Summary of Findings - Methven Auxiliary Water Race Network (Ecological Snapshot)

Report

Prepared for Ashburton District Council
Prepared by Beca Limited
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Revision History

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Executive Summary

Beca Limited (Beca) were commissioned by Ashburton District Council (ADC) to prepare a Summary of Findings report for a set of field assessments carried out as part of a wider assessment of ecological value within the Methven Auxiliary stock water race network. This work is to support an investigation into the closure of the Methven Auxiliary stock water race network.

This assessment of potential ecological value seeks to provide a high-level summary of characteristics and identify differences across the Methven Auxiliary stockwater network at a specific point in time. The race network (largely) is not comprised of 'natural streams' under the Resource Management Act (RMA) definition, therefore, this assessment has been conducted to check what ecological values may be present in this artificial network as it stands.

Existing Information

There is limited existing ecological information for the Methven Auxiliary stockwater network. Opus Ltd (now WSP) undertook an assessment of the entire ADC stockwater network in 2014 and concluded that across 20 sample sites there were a mixture of high, medium to high, and low potential ecological values across the race network. These classifications were primarily driven by the relative abundance of suitable Canterbury Mudfish habitat (a Threatened - Nationally Critical species) and/or the likely presence of other native fish species.

Four sites were located within the Methven Auxiliary stockwater network and all four were assessed as having low potential ecological value based on this assessment. No environmental DNA (eDNA) sampling was undertaken during this investigation as it was not yet a widely available tool for freshwater assessments in 2014.

In 2022, Environment Canterbury (ECan) investigated Mount Harding Creek (a natural stream section within the Methven Auxiliary stockwater race network). eDNA samples collected at multiple sites within the stream identified the presence of native fish species (including Canterbury galaxias at the uppermost site), and water quality samples suggested the water quality within Mount Harding Creek was moderate to good, with the upper sites generally appearing to have better water quality (less faecal material and lower concentrations of nutrients) than the lower sites.

Methodology

For this assessment, races within the Methven Auxiliary stockwater network were grouped into general classes (upper, middle and lower), based on their relative position within the race network extent (relative to the source of the network from the Ashburton/Hakatere River North Branch). Sample sites were split across these classes and targeted a mix of main races (carrying a greater flow/volume of water), local races (carrying a smaller volume) and natural races (as part of Mount Harding Creek).

19 sample sites were assessed via a range of field assessments to characterise the freshwater system. These assessments included:

- Rapid Habitat Assessments (RHA)
- The collection of eDNA including riverine taxon-independent community index (TICI) data
- The collection of analytical water quality samples (testing for Total Suspended Solids (TSS), Total Phosphorus (TP), Dissolved Reactive Phosphorus (DRP), Total Nitrogen (TN), *Escherichia coli* (*E.Coli*) and various other nitrogen species)
- The field measurement of other standard water quality parameters (pH, temperature, Dissolved Oxygen (DO), Oxidation Reduction Potential (ORP) and turbidity).

Summary of Results

Whilst there are some limitations of using single data points to make detailed conclusions about the overall nature (and ecological value) of the wider race network, the data obtained during the field assessments provide evidence to suggest that there may be areas with high ecological value and others with moderate-high and moderate ecological value across the Methven Auxiliary stockwater network.

Contextual water quality data suggests a slightly higher quality of water in the upper network races compared to the middle and lower network races. The contextual water quality results are supported by the eDNA TICI results, however, the differences between the network areas appear relatively minor with the upper network sites either in the 'excellent' range or marginally below in the 'good' range and the middle and lower network areas having slightly lower values (either in the 'good' or 'average' range).

In terms of the presence and relative abundance of native fish, the eDNA (multi-species analysis) results highlight differences between the three network areas. In the upper network sites, three species of native fish with a conservation status of At Risk: Declining (Canterbury galaxias, Longfin eel and Torrentfish) were identified across four of the five sites (with Site F only detecting Upland bully – a non-threatened species). Canterbury galaxias and Longfin eel were present in Sites A, C, D and E and Torrentfish were present in Site E only. The presence of these species increases the potential ecological value of a given race.

In the middle network sites, Canterbury galaxias and Torrentfish (at Sites G and K) and Longfin eel (at Site B only), were also detected but to a lesser extent (spatially) than in the upper network sites. Shortfin eel (Not Threatened) were also detected in Site M. Across the lower network sites, the only threatened species of native fish detected were Inanga (At Risk: Declining) in one site (Site S). Shortfin eel (Not Threatened) were also detected in two sites (Sites O and R).

The results of the Rapid Habitat Assessments (RHA) show sites in the upper network generally appearing to score higher overall habitat values (in the 'good' to 'fair' range) with sites in the middle and lower network scoring in the 'fair' range. This indicates that there are likely slightly higher-quality habitats (in the upper network) with features such as a higher availability and diversity of fish cover, a lower percentage of fine sediment covering the streambed and greater hydraulic heterogeneity (within the reaches assessed) compared to the middle and lower network areas, that still have good quality habitats, just with fewer of the features outlined above.

Using the EIANZ Ecological Impact Assessment (EcIA) Guidelines for assigning ecological value, the different race types have been assigned as having the following potential ecological values:

- Upper network races: **High**
- Middle network races: **Moderate-High**
- Lower network races: **Low**

Implications and Further Work

Despite the race network being comprised primarily of man-made watercourses, this assessment has highlighted that there are moderate to high ecological values present within the network and that the system supports a range of fish populations including threatened native species such as Canterbury galaxias, Longfin eel, Torrentfish and Inanga. Although the most recent survey work did not confirm the presence of Canterbury Mudfish, it is also possible that these may be present in certain sections of the race network, based on previous survey work done by Opus and the general habitat characteristics observed in some sections of the race network.

Based on the results of this initial assessment of potential ecological value, and a Preliminary Planning Assessment that was undertaken previously for the proposed closure of the Pudding Hill stockwater network in 2024, a full Ecological Impact Assessment (EcIA) is likely required to understand the likely impacts on the ecological values (identified) as a result of the proposed closure of the stockwater race network. It is also

likely that a regime of fish salvage and relocation will be required during works related to the closure of the races, in addition to any other consent requirements that may be determined.

Given the extent of habitat impacted, it is recommended that a fish salvage and relocation plan is developed to support any closure plan, working in a phased manner with ADC's preferred contractor team during implementation. Because of the scale of the change, engagement with the Department of Conservation and the Ministry for Primary Industries (who part-regulate the 'take' of fish species) is also recommended, as there are additional obligations on the transfer of fish species from this type of catchment to a receiving waterbody.

1 Introduction

1.1 Background

Beca Limited (Beca) were commissioned by Ashburton District Council (ADC) to prepare a Summary of Findings for the set of field assessments carried out as part of the wider assessment of ecological value within the Methven Auxiliary stock water race network.

ADC are undertaking an assessment of the feasibility of closing the Methven Auxiliary stock water race network and information collected as part of this assessment will be used to inform the stock water closure plan with respect to addressing risks to ecological values that may be present.

1.2 Purpose and Scope

The purpose of this report is to provide a summary of findings from the field assessments, and to describe the key ecological and water quality characteristics.

Information presented here may then be used to inform an Ecological Impact Assessment (EcIA) once any consenting requirements and the proposed strategy for closure of the stock water race network are confirmed.

The scope of the tasks for this report (and the field assessments) includes:

- Undertake site visits to gather ecological and water quality data at 19 sites across the stockwater race network including:
  - Collection of water quality samples
  - Collection of environmental DNA (eDNA) samples
  - Field measurements of water quality parameters
  - Undertaking of (freshwater) Rapid Habitat Assessments (RHA)
- Provide a summary of findings including:
  - Observations from the RHA
  - Water Quality Data
  - eDNA Data

2 Site Location and Existing Information Review

2.1 Site Location

The Methven Auxiliary stockwater race network is fed by a water take from the Ashburton/Hakatere River North Branch, in the Canterbury Plains, west of the Methven township (refer Figure 1). The intake supports a race network that has a total length of approximately 310 km, consisting of both main and local race races that flow between the Ashburton/Hakatere River North Branch (to the south) and the Rakaia River (to the north).

The Methven Auxiliary race system initially flows eastwards towards the Rakaia River before it reaches a confluence with Mount Harding Creek (that flows northwest to the southeast) at Draytons Gate. For a brief distance of approximately 11 km, Mount Harding creek continues to flow in a southeast direction and forms part of the race network.

On the northwestern edge of the Methven township (on Forest Drive), a control gate diverts the larger proportion of water from the Mount Harding Creek section of the race network, eastward, through the Methven township and towards the Rakaia River to form the rest of the Methven Auxiliary race network.

From here, the races generally flow in a southeasterly direction towards and slightly beyond State Highway 1 (SH1) with the last races appearing to terminate (and discharge to ground) approximately 7 km southeast of SH1 between the towns of Rakaia (to the north) and Ashburton (to the south).

Figure 1 outlines the sample sites selected for the field assessments, the extent of the race network under assessment and the sections of the race network that are classified as a natural stream, main race or local race.

