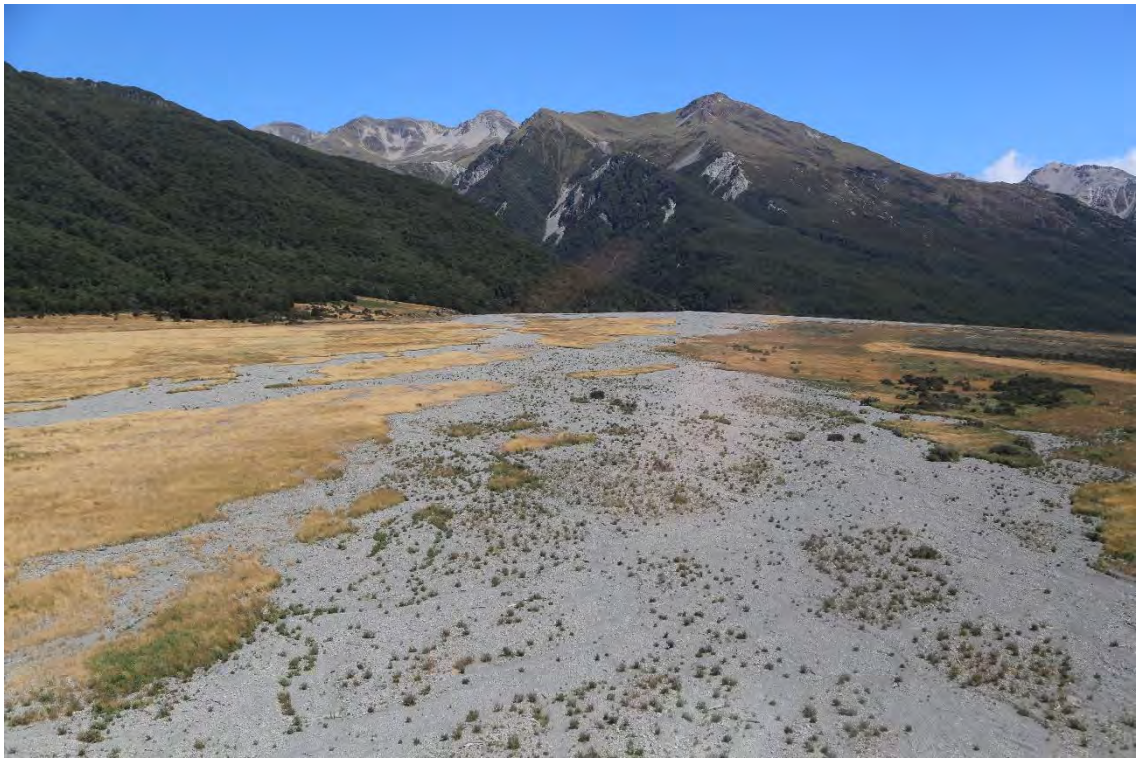

Figure A13: Russell lupin in gravels at Turkey Flat (Crow Management Area).

Figure A14: Russell lupin at Turkey Flat. Some plants in the foreground sprayed and dead (Crow Management Area).

Figure A15: Russell lupin infestation in the Waimakariri River bed, below Bealey Hotel (Bealey-Hawdon Management Area).

Figure A16: Gorse patch among indigenous shrubland and beech patches near the Cox River (Poulter-Esk Management Area).

Figure A17: Grey willow controlled in the Poulter River above Casey Stream (Poulter-Esk Management Area).

Figure A18: Gorse and scotch broom infestation on true right of Waimakariri River terrace along Cass Hill and Sugarloaf, downstream of the Cass River confluence (Pearson Management Area).

Figure A19: Kiwirail Midland line, near the Craigieburn Road. Scotch broom infestation either side of rail, with crack willow infestation near wetland adjacent to railway (Pearson Management Area).

Figure A20: Holly infestation on Romulus Hill (near Grasmere Station), along the Cass River (Pearson Management Area).

Figure A21: Alder infestation on scree slope above Porter River (Craigieburn Management Area).

Figure A22: Weed surveyor controlling broom on terrace above Whitewater Stream (Craigieburn Management Area).

Figure A23: False tamarisk in Broken River, upstream of SH73 (Craigieburn Management Area).

Figure A24: Russell lupin on edge of Waimakariri River (Gorge Management Area).

Figure A25: Wild cherry in lower Waimakariri Gorge at southern end of Operational Area (Gorge Management Area).

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

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