The Manuherekia Exemplar catchment: Thomson's Creek Galaxias management plan

Galaxias anomalus – Central Otago roundhead galaxias, adult and juvenile, Thomson's Creek.

Abstract

The Minister for the Environment announced that the Manuherekia River was going to be included into Explemar catchment programme. The initial project was to focus on the Thomson's Creek catchment; with the focus on wetland development and galaxiid enhancement. This report defines the issues confronting the galaxiid population and provides management opportunities to enhance the remaining subpopulations.

Thomson's Creek is sourced from the Dunstan Mountains and flow in easterly direction and enters the Manuherekia River, near the township of Omakau. Thomson's Creek was considered to hold a healthy population of the threatened Central Otago roundhead galaxias. However much of the data was old (>5yrs) and therefore was considerable to unreliable.

A fish survey was conducted by several key stakeholders to obtain up to date understanding of the distribution galaxias. The design of the survey was to inform the following management objectives:

- Maintain the existing distribution of the galaxiids in Thomson's Creek.

- If possible, improve the health and extent of the population by undertaking fencing, revegetation, and willow removal
- Ensure the continued exclusion of undesirable fish species
- Where appropriate conduct removal of undesirable fish species.

Introduction and/or background

Otago is home to the most diverse freshwater fish community in New Zealand. This diversity is primarily due to a suite of non-migratory galaxiids. This group of galaxiids can be split into two distinct body- shape categories. Firstly, the *Galaxias vulgaris* species complex is comprised of ten lineages, (and counting), these are cigar-shaped fish. The second group is known as 'pencil-shaped' galaxiids, of which there are two species in Otago. Many of New Zealand freshwater fish undertake some form of migration, some fish move to the and from the sea and others move in and out of lakes. Non-migratory galaxiids as the name suggests do not migrate from the waterway from where they were hatched. Therefore, these galaxiids spawn; live in the same section of water, for their entire lifecycle, many moving as little as 75 metres from where they were hatched.

There is limited knowledge on the life-history strategies for all of these galaxiids. However, what is known means they can be split into two distinct groups. Firstly, **'**fast' life history in that they can tolerate bed disturbance, are highly fecund, sexually mature younger and smaller, high level of recruitment, faster growing, and have excellent dispersal mechanisms. The second group have 'slow' life history, they tend to be located in small stable streams, have low fecundity but produce larger eggs and larvae, poor recruitment, slower growing, longer lived (Tagging data suggests that the dusky galaxias could live 20+yrs).They tend to have poor dispersal, so the mechanisms of connectivity necessary to support a meta-population dynamic are absent. Hence, they are more likely to form more isolated and fragmented population structures (Jones 2014). Once lost from a reach of a waterway they are unlikely to recolonise even though the species may still persist higher in the catchment**.**

Many of these species have restricted geographical distributions and some are confined to a single catchment. These distributional limitations coupled with on-going threats from land use change (both agricultural and forestry effects), water demands, predation and competition from introduced fish invasions and general lack of conservation management have collectively increased the conservation concerns for the non-migratory galaxiids in Otago.

This concern has increased to point where now all of Otago non-migratory galaxiids are threatened with extinction. The loss or partial loss of populations continues unabated and without some form of management intervention it is probable that extinctions will occur.

Survey methods:

To inform this plan, surveys were undertaken collaboratively by Department of Conservation (DOC), Otago Fish and Game (OTFG), Water Resource Management (WRM), Water Ways Consulting (WWCL), Ministry for Environment (MfE), Creekside Consulting (CC) and Otago Regional Council (ORC).

Surveys were completed 25th – 27th January 2021 by four teams of two or more people. Survey methods varied and included electric fishing (Kainga EFM300), spotlighting, trapping with Gee's minnow traps and visual observations. Fish were identified to species and either length measured to the nearest millimetre or visually assessed. Data collected will be submitted to NIWA's freshwater fish database (NZFFD).