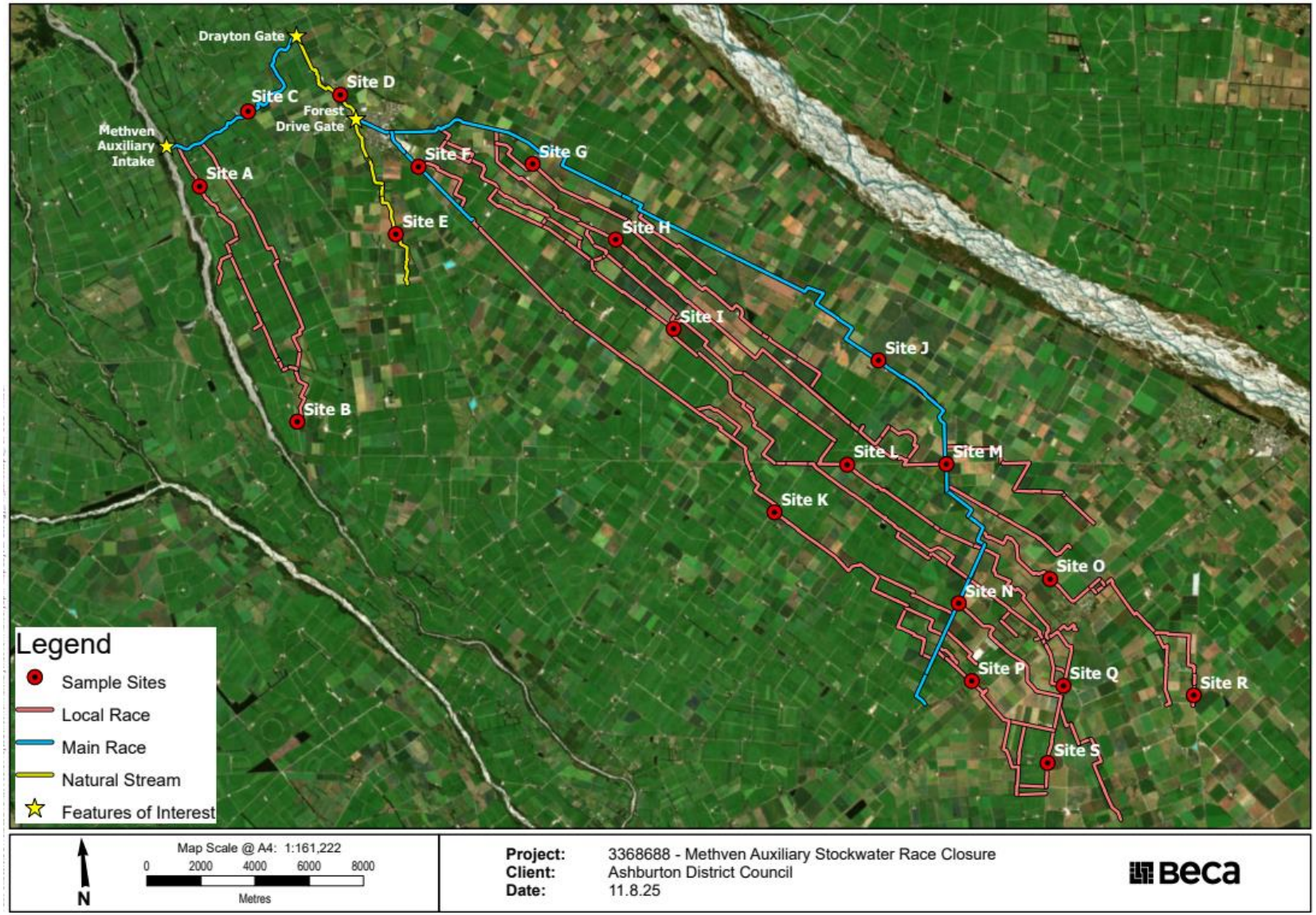

Figure 1. Site map of the Methven Auxiliary stockwater race network including the sample sites assessed in this investigation, the extent of the race network under assessment, the sections of the race network that are classified as a natural stream, main race or local race

2.2 Ecological Context

The Methven Auxiliary Hill race network is located in the Canterbury Plains area and sits across two ecological districts: the High Plains Ecological District (for the majority of races west and north of Methven) and the Low Plains Ecological District (for the races east and south of Methven)[1].

Prior to anthropogenic modification, both these areas would have had extensive sections of lowland, short tussock grassland with pockets of floodplain forest (native podocarp/hardwood). Significant land use changes have occurred post European settlement and the plains have been farmed intensively for sheep, cattle and crops. Planting of small exotic forests and the development of small rural centres (such as Methven and Rakaia) have also changed the land use characteristics of the area.

2.3 Background Information Review

2.3.1 Opus – Ecological Assessment of ADC Race Network (2014)

Opus (now WSP) conducted a high-level Ecological Assessment[2] of the entire ADC stockwater race network in 2014. The investigation consisted of a series of field assessments (including rapid survey/habitat assessments and conventional aquatic assessments such as fish surveys and the collection of aquatic macroinvertebrate samples) to determine the potential ecological value at 20 sample sites (Figure 2) across ADC's race network.

The sites were spread across the Canterbury Plains between the Rangitata River and the Rakaia River (south to north), west of the Methven township and approximately 6 km east of SH1 (west to east). The sites generally were situated in the middle-lower portions of the wider stockwater race network (as defined for the current assessment framework in this investigation later in Section 3.1).

The assessment considered attributes such as suitable Canterbury Mudfish/Kōwaro habitat (*Neochanna burrowsius*; Threatened – Nationally Critical), the abundance and community composition of macroinvertebrates (macroinvertebrate community index), the presence of native fish species, and other ecological health parameters such as the water clarity, presence of algae/macrophytes and riparian vegetation. The above attributes were evaluated for each site and an overall potential ecological value was assigned to each site.

The investigation concluded that:

- Only one of the sites (located approximately 1 km north of the Ashburton/Hakatere River North Branch and 15 km west of the Ashburton township) was deemed to hold a high potential ecological value (as Opus determined there was a high presence of suitable Canterbury Mudfish habitat available at the site).
- Four sites (between the Ashburton/Hakatere River South Branch and the Rangitata River) were deemed to hold a medium-high potential ecological value (due to the presence of Longfin Eel (*Anguilla dieffenbachia*; At Risk: Declining) and the moderate presence of suitable Canterbury Mudfish habitat available at the sites – as determined by Opus).
- All remaining 15 sites were deemed to hold a low potential ecological value due to a lack of suitable mudfish habitat and lack of presence of native fish species (captured or observed during the fish survey).
  - Four sites were located within the Methven Auxiliary stockwater network and were all assessed as likely holding low potential ecological value based on the field assessments.

[1] McEwen, W. M. (1987). Ecological Regions and Districts of New Zealand. Department of Conservation.

[2] Opus International Consultants Ltd. Ecological Assessment & Management Plan: Ashburton Water Race Network. February 2014.

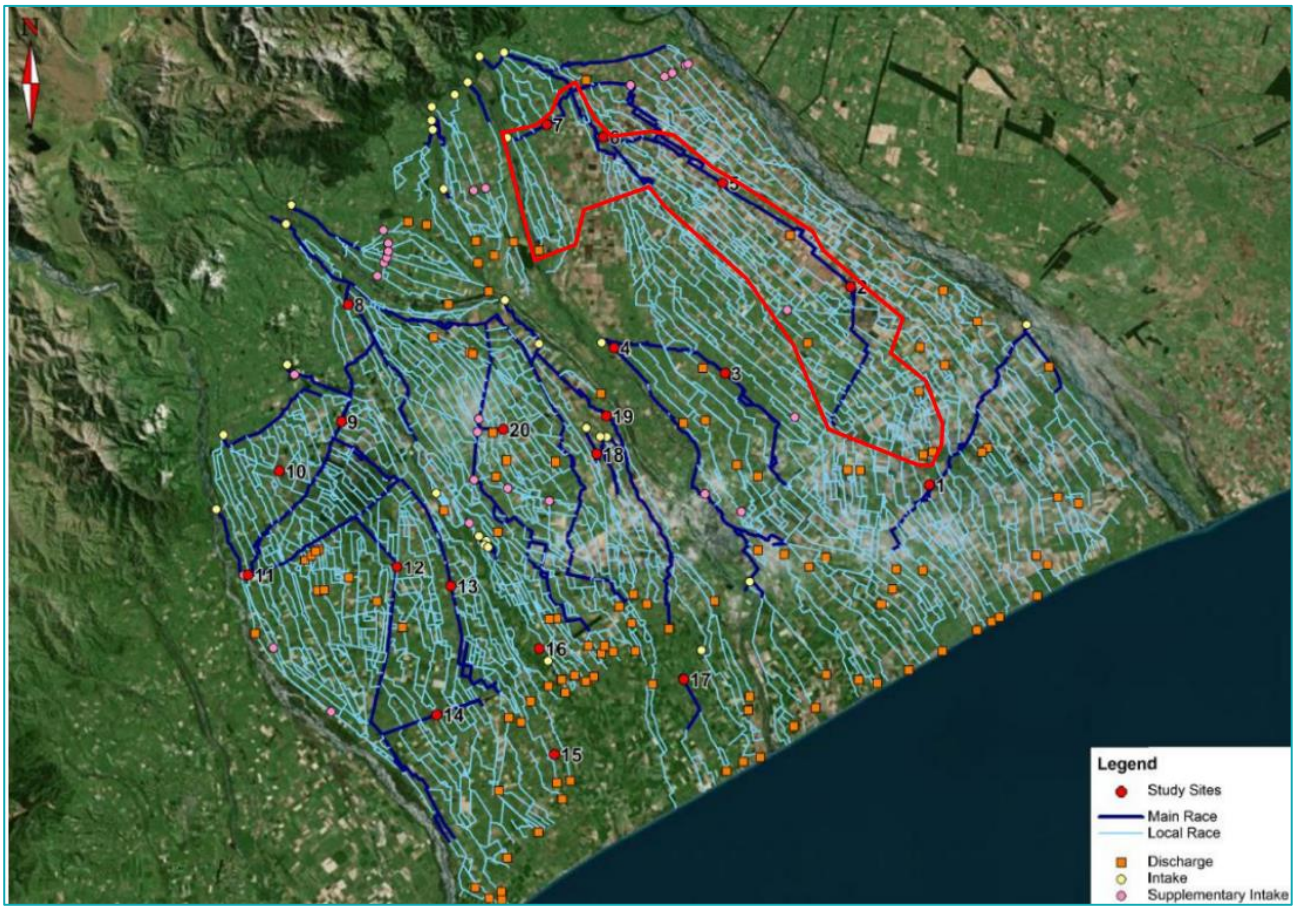

Figure 2. Map outlining sample sites assessed in the existing ecological assessment of the wider ADC stockwater network (Opus, 2014) and overlaid (in red) the indicative area of the Methven Auxiliary stockwater network.

2.3.2 Environment Canterbury (ECan) – Review of Mount Harding (2022)

Environment Canterbury (ECan) conducted an investigation and review of Mount Harding Creek in 2022 (also known as Washpen Creek above its confluence with the Pudding Hill stockwater network north of Methven). eDNA and water quality samples were collected and analysed across five sites (Figure 3) including parameters such as turbidity, ammoniacal nitrogen, nitrate-nitrite nitrogen, dissolved reactive phosphorus (DRP) and Escherichia coli (*E.coli*).

The water quality results suggested that the two uppermost sites (above or adjacent to Methven) had lower turbidity and concentrations of nutrients than sites lower in the race network (south of Methven towards the Ashburton/Hakatere River North Branch). Concentrations of *E.coli,* however, appeared highest in the uppermost site and then relatively consistent across the other four sites.

eDNA samples detected native Galaxiid species (specifically Canterbury galaxias - *Galaxias vulgaris;* At Risk – Declining) at the uppermost site only. All other sites were dominated by Brown trout (*Salmo Trutta*; Introduced) and species of bullies (predominantly Upland bully - *Gobiomorphus breviceps;* Not Threatened).

The lowermost site showed the most diversity, detecting Upland Bully, Brown Trout, Long-fin and Short-fin Eels, Chinook Salmon (*Oncorhynchus tshawytscha*; Introduced) and Torrentfish/panoko (*Cheimarrichthys fosteri;* At Risk – Declining).

Figure 3. Map outlining sample locations assessed in the investigation into Mount Harding Creek (ECan, 2022)

3 Methodology

3.1 Delineation of Network/Classification of Sample Sites

The Methven Auxiliary race network has a total length of approximately 310 km and as such, it was deemed not practical or feasible to assess every individual race within the system.

In this assessment, races were grouped into general classes, based on their relative position within the Methven Auxiliary stockwater network (relative to the source of the network from the Ashburton/Hakatere River North Branch).

Sample sites were split across these classes, and targeted a mix of main races (carrying a greater flow/volume of water) and local races (carrying a smaller volume). The 19 sites are outlined below:

- **Five upper network sites** (Sites A, C, D, E and F) are located between the Ashburton/Hakatere River North Branch and Methven township or in the immediate surrounds
  - Includes two main races and three local races.
- **Eight middle network sites** (Sites B, G, H, I, J, K, L and M) are located between Methven township and SH1
  - Includes two main races and five local races.
- **Six lower network sites** (Sites N, O, P, Q, R and S) are located either slightly northwest or southeast of SH1
  - Includes one main race and five local races.

3.2 Field Assessments

Site visits were undertaken on 4 June and 10 June 2025 to collect ecological information and data from a series of water races within the Methven Auxiliary race network. The weather on both days was overcast with light rain falling. The sampling days were non-consecutive due to a heavy rainfall event that affected the catchment of the race network and the decision was made to postpone the second day of sampling until the water levels had returned to close to their typical base flows.

There had been approximately 20 mm of rainfall in the previous two weeks[3] for the wider Methven area preceding the sampling. Stream flow data from the last 14 days for the Ashburton/Hakatere River North Branch approximately 7 km upstream of the Methven Auxiliary intake[4], indicated a small elevation in river flows coinciding with a small rainfall event, on 26 May at approximately 5:00 am, with a peak flow of 10.65 m^3/s. This peak flow is approximately double the regular base flow (5 m^3/s).

3.2.1 Water Quality Sampling

3.2.1.1 Analytical Samples

Water quality samples were collected from each of the 19 sites using a mighty gripper tool. Each sample was collected into laboratory-supplied sample containers and a clean pair of nitrile gloves were worn. Each sample was given a unique sample identification number and the location the sample was collected from was recorded.

Following collection, all samples were placed directly into a chilled chilly bin and were transported under standard chain of custody procedures to the laboratory for analysis, to ensure that samples were analysed

[3] Met Service. Retrieved on 11/6/2025 from https://www.metservice.com/weather-stationlocation/93756/methven

[4] ECan. Retrieved on 11/6/2025 from https://www.ecan.govt.nz/data/riverflow//sitedetails/68810

within the appropriate holding times for each analyte. Hill Laboratories performed all analyses and are International Accreditation New Zealand (IANZ) accredited. All test methods were also IANZ accredited.

The samples were then analysed for a range of standard analytes that can be used to characterise freshwater systems, including:

- Total Suspended Solids (TSS)
- Total Phosphorus (TP)
- Dissolved Reactive Phosphorus (DRP)
- Total Nitrogen (TN)
- *Escherichia coli (E.Coli)*
- Various nitrogen species including Nitrate-nitrogen (NO3-N), nitrite-nitrogen (NO2-N) and ammoniacal-nitrogen (NH4-N)

One duplicate sample was collected and analysed for the parameters above for quality assurance and quality control (QA/QC) purposes. The relative percentage difference (RPD) was calculated for the duplicate results to determine the percent variation between the duplicate and the parent sample.

3.2.1.2 Field Measurements

A YSI Pro DSS multi-meter probe (supplied by Van Walt Ltd) was used at each of the 19 sample sites to capture in-situ field measurements of temperature, dissolved oxygen (DO), specific conductivity (SPC), oxidation reduction potential (ORP) and turbidity. The multi-meter probe was suspended mid-stream for a minimum period of five minutes (to allow for the parameters to stabilise) and the values were then recorded on a logging sheet.

3.2.2 Rapid Habitat Assessment (RHA)

During the site visits on 4 and 10 June 2025, a Rapid Habitat Assessment (RHA) was undertaken on reaches of the stock water race systems at each of the 19 sites. The RHA provides an overall habitat quality score (Table 1) for a given reach or section of a stream which indicates the general stream habitat condition based on a variety of physical aspects related to the structure of the stream[5].

Table 1. Rapid Habitat Assessment (RHA) interpretation

RHA Habitat Condition Class	RHA Score
Excellent	76-100
Good	50-75
Fair	25-49
Poor	0-24

3.2.3 eDNA Sampling

One eDNA sample was collected at each of the 19 sites. Mini eDNA kits with 5 µm CA filters were used in accordance with the methodology recommended by Wilderlab Ltd[6]. Multi-species analyses by DNA metabarcoding were undertaken on eDNA samples by Wilderlab Ltd to produce a list of all DNA sequences detected within a broad taxonomic group (e.g., fish, insects, birds, mammals) and the number of times each appears in the sample.

[5] Cawthron Institute. Rapid Habitat Assessment Protocol. Accessed on 26/05/2025.

[6] Wilderlab. Directions for Sampling. https://www.wilderlab.co.nz/directions Accessed on 26/05/2025.

These DNA sequences are then compared against a reference database to assign species names and characterise the community as a whole.

The eDNA sample collected from Site Q appeared to have a lab processing error as no freshwater species were detected in the sample. Wilderlab Ltd were contacted to provide a possible explanation for this result. They concluded that the sample appeared to have been compromised by the chemical composition of the water in the sample (such as a low pH or high concentrations of phosphorus or heavy metals), however, both pH measurements and total phosphorus concentrations (outlined in Section 4.3.1) were slightly elevated but were similar to the concentrations recorded for other sites in that area of the race network. Heavy metals were not sampled for as part investigation so elevated concentrations of these may explain this result.

As a result of this, there are no eDNA species records for Site Q and the TICI value has been derived from a 'forced calculation' by Wilderlab Ltd and accordingly the TICI result for this sample should be treated with a degree of caution.