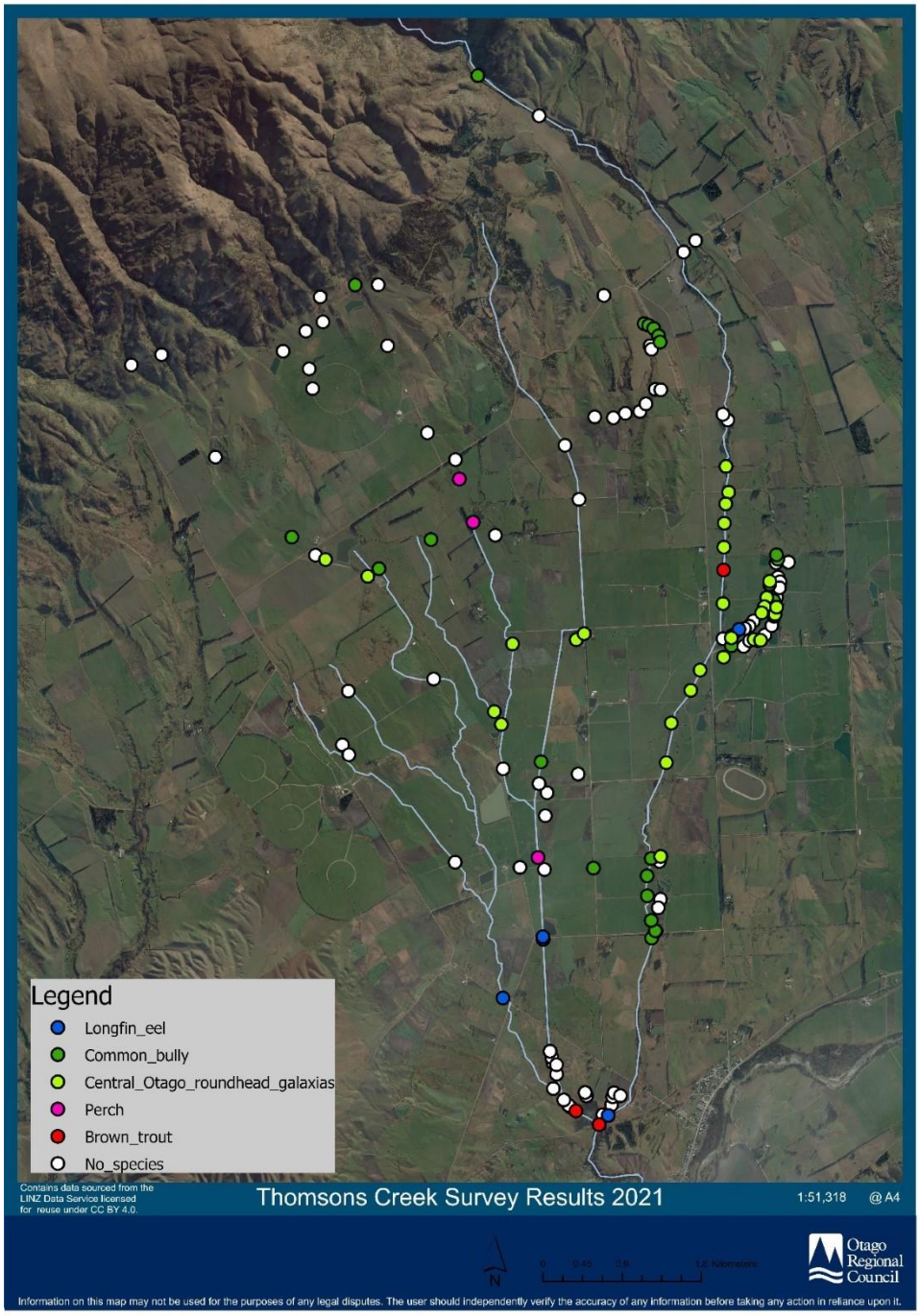

Figure 1. Surveyed sites within Thomson's Creek catchment – January 2021. Waterways highlighted for effect using supplied shapefiles. N.B. Overlapping data points (where more than one species was found at one site) not shown clearly. Yellow lines represent additional longitudinal surveys that found trout, eels and galaxias.

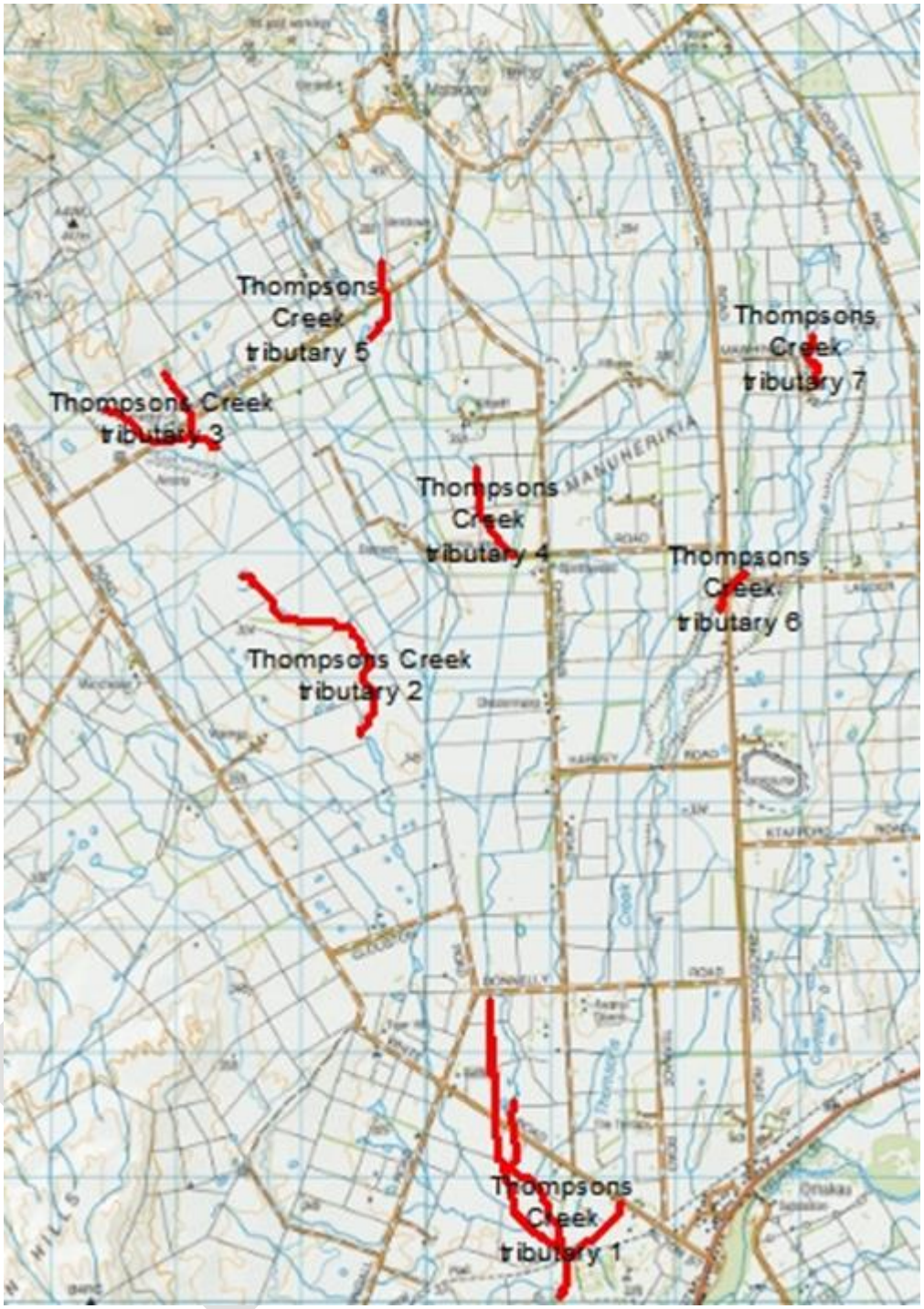

Figure 2. DOC subpopulation fragments in Thomson's Creek based on NZFFD data prior to 2021. These are constrained by REC waterway segments and informed by the best guesses of Nicholas Dunn and Daniel Jack. We have utilised DOC subpopulation nomenclature to enhance cross-agency consistency. N.B. Fragment titles (sic) supplied by DOC.