3.2.3.1 Riverine taxon-independent community index (TICI)

Based on the eDNA data, Wilderlab Ltd can also provide a riverine taxon-independent community index (TICI) value for each sample. This index effectively assigns values to different freshwater species (fish, invertebrates, bacteria) based on their perceived tolerance to the overall ecological health of the waterway.

More tolerant species (that can survive in poorer quality systems) are assigned lower values and more sensitive species (that require higher quality systems to support their functioning) are assigned higher values, culminating in an overall TICI value for each sample (or system) that can be used to infer the relative quality of the system (as outlined in Table 2). There is currently limited understanding on the potential impacts of dilution effects on TICI methods as a result of higher-than-average flow regimes (flushing flows) within a stream system. Typically, Macroinvertebrate Community Index (MCI) sampling would not have been undertaken in these conditions.

Table 2. TICI Interpretation

TICI Habitat Class	TICI Value
Pristine	>120
Excellent	110-120
Good	100-110
Average	90-100
Poor	80-90
Very Poor	<80

3.2.4 Water Quality Assessment Criteria

As the water races in this assessment are largely non-natural stream systems (except for Sites D and E, which are within Mount Harding Creek and this is classed as a natural stream), it is important to note that the application of typical water quality criteria and the use of it for interpretation should be used for context, not management or policy-decision making purposes. These criteria values have been used to provide a high-level context on the general water quality in these systems, to further inform the likely ecological value of the race network and inform the race closure plan.

3.2.4.1 Criteria Values Applied

The following water quality criteria have been applied in this assessment:

- The Australian and New Zealand Environment Guidelines for Fresh and Marine Water Quality (ANZG, 2018) 80th percentile default guideline values (DGVs) for physical and chemical stressors.
  - Cool, wet hill (fed) (CW-H) values applied for all five upper network sites.

  - Cool, dry, low-elevation (CD-L) values applied for all remaining fourteen middle and lower network sites.
- Region-wide Water Quality Limit values from Schedule 8 of the Canterbury Land and Water Regional Plan (LWRP, 2022).
  - 1 day (summer*) minimum value (for Hill-fed lower systems) applied for dissolved oxygen.
  - Annual maximum value (for Hill-fed lower systems) applied for ammoniacal nitrogen.
- Freshwater Outcomes for Canterbury Rivers values from Table 1a of the Canterbury Land and Water Regional Plan (LWRP, 2022).
  - 95th percentile value for *E.coli* human health attributes.

*Note: Samples for this investigation were not collected during the summer period (defined as 1 November to 30 April in Schedule 8 of the LWRP).

3.2.5 Ecological Value - Assessment Methodology

An assessment of ecological effects was undertaken in accordance with Ecological Impact Assessment (EcIA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems (Roper-Lindsay et al., 2018).

The EIANZ guidelines set out a methodology to assign ecological value to species and ecosystems based on four assessment criteria which are consistent with significance assessment criteria set out in the Proposed National Policy Statement for Indigenous Biodiversity (2019) Appendix A: Criteria for identifying significant indigenous vegetation and significant habitat of indigenous fauna.

In summary:

- Attributes are taken into account when considering ecological value or importance. They relate to matters such as representativeness, the rarity and distinctiveness, diversity and patterns, and the broader ecological context.
- Determining Factors for valuing terrestrial species; terrestrial species span a continuum of very high to negligible, depending on aspects such as whether species are native or exotic, have threat status, and their abundance and commonality at the site impacted.
- Ecological Values are scored based on an expert judgement, qualitative and quantitative data collected.

4 Field Assessment Results

Field assessments were undertaken at 19 sample sites across the Methven Auxiliary stock race network, following the methodologies outlined in Section 3.

Sites were situated on both main and local races (as defined by ADC) and covered upper network (five sites), mid network (eight sites), and lower network (six sites) areas of the stock race network.

The results from the field assessments for the different network areas are summarised in Sections 4.1 to 4.3.

The contextual water quality results (covering both field measurements and analytical results) are presented first, followed by the aquatic ecology results (rapid habitat assessment and eDNA) followed by a final general summary of the network area, synthesising all of the results.

Full analytical results (for both the water quality and eDNA datasets) are provided in **Appendix A** and **B** respectively. Site photos taken during the RHA at each site are also provided in **Appendix C**.

Table 3. All 19 field assessment sites.

Site Name	Network Class	Race Type	X Coordinate	Y Coordinate
Site A	Upper Network	Local	1484189.393	5166568.715
Site B	Mid Network	Local	1487054.558	5158013.927
Site C	Upper Network	Main	1486084.614	5169106.971
Site D	Upper Network	Natural (Mount Harding Creek)	1489383.305	5169455.424
Site E	Upper Network	Natural (Mount Harding Creek)	1491003.628	5164393.421
Site F	Upper Network	Main	1493996.555	5164385.973
Site G	Mid Network	Local	1496012.689	5166546.757
Site H	Mid Network	Local	1498763.261	5163660.534
Site I	Mid Network	Local	1500588.325	5160367.619
Site J	Mid Network	Main	1506641.423	5159578.712
Site K	Mid Network	Local	1503692.250	5153621.458
Site L	Mid Network	Local	1506385.934	5155131.718
Site M	Mid Network	Main	1509894.143	5154899.215
Site N	Lower Network	Main	1509983.311	5149957.154
Site O	Lower Network	Local	1513276.148	5150593.262
Site P	Lower Network	Local	1510257.716	5147174.396
Site Q	Lower Network	Local	1513486.754	5146772.834
Site R	Lower Network	Local	1518056.352	5146121.101
Site S	Lower Network	Local	1512735.643	5144087.771

4.1 Upper Network Sites (Sites A, C, D, E and F)

4.1.1 Water Quality Results

Table 4. Summary of field measured parameters for upper network sites (including comparison against guideline criteria values).

Field Measured Parameters	Site A	Site C	Site D	Site E	Site F	ANZG P/C Stressor CW/H	LWRP WQ Limits
Temperature (^{0}C)	8.9	7.2	7.8	7.9	8.1	-	-
pH (pH units)	7.8	7.6	**7.3**	7.7	**8.1**	7.35 - 7.8	-
Dissolved Oxygen (mg/L)	11.61	12.64	12.43	12.46	13.27	-	<5
Specific Conductivity (µS/cm)	91.5	77.4	90.9	**97.4**	88.4	95	-
Oxidation Reduction Potential (mV)	87.4	87.6	93.7	99.8	107.8	-	-
Turbidity (NTU)	**4.38**	**12.8**	**15.3**	**11.7**	**25.8**	2.4	-

Note: Results above or ANZG P/C stressor values are **bold**. Values for pH reported as an optimum range rather than an upper limit.

The field measurements for the five upper network sites suggest the water quality is in a moderately healthy state. The only recorded exceedances of the guideline criteria values were for pH (that were recorded marginally outside the criteria range at two sites) and for turbidity at all sites.

Table 5. Summary of analytical results for upper network sites (including comparison against guideline criteria values).

Analytical Parameters	Site A	Site C	Site D	Site E	Site F	ANZG P/C Stressor CW/H	LWRP WQ Limits
Total Suspended Solids (g/m^3)	**4**	**13**	< 3	**6.0**	**21.0**	2.6	-
Escherichia coli (MPN/100mL)	33	33	76	161	687	-	1000
Total Kjeldahl Nitrogen (TKN) (g/m^3)	< 0.10	< 0.10	< 0.10	0.1	0.16	-	-
Total Phosphorus (g/m^3)	0.005	0.006	0.011	0.01	**0.023**	0.016	-
Total Nitrogen (g/m^3)	**0.51**	0.17	**1.13**	**1.1**	**1.12**	0.238	-
Total Ammoniacal-N (g/m^3)	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.006	0.05
Nitrate-N (g/m^3)	< 0.002	< 0.002	< 0.002	< 0.002	0.002	0.087	-
Nitrite-N (g/m^3)	0.42	0.107	1.07	1	0.95	-	-
Nitrate-N + Nitrite-N (g/m^3)	0.43	0.107	1.07	1	0.96	-	-
Dissolved Reactive Phosphorus (g/m^3)	< 0.004	< 0.004	< 0.004	0.005	< 0.004	0.08	-

Note: Results above ANZG P/C stressor values are **bold.** Results below the laboratory limit of detection (L.O.D) are in grey text.

The analytical results for the five upper network sites also suggest that the water quality across the sites is moderately healthy. Marginal exceedances were reported for at least one parameter at all of the sites with Site F having the most exceedances in total (three) for concentrations of TSS, total phosphorus and total nitrogen.

4.1.2 Aquatic Ecology Results

4.1.2.1 eDNA

4.1.2 Aquatic Ecology Results

4.1.2.1 eDNA

Table 6. Summary of key eDNA results for upper network sites. Threatened species in **bold text.**

Site Name	Native Fish Detected	Scientific Name(s)	Common Name(s)	Conservation Status	TICI Value (and rating)
Site A	Yes	*Gobiomorphus breviceps*	Upland bully	Not Threatened	108.06 (Good)
Site C					117.9 (Excellent)
Site D		***Galaxias vulgaris***	**Canterbury galaxias**	**At Risk: Declining**	108.46 (Good)
Site E		***Anguilla dieffenbachii***	**Longfin eel**	**At Risk: Declining**	105.77 (Good)
		Cheimarrichthys fosteri	**Torrentfish**	**At Risk: Declining**	
Site F		*Gobiomorphus breviceps*	Upland bully	Not Threatened	104.59 (Good)

The eDNA results highlight the presence of both Canterbury galaxias (At Risk: Declining) and Longfin eel (At Risk: Declining) largely throughout the upper network area of the Methven Auxiliary stockwater network as they were detected in all but one of the five sites. Torrentfish (At Risk: Declining) were also detected at one of the five sites. The TICI values also appear relatively high across the five sites with one site recording a slightly higher value pushing it into the “excellent” condition class and the remaining four sites in the “good” class.

4.1.2.2 Rapid Habitat Assessment (RHA)

Table 7. RHA scores for the upper network sites.

Site Name	Overall RHA score	RHA Habitat Condition Class
Site A	58	Good
Site C	50	Good
Site D	62	Good
Site E	63	Good
Site F	41	Fair

The RHA results suggest the race systems in the upper network area are generally of a good to fair habitat condition.

This is primarily based on the percentage of the streambed(s) that appeared clear of deposited sediment (particularly Sites D and E), the moderate-high amount and diversity of available fish cover, the moderate hydraulic heterogeneity (number of different hydraulic components such as riffles, pools, fast runs, slow runs) and the degree of shading (provided by riparian vegetation) across the reaches assessed.

4.1.3 Assessed Ecological Value

Overall, the snapshot of ecological and contextual water quality data, and the limited existing data indicates that the ecological value of the upper network sites, is likely to be **high** following the EIANZ Ecological Impact Assessment (EcIA) Guidelines for assigning ecological value.

This is based on the likely presence of two At Risk: Declining species of native fish (Canterbury galaxias and Longfin eel) and the potential presence of another (Torrentfish), the TICI ratings of excellent and good (likely driven by a high percentage/detection rate of EPT macroinvertebrate taxa). Additionally, the generally moderate-high habitat condition of the races as determined by the RHA (that are likely to support populations of native fish) and the contextual water quality data that also suggests the races in the upper network are in a generally healthy condition (as they do not contain excessive levels of nutrients or faecal bacteria) and largely meet the water quality limits (and characteristics expected) of natural stream systems in the Canterbury region.

Table 8. Scoring and justification for assigned ecological value to the upper network sites.

Matter	Rating	Justification
Representativeness	High	Natural meander and in-stream habitat (in some races). Limited erosion and deposited sediment on the streambed in most sites. Moderate-high water quality value – TICI values of Excellent and Good. Modified agricultural catchment. Moderate exotic riparian vegetation provides limited shading. Limited macrophyte growth.
Rarity/Distinctiveness	High	Permanent stream that likely provides habitat for At Risk native fish species year-round (Canterbury galaxias and Longfin eel detected at four of five sites and Torrentfish detected at one site). Fish passage not impeded.
Diversity and Pattern	Moderate	Moderate in-stream habitat heterogeneity – comprising typical, healthy riffle-run structure.
Ecological context	Moderate	Important role in providing connectivity between headwaters and wider race system. Provider of native fish spawning and juvenile fish habitats. Some land use pressures from agriculture.
		Overall value: ***High***

4.2 Middle Network (Sites B, G, H, I, J, K, L and M)

4.2.1 Water Quality Results

Table 9. Summary of field measured parameters for the middle network sites (including comparison against guideline criteria values).

Field Measured Parameters	Site B	Site G	Site H	Site I	Site J	Site K	Site L	Site M	ANZG P/C Stressor CD/L	LWRP WQ Limits
Temperature (^{0}C)	7.5	8.0	8.8	8.3	3.1	3.4	3	4.5	-	-
pH (pH units)	**7.3**	7.5	**7.9**	7.7	**7.9**	7.7	7.6	**8.3**	7.35 - 7.8	-
Dissolved Oxygen (mg/L)	10.82	12.62	12.6	12.06	16.46	16.5	14.06	15.44	-	<5
Specific Conductivity (µS/cm)	91.8	**133.4**	109.3	105.5	105.3	119.3	109.3	106.9	95	-
Oxidation Reduction Potential (mV)	93.8	-47.6	49.2	35.8	37.3	24.5	51.4	53.2	-	-
Turbidity (NTU)	0.41	**20**	**15.1**	**27**	**16.9**	**9**	**7.45**	**15**	2.4	-

Note: Results above or ANZG P/C stressor values are **bold**. Values for pH reported as an optimum range rather than an upper limit.

The field measurements for the eight middle network sites suggest the water quality is in a moderately healthy state. The only recorded exceedances of the guideline criteria values were for turbidity (at all sites except Site B), pH (at sites B, H, J and M) and specific conductivity at Site G only.

Table 10. Summary of analytical results for middle network sites (including comparison against guideline criteria values).

Analytical Parameters	Site B	Site G	Site H	Site I	Site J	Site K	Site L	Site M	ANZG P/C Stressor CD/L	LWRP WQ Limits
Total Suspended Solids (g/m^3)	**6.0**	**20.0**	**26.0**	**96.0**	**54.0**	**4.0**	< 3	**46.0**	2.1	-
Escherichia coli (MPN/100mL)	249	261	980	1,414	488	140	108	219	-	1000
Total Kjeldahl Nitrogen (TKN) (g/m^3)	0.1	0.16	0.21	0.45	0.24	0.36	0.42	0.26	-	-
Total Phosphorus (g/m^3)	0.013	**0.029**	**0.037**	**0.149**	**0.086**	**0.03**	**0.045**	**0.072**	0.014	-
Total Nitrogen (g/m^3)	0.34	**1.33**	**1.34**	**1.47**	**2.5**	**2.5**	**2.9**	**2.5**	0.91	-
Total Ammoniacal-N (g/m^3)	<0.01	<0.01	**0.013**	**0.045**	<0.01	<0.01	<0.01	<0.01	0.001	0.05
Nitrite-N (g/m^3)	0.003	0.005	0.006	0.009	0.004	0.019	0.012	0.007	-	-
Nitrate-N (g/m^3)	0.23	**1.16**	**1.12**	**1.01**	**2.2**	**2.1**	**2.4**	**2.2**	0.27	-
Nitrate-N + Nitrite-N (g/m^3)	0.23	1.16	1.12	1.02	2.2	2.1	2.4	2.2	-	-
Dissolved Reactive Phosphorus (g/m^3)	0.006	**0.009**	**0.009**	**0.013**	**0.013**	**0.014**	**0.032**	**0.016**	0.008	-

Note: Results above ANZG P/C stressor values are **bold** and results above the LWRP water quality limits are in red text. Results below the laboratory limit of detection (L.O.D) are in grey text.

The analytical results for the eight middle network sites suggest that the water quality across the sites is of fair health. Concentrations of nutrients are above water quality guideline values across all sites except for Site B, exhibiting that there is some likely impact of localised runoff (primarily nutrients and faecal indicator bacteria) from adjacent and upstream farming practices that may be entering the race network.

Site B, exhibiting that there is some likely impact of localised runoff (primarily nutrients and faecal indicator bacteria) from adjacent and upstream farming practices that may be entering the race network.

Exceedances of the selected water quality guidance values were reported across multiple parameters at all of the sites, with Sites H and I having the most exceedances in total (seven) for concentrations of TSS, total nitrogen, total phosphorus, dissolved reactive phosphorus, ammoniacal nitrogen, nitrate-N and *E.coli.*

4.2.2 Aquatic Ecology Results

4.2.2.1 Rapid Habitat Assessment (RHA)

Table 11. RHA Scores for Middle Network Sites

Site Name	Overall RHA score	RHA Habitat Condition Class
Site B	41	Fair
Site G	31	Fair
Site H	33	Fair
Site I	33	Fair
Site J	42	Fair
Site K	40	Fair
Site L	33	Fair
Site M	33	Fair

The RHA results suggest the race systems in the middle network area are generally of a fair habitat condition. This is primarily based on the moderate-high amount of deposited sediment on the streambed(s), the moderate-low amount and diversity of available fish cover, the moderate-low hydraulic heterogeneity and the moderate-low percentage of suitable substrate or habitat for macroinvertebrate communities.