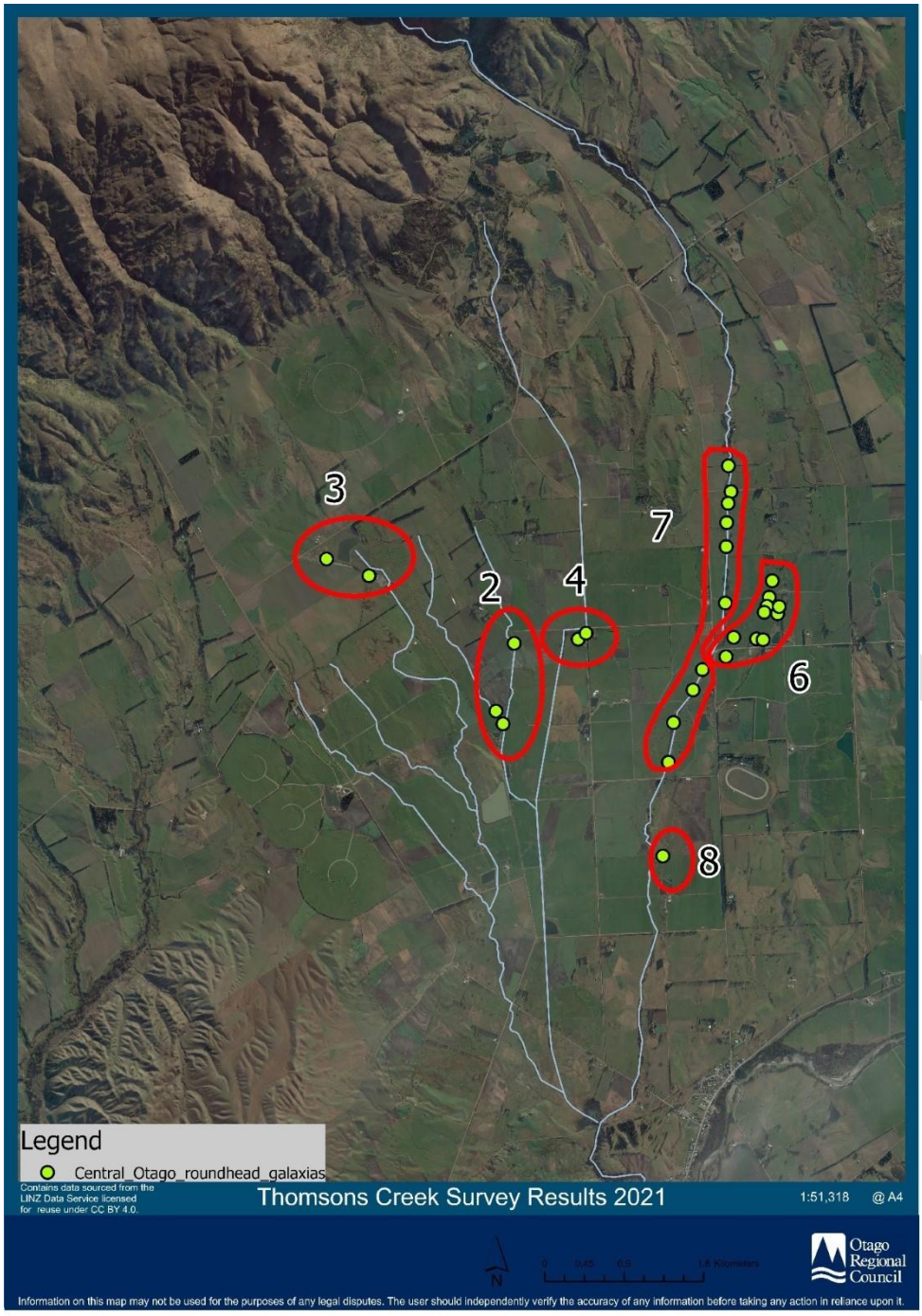

Figure 3. Observations of Galaxias anomalus in Thomson's Creek (green) assigned to subpopulations aligned with DOC subpopulations.

Subpopulation 2: Morgan's

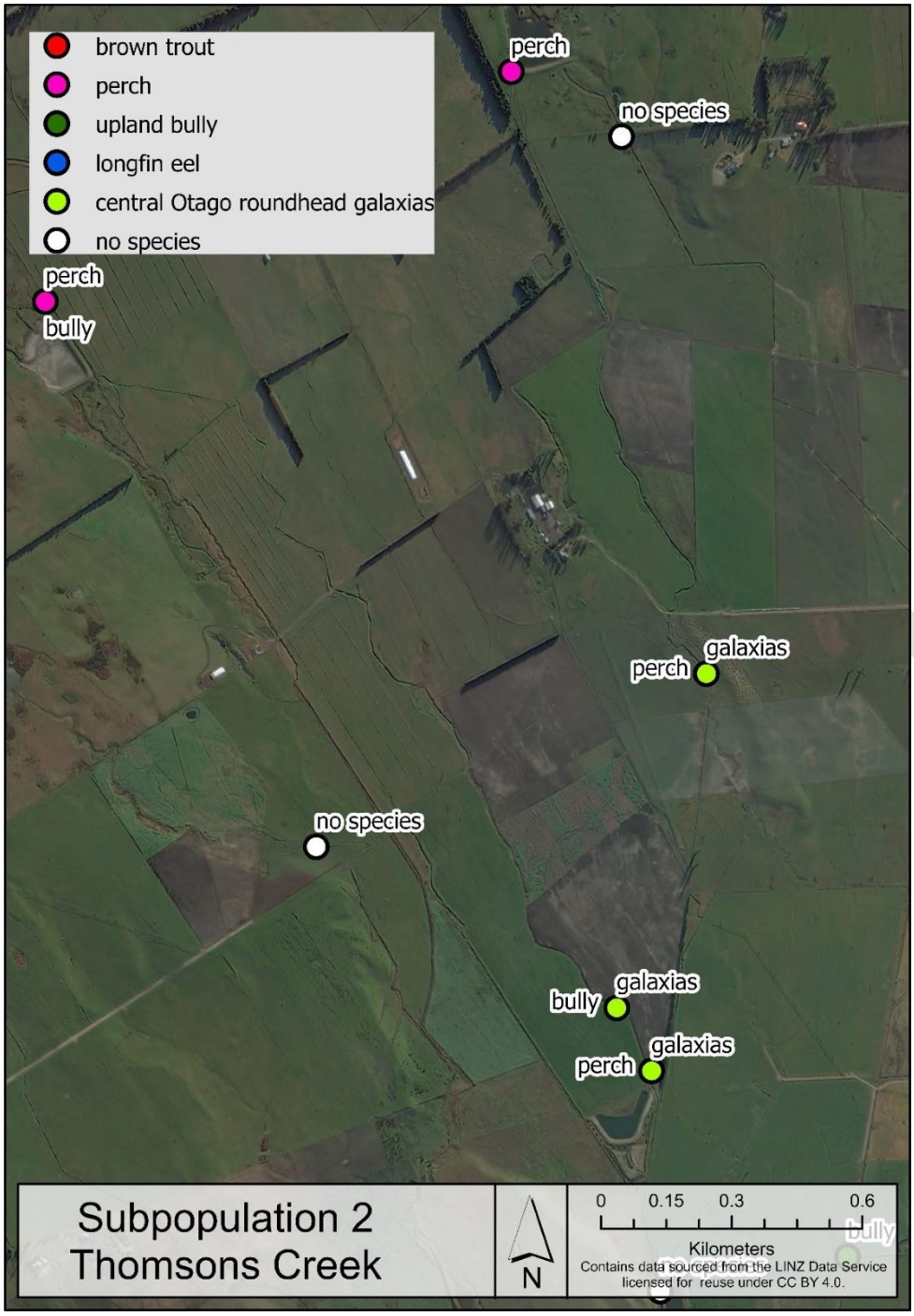

Figure 4. Subpopulation 2 – Thomson's Creek. N.B. Overlapping species indicated by two or more labels for the same data point.

Subpopulation 2 is confined to the sluice channel, and at best could be described as a marginal population. Two juvenile Central Otago roundhead galaxias (<60mm) were captured, these two fish were 150metres apart and both were associated with exposed bed gravels.

In general, the bed was smothered in varying depths of sediment; the exposed gravel bed was associated where there was an increase in water velocity, which was sufficient to shift sediment. One of the gravel areas was immediately downstream of the flume that measuring the water take.

Figure 5 Proposed fence line boundaries and culvert locations

Suggested management recommendations

The farmer Mr Richard Morgan mentioned that the sluice channel dries periodically during the summer period. Based on these observations this suggests that this may not be permanent habitat and the presence of the galaxiid is purely dependent on them finding some form of refugia.

If any management actions were to proceed with this population, the creation of refuge habitat needs to be considered.

Management Actions

- Erect a fence - estimated total 4 km (2km x both sides)

- Install culverts to increase water velocity, and thereby shift sediment.
    - Location 1329827/5005167 & 1330039/5004803
    - At the downstream aperture of the culvert, create a pool with a depth of .500mm. Place cobble sized rock particles.

- Plant overhanging vegetation

- Undertake a survey for perch in the dam and connecting water races. Objective of the survey is to assess whether perch removal is feasible. Est. Cost 2k

General comments made during the survey

Two <60mm galaxiids were observed over a 400-metre reach of the sluice channel. In addition, three perch <70mm were also caught, the perch were caught from the same pool.

Richard Morgan stated that the upper reach of the sluice channel went dry most years

A layer of sediment covered what appeared to be solid substrate. The only exposed gravels were at the outlet of the water measuring flume.

Elliot stated that they were planning to fence off the sluice channel.

Recommended management actions:
Of the populations Pete observed this population would be the lowest priority when considering management actions.

To consider in future work there would be a need to understand where the galaxiids were being sourced from.

Need to understand where the perch are coming from within the catchment, and decision will need to be made whether the removal of the perch needs to happen. Perch have potential to undermine any attempts to enhance this galaxiid population.

Management actions – install culverts (to increase water velocity and to shift fine sediment).

- Place cobble sized rocks in the bed immediately downstream of the culvert.
- Plant discrete pockets of tussock in the same location, these will provide some cover.

Subpopulation 3: Naylor/Morgan's

Figure 6. Subpopulation 3 – Thomson's Creek. N.B. Overlapping species indicated by two or more labels for the same data point.

The population occupies the old Chandler Creek bed and of the smaller population fragments found during the Thomson's Creek survey this is the best, in terms of galaxiid densities. The water for the spring appears to be partially sourced from seepage from the upstream dam.

Figure 7 Proposed fence line boundaries and culvert location

Management Actions

- Erect a fence - estimated distance 1.2km

- Establish plantings – Area 1.2ha. Once tussocks and carex plants have become established consider willow removal.

- Install an overhanging culvert – location 1328505/5006587. Careful consideration on the exact location of the culvert is required, if the culvert is to far down the spring there is potential for the bottom pond water levels to back fill and inundate the outlet of the culvert. Discussion with the landowner should be sufficient to gauge the dam levels.

- Undertake a survey for perch in the dams and connecting water races and Chandler Creek catchment. Objective of the survey is to assess whether perch removal is feasible. Est. Cost 5k

- Scope out the need for the need to secure more permanent water source.

Figure 8 Upstream aspect of spring

General comments made during the survey

- *Probably the best spring population of galaxiids observed, during the survey.*
- *The waterway in parts is the old Chandler Creek bed. In flows between to two irrigation ponds.*
- *Perch occupy both the pond above and below this site, however the top pond does not discharge to this site.*
- *There is no fish passage barrier and therefore what species of fish that is currently occupying the bottom storage pond has unrestricted access. There is an old track culvert that potentially may have historically acted as barrier. However, it wasn't at the time of the survey as the water level of the pond had back filled to point where it had inundated the outlet of the culvert.*
- *The flows in the spring were in parts augmented via a seepage from the top storage dam and the Omakau Area Irrigation Company main race.*

Recommended management actions:

- *Install a barrier – potentially an overhanging culvert. To define the ideal location (to avoid inundation from the storage dam) for the culvert will require speaking with the landowner to obtain an understanding of water levels in the storage pond.*
- *Fence the spring off and revegetate with suitable plants.*
- *Consider the need for willow removal – question in the short term are they currently providing some level of benefit.*
- *Secure long-term water supply, currently the flow is dependent on seepage*

Subpopulation 4: Morgan's

Figure 9 Subpopulation 4 – Thomson's Creek.

Minnow trapping caught six Central Otago roundhead galaxias 73-106mm long.

The population extends over three properties. The upstream end of the stream rises as a spring on the eastern side of Chestermans Road. This area appears to be either un-grazed or not currently grazed. The stream then extends southwards along a roadside drain from the road culvert. The drain also extends to the north a short distance further up Chestermans Road. The stream enters the Elliot(?) property and flows westwards to a large Thomson Creek tributary. The stream on the Elliot property is unfenced and had stock grazing to the stream edge and some stock damage in the stream.