4.2.2.2 eDNA

Table 12. Summary of key eDNA results for middle network sites. Threatened species in **bold text.**

Site Name	Native Fish Detected	Scientific Name	Common Name	Conservation Status	TICI Value (and rating)
Site B	Yes	*Gobiomorphus breviceps* ***Anguilla dieffenbachii***	Upland bully **Longfin eel**	Not Threatened **At Risk: Declining**	99.6 (Average)
Site G		*Gobiomorphus breviceps* ***Cheimarrichthys fosteri***	Upland bully **Torrentfish**	Not Threatened **At Risk: Declining**	102.65 (Good)
Site H		*Anguilla australis* *Gobiomorphus breviceps*	Shortfin eel Upland bully	Not Threatened Not Threatened	101.69 (Good)
Site I		*Gobiomorphus breviceps*	Upland bully	Not Threatened	102.48 (Good)

Site Name	Native Fish Detected	Scientific Name	Common Name	Conservation Status	TICI Value (and rating)
Site J		***Galaxias vulgaris***	**Canterbury galaxias**	**At Risk: Declining**	103.95 (Good)
		Gobiomorphus breviceps	Upland bully	Not Threatened	
Site K		***Cheimarrichthys fosteri***	**Torrentfish**	**At Risk: Declining**	100.85 (Good)
		Gobiomorphus breviceps	Upland bully	Not Threatened	
Site L		*Gobiomorphus breviceps*	Upland bully	Not Threatened	99.87 (Good)
Site M		*Anguilla australis*	Shortfin eel	Not Threatened	102.57 (Good)
		Gobiomorphus breviceps	Upland bully	Not Threatened	

The eDNA results highlight the presence of Upland bully (Not Threatened) throughout the middle network area. Of more interest is the detection of Longfin eel and Canterbury galaxias (both At Risk: Declining) in two separate sites (Site B and Site J respectively) and Torrentfish (At Risk: Declining) in two sites (Site G and Site K). Shortfin eel (Not Threatened) were also detected in two sites (Site H and Site M). The TICI values also appear relatively high across the eight sites with all but one of the values in the “good” condition class (Site B had a value indicative of “average” condition).

4.2.3 Assessed Ecological Value

Overall, the snapshot of ecological and contextual water quality data, and the limited existing data indicates that the ecological value of the middle network sites, is likely to be **moderate-high** following the EIANZ Ecological Impact Assessment Guidelines for assigning ecological value.

This is based on the likely presence of At Risk: Declining species of native fish (Canterbury galaxias, Longfin eel and Torrentfish) within at least one of the sections of the races assessed in this area of the race network, the TICI ratings of good-average (likely driven by a moderate-high percentage/detection rate of EPT macroinvertebrate taxa) and the generally fair habitat condition of the races as determined by the RHA (that are likely to support small populations of native fish and macroinvertebrate communities).

The contextual water quality data also suggests that races in the middle network are in an average-moderate condition (with respect to water quality) with some potentially elevated levels of nutrients and faecal bacteria observed (faecal matter in Site I only and elevated nutrients in all sites except for Site B) and in several cases, these values exceeded the ANZG water quality limits for cool, dry, low-elevation natural stream systems.

Table 13. Scoring and justification for assigned ecological value to the Middle Network Sites.

Matter	Rating	Justification
Representativeness	Moderate	Modified race type systems, with moderate in-stream habitat. Moderate degree of erosion and deposited sediment on the streambed. Moderate water quality value – TICI values of "Good" for all but one of the eight sites. Modified agricultural catchment. Low exotic riparian vegetation provides limited shading. Limited macrophyte growth.
Rarity/Distinctiveness	High	Permanent stream that likely provides habitat for At Risk fish species year-round (Canterbury galaxias, Longfin eel and Torrentfish detected at different sites throughout the middle area of the race network). Fish passage not impeded.
Diversity and Pattern	Low	Modified race type systems. Moderate-low in-stream habitat heterogeneity – comprising typical, healthy slow run – fast run structure.
Ecological context	Moderate	Important role in providing connectivity between headwaters and wider race system. Provider of native fish spawning and juvenile fish habitats. Some land use pressures from agriculture.
		Overall value: ***Moderate-High***

4.3 Lower Network (Sites N, O, P, Q, R and S)

4.3.1 Water Quality Results

Table 14. Summary of field measured parameters for the lower network sites (including comparison against guideline criteria values).

Field Measured Parameters	Site N	Site O	Site P	Site Q	Site R	Site S	ANZG P/C Stressor CD/L	LWRP WQ Limits
Temperature (^{0}C)	5.2	5	6.2	6.6	7.2	6.6	-	-
pH (pH units)	7.75	**7.85**	**7.93**	**7.86**	7.7	7.7	7.23 - 7.8	-
Dissolved Oxygen (mg/L)	15.71	14.68	14.2	14.29	13.28	14.55	-	<5
Specific Conductivity (µS/cm)	107.9	105.6	103.3	102.2	90.8	97.4	116	-
Oxidation Reduction Potential (mV)	45.9	53.7	49.3	43.2	20.4	37.9	-	-
Turbidity (NTU)	**24.1**	**16.4**	**33.4**	**10.4**	**19.2**	**10.6**	1.3	-

Note: Results above ANZG P/C stressor values are **bold**. Values for pH reported as an optimum range rather than an upper limit.

The field measurements for the six lower network sites suggest the water quality is in a moderately healthy state. The only recorded exceedances of the guideline criteria values were for turbidity (at all sites) and for pH (at sites O, P and Q only) where the pH appeared marginally more alkaline than the ANZG criteria range.

Table 15. Summary of analytical results for lower network sites (including comparison against guideline criteria values).

Analytical Parameters	Site N	Site O	Site P	Site Q	Site R	Site S	ANZG P/C Stressor CD/L	LWRP WQ Limits
Total Suspended Solids (g/m^3)	**56.0**	**11.0**	**21.0**	< 3	**7.0**	**3.0**	2.1	-
Escherichia coli (MPN/100mL)	238	276	179	158	44	64	-	1000
Total Kjeldahl Nitrogen (TKN) (g/m^3)	0.3	0.29	0.31	0.4	0.48	0.5	-	-
Total Phosphorus (g/m^3)	**0.096**	**0.048**	**0.069**	**0.046**	**0.09**	**0.081**	0.014	-
Total Nitrogen (g/m^3)	**2.6**	**2.6**	**2.6**	**2.7**	**2.1**	**2.5**	0.91	-
Total Ammoniacal-N (g/m^3)	<0.01	**0.016**	**0.142**	<0.01	**0.012**	**0.013**	0.01	0.05
Nitrite-N (g/m^3)	0.01	0.012	0.012	0.013	0.012	0.014	-	-
Nitrate-N (g/m^3)	**2.3**	**2.3**	**2.3**	**2.2**	**1.64**	**1.94**	0.27	-
Nitrate-N + Nitrite-N (g/m^3)	2.3	2.3	2.3	2.3	1.65	1.95	-	-
Dissolved Reactive Phosphorus (g/m^3)	**0.02**	**0.02**	**0.02**	**0.025**	**0.033**	**0.044**	0.008	-

Note: Results above ANZG P/C stressor values are **bold**. Results below the laboratory limit of detection (L.O.D) are in grey text.

The analytical results for the six lower network sites suggest that the water quality across the sites is of moderate to fair condition. Impacts from adjacent / upstream localised runoff do not appear to have increased from the mid-network sites in terms of nutrients and faecal indicator bacteria.

Exceedances were reported across multiple parameters at all of the sites, with the majority of sites recording exceedances for concentrations of TSS, total phosphorus, ammoniacal nitrogen and nitrate-N.

4.3.1.1 QA/QC

A duplicate sample was collected from Site S and analysed for the same parameters as the parent sample. The maximum relative percentage difference (RPD) value across all the parameters was 19.8% and the average was 5.6%. Overall, the results suggest an acceptable level of consistency in the sampling methods employed during the field assessments.

4.3.2 Aquatic Ecology Results

4.3.2.1 RHA Results

Table 16. RHA Scores for Lower Network Sites

Site Name	Overall RHA score	RHA Habitat Condition Class
Site N	35	Fair
Site O	45	Fair
Site P	41	Fair
Site Q	31	Fair
Site R	32	Fair
Site S	33	Fair

The RHA results suggest the race systems in the middle network area are generally of a fair habitat condition.

This is primarily based on the moderate amount of deposited sediment on the streambed(s), the moderate amount and diversity of available fish cover, the moderate-low hydraulic heterogeneity and the moderate-low percentage of suitable substrate or habitat for macroinvertebrate communities.

4.3.2.2 eDNA Results

Table 17. Summary of key eDNA results for lower network sites. Threatened species in **bold text.**

Site Name	Native Fish Detected	Scientific Name	Common Name	Conservation Status	TICI Value (and rating)
Site N	Yes	*Gobiomorphus breviceps*	Upland bully	Not Threatened	102.9 (Good)
Site O		*Gobiomorphus breviceps* *Anguilla australis*	Upland bully Shortfin eel	Not Threatened Not Threatened	100.87 (Good)
Site P		*Gobiomorphus breviceps*	Upland bully	Not Threatened	100.31 (Good)
Site Q		*No fish species detected refer to Section 3.2.3 for details*[7]			99.01 (Good)
Site R		*Gobiomorphus breviceps* *Anguilla australis*	Upland bully Shortfin eel	Not Threatened Not Threatened	97.63 (Average)
Site S		*Gobiomorphus breviceps*	Upland bully	Not Threatened	98.62 (Average)

[7] The TICI value for Site Q was derived via a "forced" calculation by Wilderlab Ltd based on 28 TICI indicator species due to the lack of species detected in the sample (as outlined in Section 3.2.3).

Site Name	Native Fish Detected	Scientific Name	Common Name	Conservation Status	TICI Value (and rating)
		Galaxias maculatus	**Inanga**	**At Risk: Declining**	

The eDNA results generally highlight the presence of Upland bully (Not Threatened) throughout the lower network area as they were detected in all six of the sites. Shortfin eel (Not Threatened) were also detected in two sites (Site O and Site R). Of more interest, Inanga (At Risk: Declining) were detected at a single site (Site S - the site closest to the end of the water race network). The TICI values also appear relatively high across the five sites with all values in the "good" condition class.