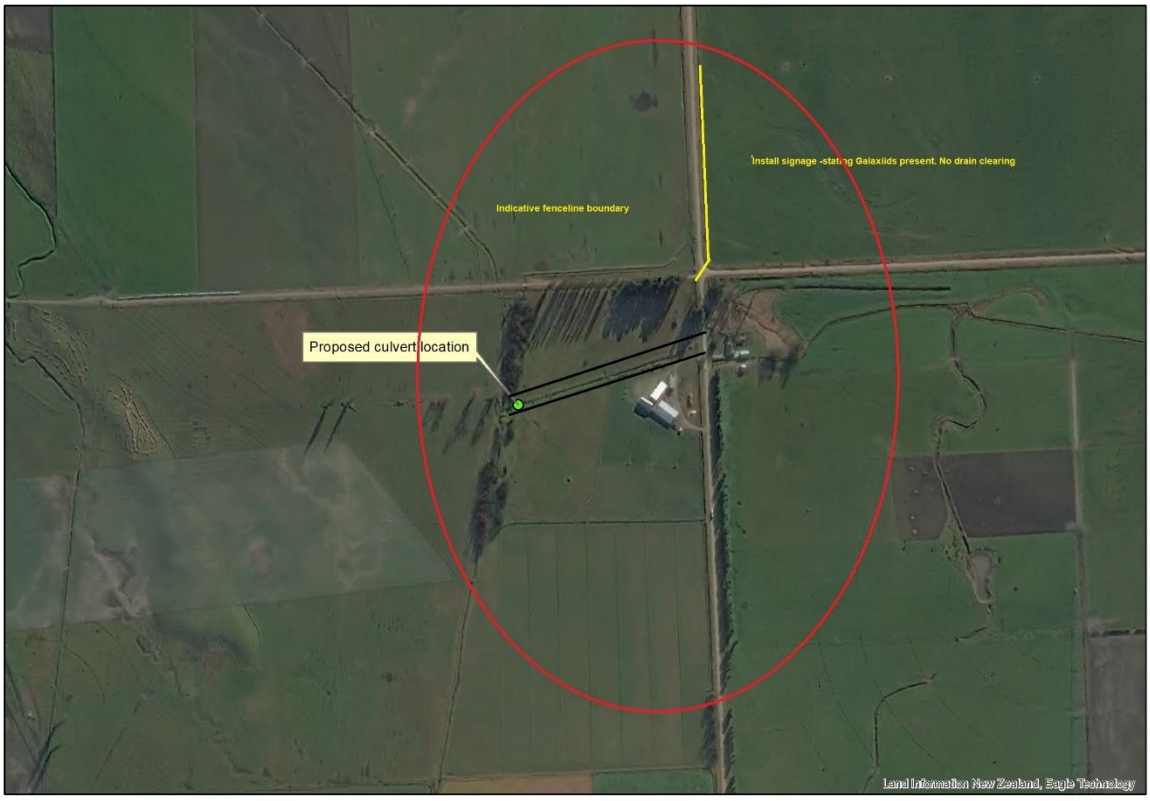

Figure 10 Proposed fence line boundaries and culvert location

Management Actions

- Erect a fence - total estimated distance 0.5km
- Establish plantings – Area 0.5ha. Grasses?
- Install an **overhanging** culvert – location 1330725/ 5005822
- Install signage on the waterway that runs parallel with Chesterman's Road stating the presence of galaxiid- "No Creek Clearing"
- Create a meander in the waterway

- Install sediment trap downstream of culvert location

General comments made during the survey

Currently protected by: Limited or no grazing in the upper section, no grazing in the mid-section along the roadside.
The stock damaged lower reach has no trout spawning habitat and is low quality habitat for trout and this may be preventing trout establishing in this reach. The poor habitat quality may also be limiting perch encroachment into this reach
Issues: Stream rises as a spring and is reliant on the spring to maintain fish habitat. Low flow condition is unknown nor is the water source, whether it is reliant on irrigation or is a natural spring.
Recommended management actions:

- *Create barrier to salmonid and perch invasion of the stream.*
- *Fence lower reach on Elliot property, but only after creating a barrier.*
- *Restrict drain management by Central Otago District Council – no weed spraying and no drain clearance.*
- *Consider a drought water supply to spring head. This would be a piped water supply from a water race or larger stream.*
- *Habitat management options after habitat protection*
- *Riparian planting and subsequently clearance of mud from stream bed*
- *Meander or create more diverse habitat in straight channels*
- *Fence the spring off and revegetate with suitable plants.*
- *Consider a sediment trap downstream of Chestermans Road to capture sediment runoff from the road.*

Figure 11 Lower reach of stream, looking upstream towards Chestermans Road

Subpopulation 6: Hamish Stratford & Wildon Dairy

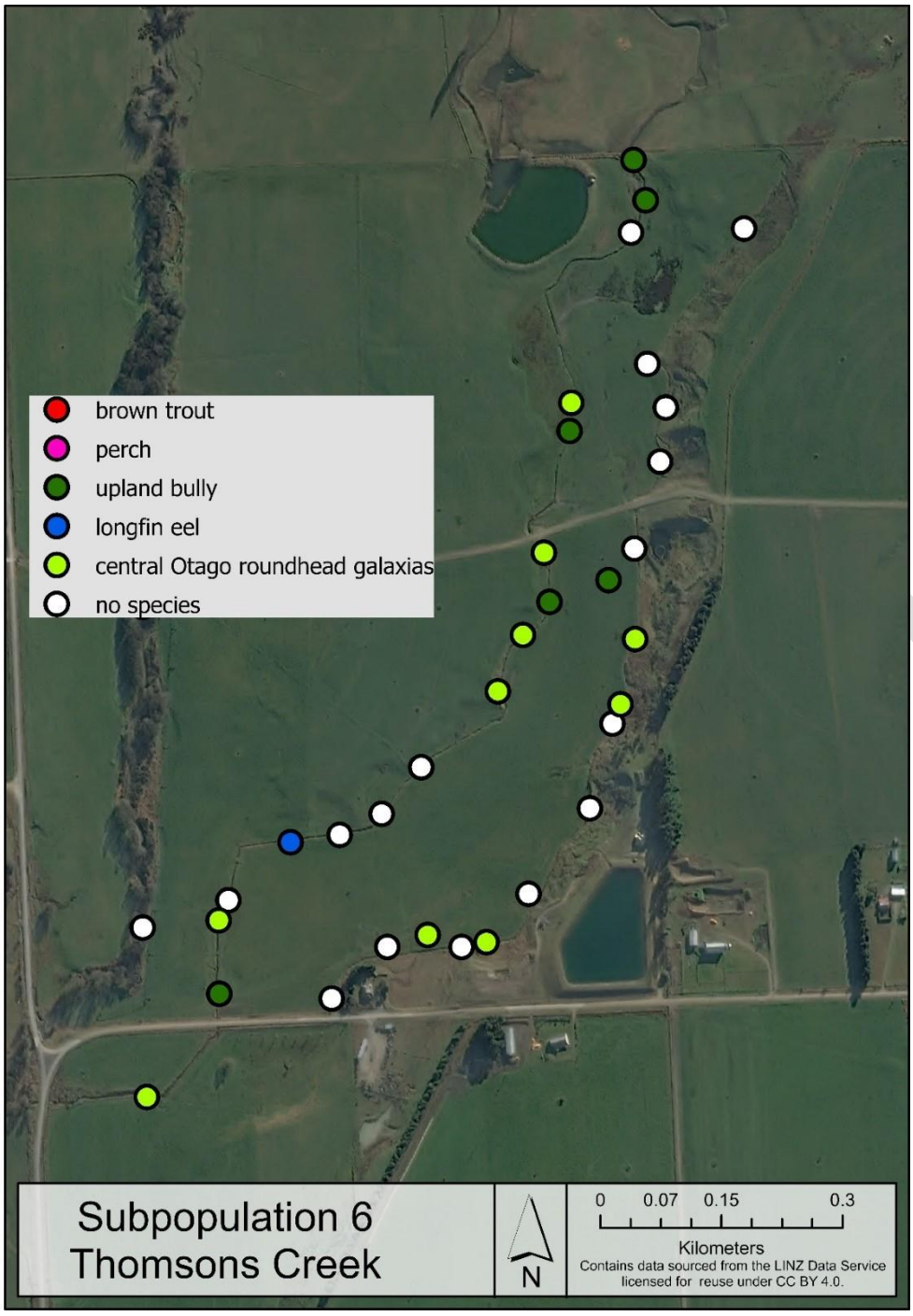

Figure 12 Subpopulation 6

The galaxiid are randomly distributed throughout the spring but appear to be associated with exposed bed gravels. The spring in general is heavily laden with sediment, with the limited exposed gravels. Where there are gravel patches are associated at the bottom of culverts (road or centre pivot). It appears the with the narrowing of the sediment has created and increase water velocity which sufficient to shift sediment from bed.