4.4 Assessed Ecological Value

Overall, the snapshot of ecological and contextual water quality data, and the limited existing data indicates that the ecological value of the lower network sites, is likely to be **moderate** following the EIANZ Ecological Impact Assessment Guidelines for assigning ecological value.

This is based on the likely presence of an At Risk: Declining species of native fish (Inanga) within at least one of the sections of the races assessed in this area of the network, the TICI ratings of good (likely driven by a moderate-high percentage/detection rate of EPT macroinvertebrate taxa), and the generally fair habitat condition of the races as determined by the RHA (that are likely to support small populations of native fish and macroinvertebrate communities).

The contextual water quality data also suggests that races in the lower network are in a moderate to fair condition (with respect to water quality) with some potentially elevated levels of nutrients observed across the sites and in several cases these values exceeded the ANZG water quality limits for cool, dry, low-elevation natural stream systems.

Table 18. Scoring and justification for assigned ecological value to the Lower Network Sites.

Matter	Rating	Justification
Representativeness	Low	Modified race type systems, with moderate in-stream habitat. Moderate erosion and some deposited sediment on the streambed. Moderate water quality value – TICI values of Good for all sites. Modified agricultural catchment. Low exotic riparian vegetation provides limited shading. Moderate macrophyte growth.
Rarity/Distinctiveness	High	Permanent stream that likely provides habitat for At Risk fish species year-round (Inanga detected at one site). Fish passage not impeded.
Diversity and Pattern	Low	Modified race type systems. Moderate-low in-stream habitat heterogeneity – comprising typical, healthy slow run-fast run structure.
Ecological context	Moderate	Important role in providing connectivity between headwaters and wider race system. Provider of native fish spawning and juvenile fish habitats. Some land use pressures from agriculture.
		Overall value: ***Moderate***

5 Initial Conclusions, Implications and Further Work

5.1 Overall Summary

This assessment of ecological value was undertaken to describe potential differences and changes within the broad sub-network groups across the Methven Auxiliary stockwater network. Whilst there are likely limitations of using single data points to make detailed conclusions about the overall nature (and ecological value) of the wider race network, the data obtained during the field assessments provide evidence to suggest that there may be areas with high ecological value and others with moderate-high and moderate ecological value across the Methven Auxiliary stockwater network.

The contextual water quality data, appears to suggest a slightly higher quality of water in the upper network races compared to the middle and lower network races and this is believed to in-turn provide more favourable bio-physical conditions for sensitive (and higher value) species to reside. The middle and lower network appear to share relatively similar water quality characteristics, with both areas of the network appearing to carry higher loads of nutrients (nitrogen and phosphorus) and in some cases faecal matter (*E.coli*).

The contextual water quality results are supported by the eDNA TICI results (Figure 4), however, the differences between the network areas appear minor. The upper network area has slightly higher values (either in the ‘excellent’ range or marginally below in the ‘good’ range) than the middle and lower network areas that have slightly lower values (either in the ‘good’ or ‘average’ range).

The eDNA (multi-species) results (Figure 5) highlight differences between the three network areas. In the upper network sites, three species of native fish with a conservation status of At Risk: Declining (Canterbury galaxias, Longfin eel and Torrentfish) were identified across four of the five sites (with Site F only detecting Upland bully – a non-threatened species). Canterbury galaxias and Longfin eel were present in Sites A, C, D and E and Torrentfish were present in Site E only. The presence of these species increases the potential ecological value of a given race.

In the middle network sites, Canterbury galaxias and Torrentfish (at Sites G and K) and Longfin eel (at Site B only), were also detected but to a lesser extent (spatially) than in the upper network sites. Shortfin eel (Not Threatened) were also detected in Site M.

Across the lower network sites, the only threatened species of native fish detected were Inanga (At Risk: Declining) in one site (Site S). Shortfin eel (Not Threatened) were also detected in two sites (Sites O and R).

The results of the Rapid Habitat Assessments (RHA) across the three sub-network areas (Figure 6) further illustrate the differences outlined above, with sites in the upper network generally appearing to score higher overall habitat values (in the ‘good’ to ‘fair’ range) with sites in the middle and lower network scoring in the ‘fair’ range. This indicates that there are likely slightly higher-quality habitats (in the upper network) with features such as a higher availability and diversity of fish cover, a lower percentage of fine sediment covering the streambed and greater hydraulic heterogeneity (within the reaches assessed) compared to the middle and lower network areas, that still have good quality habitats, just with fewer of the features outlined above.

The limited extent of existing data for stockwater races in the Ashburton District (and for Mount Harding Creek) generally support the results of this assessment with similar water quality results observed and species of native fish detected. Existing (ECan) data for Mount Harding Creek suggests a higher quality of water in the upper network areas compared with the middle – lower network and a greater abundance of native fish species were also observed in the upper network. Conclusions from the Opus report also strengthen the argument that there are both high and moderate potential ecological values across the Methven Auxiliary stockwater race network.

Overall, based on the results in this assessment, the different areas of the race network have been classified as having the following potential ecological values:

- Upper Network Races: **High**
- Middle Network Races: **Moderate - High**
- Lower Network Races: **Moderate**

5.2 Summary Figures (across the network areas)

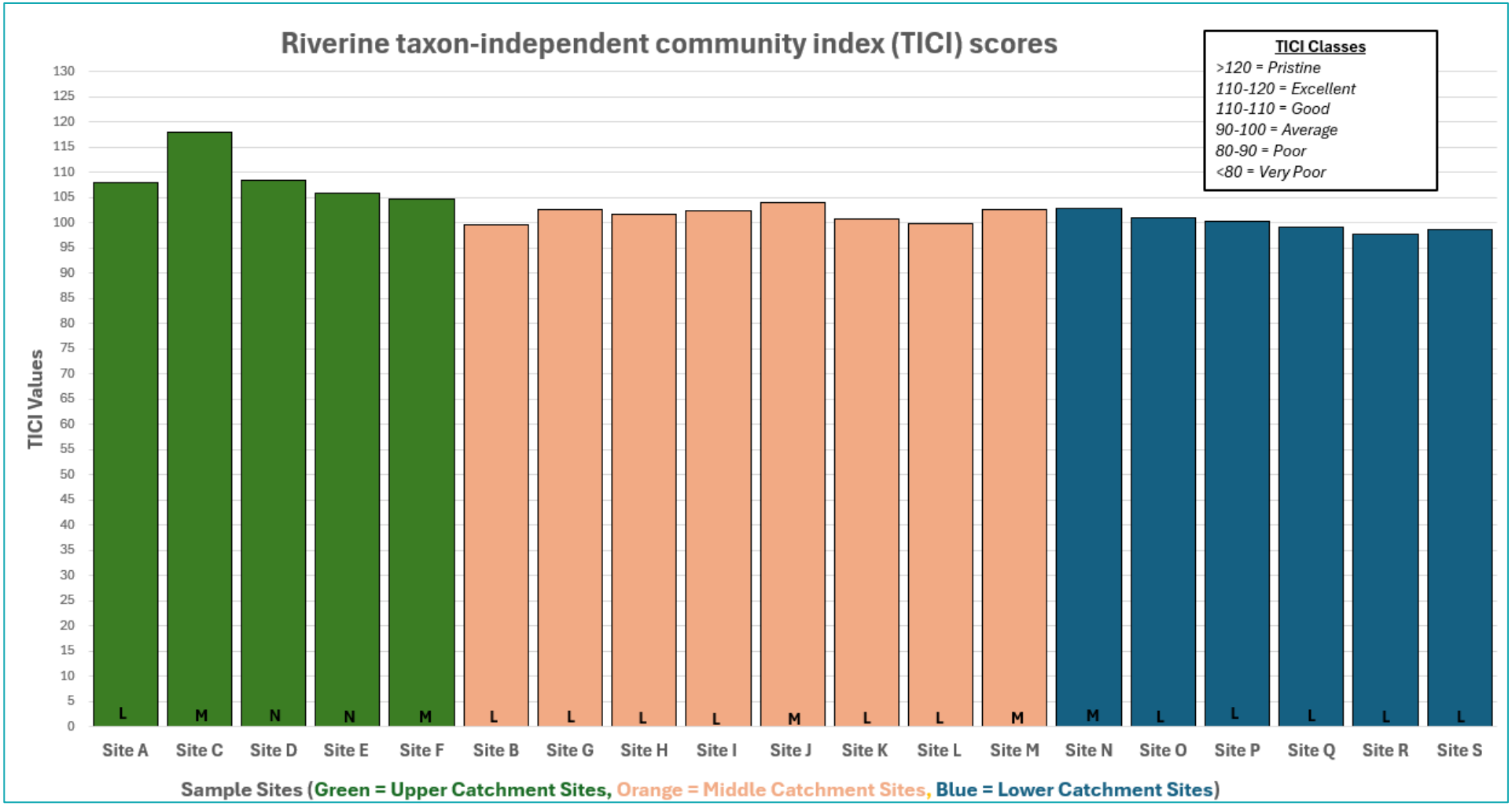

Figure 4. Summary of TICI values (and scores) across the Upper, Middle and Lower Network Sites. Letters M, N or L denote whether the site was in a main or local race or part of a natural stream (Mount Harding Creek).