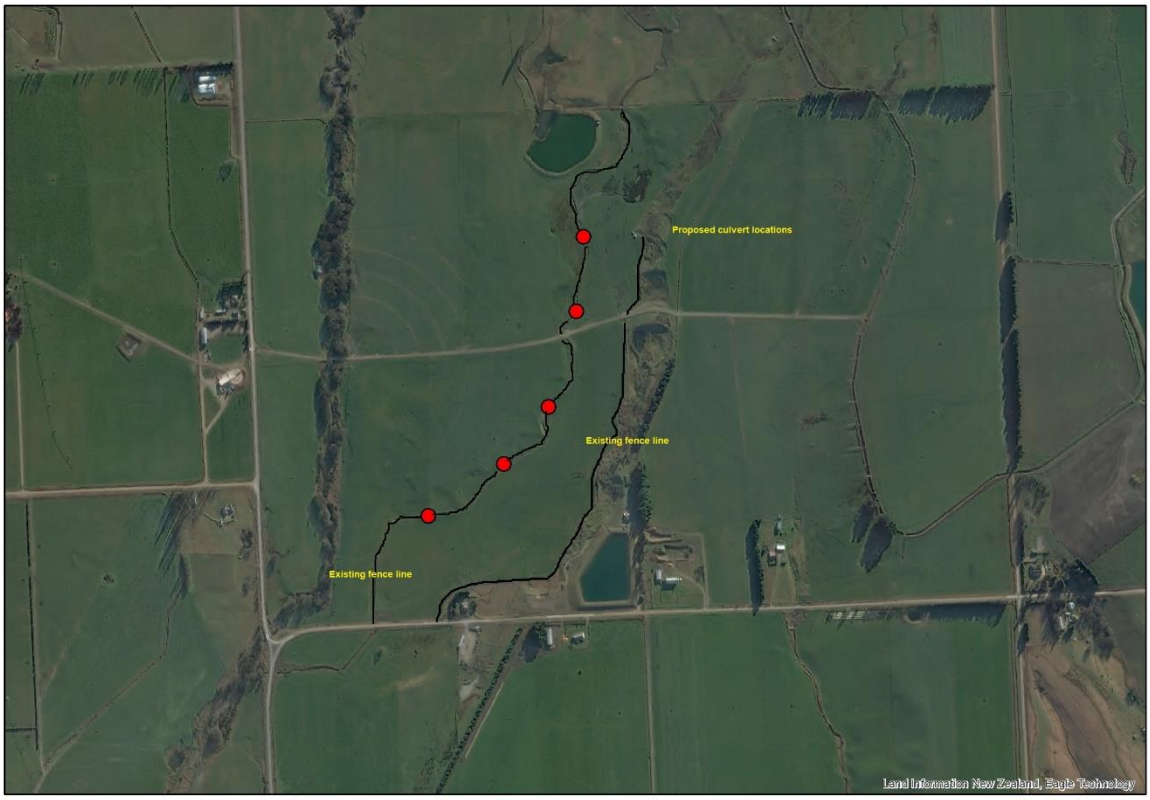

Figure 13 Map indicating fence realignment and culvert locations

Management Actions

- Pull existing fences back to appropriate distance away from the spring margins. Estimated total length of fence effected is 2.2km in the Wildon Dairy property.
- Plant bank margins with suitable plants, Estimated area 2.2ha.
- Install culverts (not over hanging) to increase water velocity, and thereby shift sediment.

  Locations – 1333067/5006568
  - 1333052/5006409
  - 1332999/5006219
  - 1332904/5006098
  - 1332743/5005984

  - At the downstream aperture of the culvert, place cobble sized rock particles.

- Mechanical clearance to cease.
- All spraying of bank vegetation to cease, or at least managed until plants become established.

Note: that salmonids have unrestricted access to this spring, it is proposed that a barrier installed on the main stem of Thomson's Creek. This location is on Williams property (1331708 / 5003089) – Figure15

General comments made during the survey

The total length of the spring is fenced off, these fences in the upper section a perched on the bank, below the road in Hamish's property the fences are set further back from the spring margins

Nova flow drainage was being installed in the upper section with the outlet of the drain being into the spring.

Stream bank vegetation has been sprayed.

No fish passage barrier, salmonids have unrestricted access into the spring.

Galaxiid abundance is relatively low, and randomly distributed throughout the spring. Data suggests that higher densities at the outlet of culverts. Not sure whether this is gravel related or a refugia pools.

Recommended management actions:

- *Cease all mechanical clearing and spraying of stream bank vegetation. In the short and immediate term, we will need to consider the management of the sediment and the potentially the management of weeds and the maintenance of any future plantings. The long-term objective is to prevent sediment from entering the spring.*

- *Pull back the fences from spring margin to a desirable distance that allows for discrete plantings. This will provide for a swath grass between the fence and the spring*

- *Install small lengths of culvert pipe, spaced xxx distance apart. The diameter of the culvert is to be such that there is an increase water velocity moving through the pipe that will shift sediment from the bed immediately d/stream of the aperture. Once the sediment has shifted, place cobble sized particles in the cleared area. Plant tussocks to provide some level of cover at the downstream aperture of the culvert.*

- *The spring is vulnerable to salmonid incursion. Due to the relatively flat nature of the land there is no obvious place to install a fish passage barrier. If, however there is a desire to install a barrier in the main-stem of Thomson's Creek, then the location of this barrier should be downstream of the spring confluence, thereby protecting both the spring and the Thomson's Creek galaxiid populations.*

Subpopulation 7: Thomson's Creek main-stem – Hills, Wildon Dairy, Manson's and William

Figure 14. Subpopulation 7 – Thomson's Creek. N.B. Overlapping species indicated by two or more labels for the same data

Pockets of Central Otago roundhead galaxias were found throughout the mainstem of Thomson's Creek between Mawhinney Road and Harvey Road. The densities of the galaxiids varied but they

appeared to be much higher in the reaches towards Mawhinney Road. The galaxiids disappeared from the reach of water from the Hills/Wilden Dairy property boundary, down to the Wilden Dairy causeway due to willow encroachment. In this section the willows bound the bed, and had formed a more entrenched bed profile, and thereby creating deep 'run-type' habitat, with an increase of water velocities. Galaxiids were also observed through the Manson's property at least down to Harvey Road they may well extended further downstream. The galaxiid through this section were associated with riffle habitat.

Other fish species observed were brown trout, upland bully, and longfin eel. There were good numbers of longfins, with lengths ranging 0.5m - >1m. Their presence was in generally associated with instream debris and undercut banks. Brown trout were located throughout the section with densities varying and more associated with habitat types. Trout were generally not present in very shallow mobile riffle habitat.

Overall, this Thomson's Creek main stem galaxiid population offers the best opportunity for enhancement of the Central Otago roundhead galaxias. Here there is the opportunity to secure and extend the galaxiid distribution over 5-6km reach, whereas the other populations are restricted to short reach lengths springs.

Management Actions

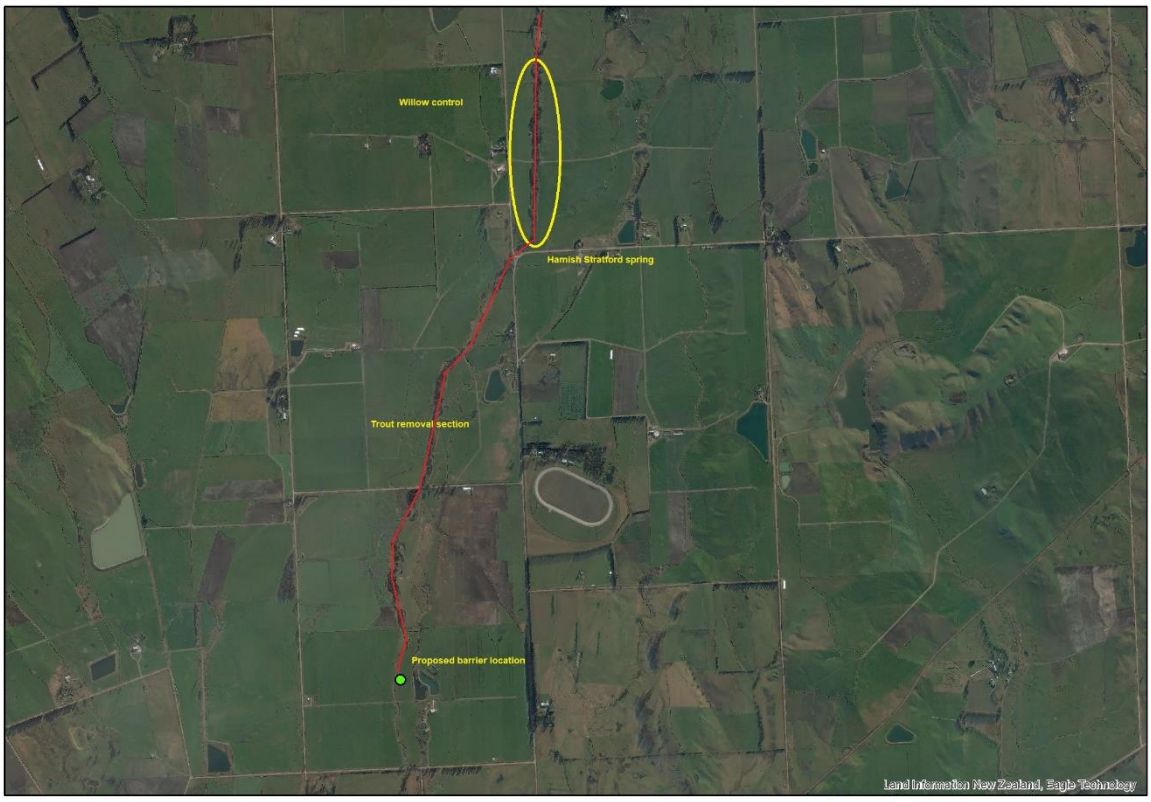

Figure 15 Location map on where management actions need to be conducted

- Install a fish passage barrier, at or near location outlined in Figure 15, (1331708 / 5003089). An indicative design is provided in Figure 16. This barrier will also protect the galaxiids in Hamish Stratford spring (Subpopulation 6).
- If the barrier is installed, then undertake trout removal from Mawhinney Rd downstream to the location of the barrier. It's envisaged that this will require a total of 10days work, over a month.
- Undertake willow control in the reach Hills/Wilden Dairy boundary downstream to Wilden Dairy causeway. Its recommended that the willow control is by basal bark spraying rather aerial, as there will be a need to maintain some willows in this reach to prevent further bank erosion.
- Monitor the extent of the drying reach upstream of Mawhinney, at different flows.

General comments made during the survey

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- *Galaxias densities were most abundant at the top end of the reach where flows start to remerge. Abundance reduced as we surveyed downstream to Mawhinney Road. Galaxias were still common at the site furthest downstream.*
- *Drying reach appears to be providing refugia for galaxias from trout further up the catchment.*
- *Currently no protection to prevent salmonid incursion from downstream up.*
- *The main stem of Thomson's Creek provides the best opportunity for targeted management to prevent localised extinction of galaxias from the catchment.*
- *Overhanging willows encroaching and "stabilising" or entraining the creek. Stable creek conditions favour predators (brown trout) in these reaches*
- *The complex flow regimes within this catchment have allowed the persistence of Central Otago roundhead galaxias in this section of the mainstem.*
- *Perch have not been observed east of Chestermans Road, nor in the mainstem of Thomson's Creek.*
- *Overhanging willows provide riparian shade, keeping water temperatures lower during low flow conditions*
- *Protection measures such as barriers must precede habitat improvements.*
- *A barrier in the mainstem of Thomson's Creek downstream of this point would likely prevent incursion of perch and could be combined with trout removal to the drying reach to minimise the impacts of predators*.
- *Assess whether trout removal is feasible.*

Figure 16 A built barrier designed to prevent salmonid incursion in Omarama spring. Credit Dean Nelson

Subpopulation 8:

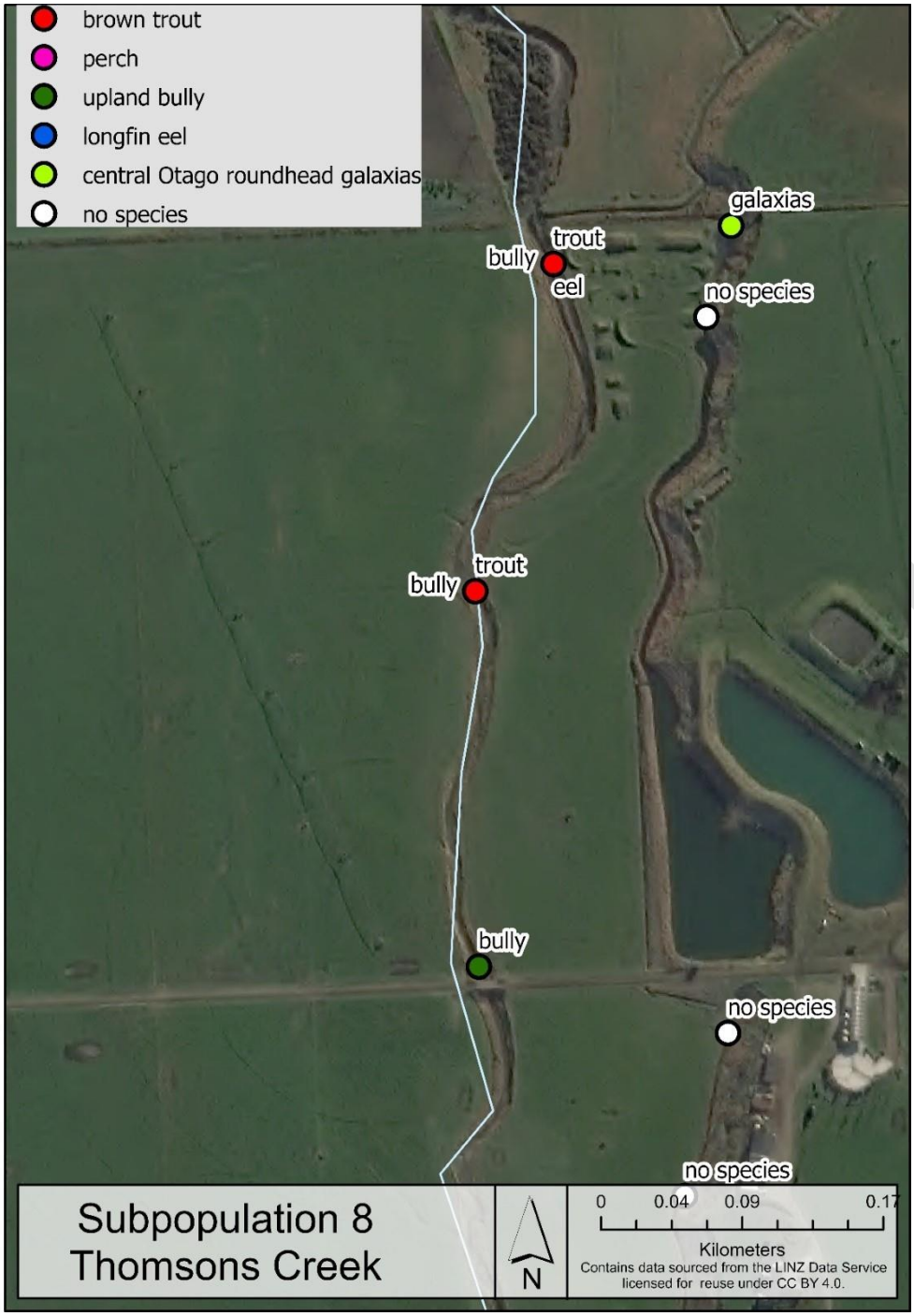

Figure 17. Subpopulation 8 – Thomson's Creek. N.B. Overlapping species indicated by two or more labels for the same data point

This subpopulation occupies a 40-60m length of waterway. The entire waterway is fed by a trickle leaking out from around/within a nova-flow pipe that sticks out from the berm/terrace on the True Left. Water surety is perilous. No other species observed in this reach. A partially blocked culvert separated the waterway from the top end of the dam (marked no species on Figure 17). This culvert

provides no protection from any fish species occupying the dam. Excessive sediment covering the bed of this waterway, with only patches of small gravels remaining. Appears to have been dug, with steep exposed sides (Figure 19). Surveys of similar waterways throughout the catchment may have been overlooked. Due to its size, this population is likely to be one of the lowest priorities within Thomson's Creek, despite being reasonably likely to suffer a localised extinction event.

Management Actions

This is a marginal population, the spring is fenced off on both sides, and it's highly unlikely that trout would ever gain access into the reach of the spring where the galaxiids occupy. The spring could benefit from the following actions

- Consider alternatives to complete creek clearance, i.e look at partial creek clearance during a single operation.

- Is there an opportunity argument the water for the spring. If the farmer needs to change his irrigation infrastructure can it be done in a manner that provides water for the spring?

General comments made during the survey

- *Fenced both sides, narrow buffers of rank grass and weeds.*

Issues:

- *Water surety perilous.*
- *Remaining population fragment occupying very small reach of suboptimal habitat.*
- *Best practice farm waterway management may have exacerbated the imminent risk of this subpopulation going extinct.*
- *Rat footprints in the mud highlight another predatory threat not often included in management objectives for threatened fishes.*

Opportunities for management:

- *Identify and secure water supply.*
- *Secure waterway and dam from incursion of predatory fish introductions.*
- *Construct a fish passage barrier on mainstem of Thomson's Creek and undertake fish removal to reduce likelihood of incursion.*
- *Increase buffer size.*
- *Weed management.*
- *Native replanting for riparian shade.*
- *Establish trap network for mammalian predators.*
- *Identify similar waterways throughout Thomson's Creek that have been overlooked that may contain additional remnant subpopulation fragments.*

Figure 18. Limited habitat at the upstream extent of subpopulation 8 – looking downstream.

Figure 19. Limited habitat at the downstream extent of subpopulation 8 – looking upstream.

Subpopulations 1 and 5:

Observations:

Despite considerable survey effort, no Central Otago roundhead galaxias were observed in locations previously defined as subpopulation 1 and subpopulation 5.
Subpopulation 1 includes sections of the Thomson's Creek mainstem near the rail trail. Galaxias are likely to be present in this section, but detectability and distribution most likely limited by flows and the presence of trout. It appears Central Otago roundhead galaxias are no longer detectable in the sludge channels identified in Subpopulation 1.

Opportunities for management:

Resurvey with the aim of re-confirming presence and distribution of these subpopulations.

Page Break

Appendix 1

Field survey team:

Paul van Klink – Otago Fish and Game

Ben Sowry – Otago Fish and Game

Chris Kavazos – Department of Conservation

Matt Hickey – Water Resource Management

Richard Allibone – Water Ways Consulting Ltd

Lachie Allibone – Water Ways Consulting Ltd

Rob Schick – Ministry for Environment

Mitch Fairhurst– Water Resource Management

Pete Ravenscroft – Otago Regional Council

Brent Dungey – Ross Dungey Consulting Ltd

Matt Salmon – Otago Regional Council

Ciaran Campbell – Otago Regional Council