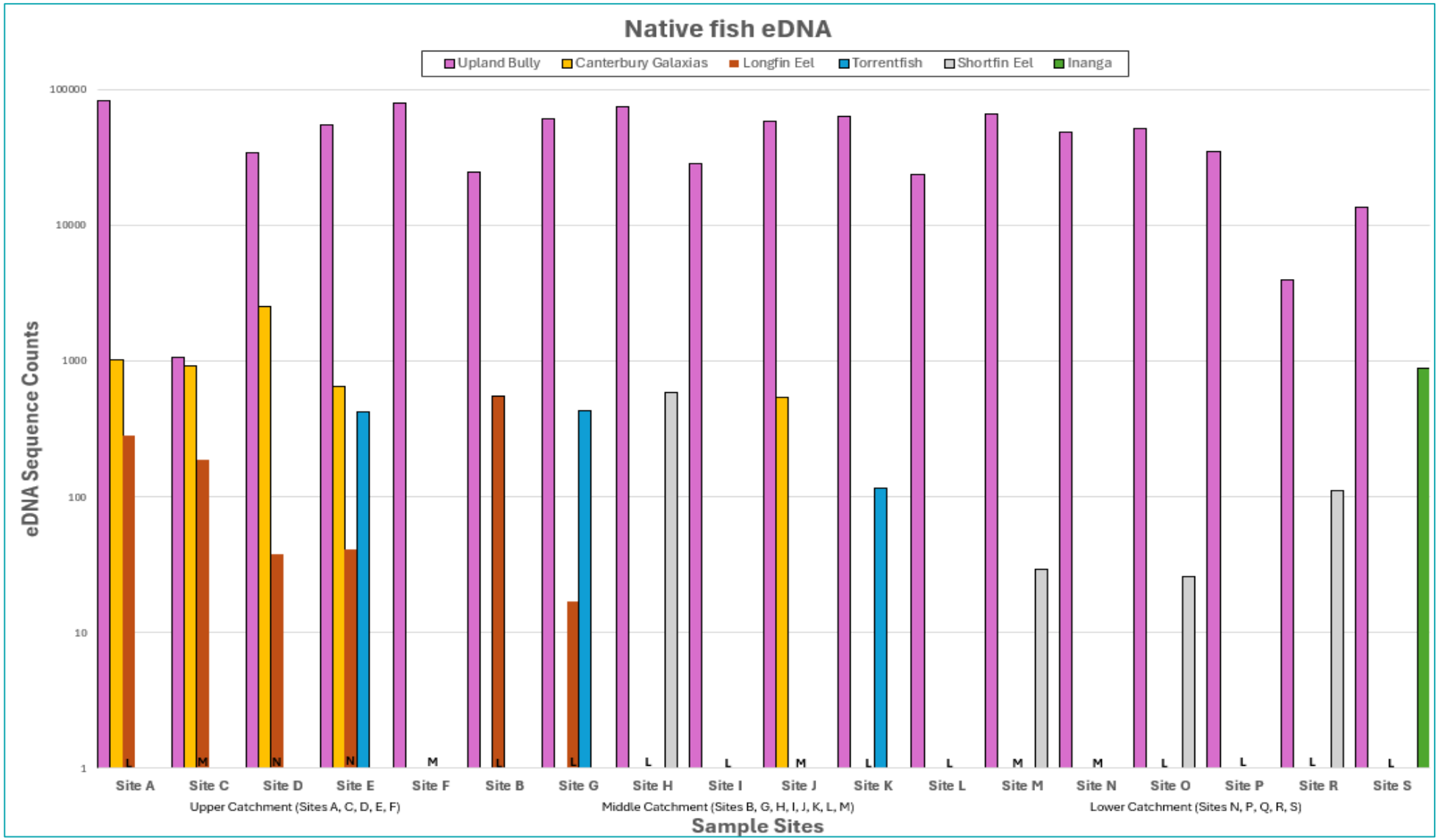

Figure 5. Summary of native fish eDNA detections across the Upper, Middle and Lower Network Sites. Letters M, N or L denote whether the site was in a main or local race or part of a natural stream (Mount Harding Creek).

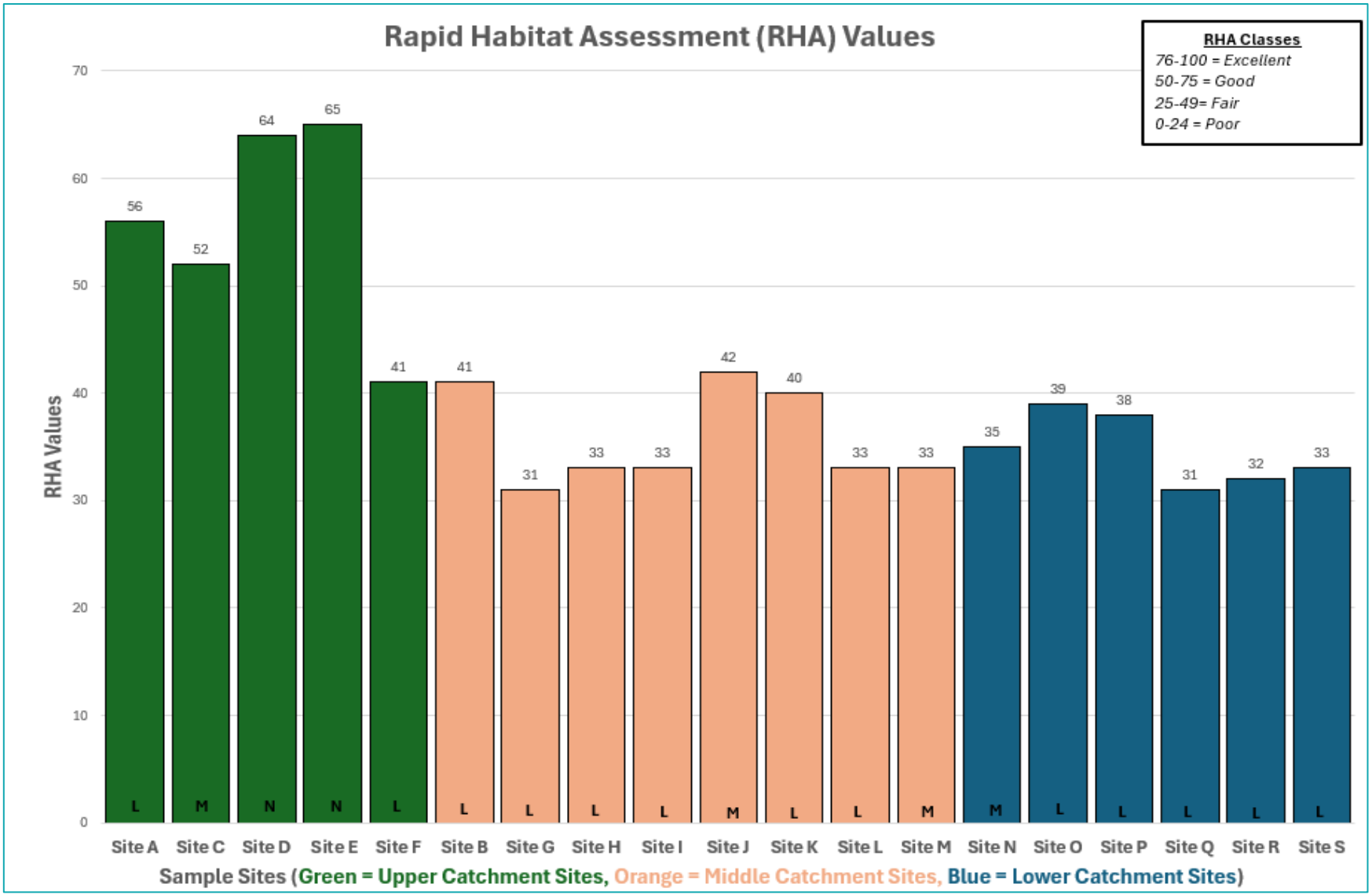

Figure 6. Rapid Habitat Assessment (RHA) values across the Upper, Middle and Lower Network Sites. Letters M, N or L denote whether the site was in a main or local race or part of a natural stream (Mount Harding Creek).

5.3 Key implications on management of race closure

Although the race network is primarily comprised of man-made watercourses designed to convey water for agricultural purposes (outside of the section that also exists as Mount Harding Creek), this assessment has shown that there are moderate to high ecological values present within the network – and that the race network subject to potential closure, supports a range of native fish species such as Canterbury galaxias, Torrentfish, Longfin and Shortfin eel, Inanga and Upland bully.

There may also be some Canterbury Mudfish present (based on assessments made by others (Opus) previously). Despite them not being detected (via eDNA) in any of the races assessed in this one-off survey, there are some areas of the race network having possibly suitable habitat for these species.

A regime of fish salvage and relocation should be undertaken during the programme of works if the races are to be closed, in addition to any other consent requirements that may be determined.

Given the extent of habitat impacted, it is recommended that a fish salvage and relocation plan is developed to effect any closure plan, working in a phased manner with ADC's preferred contractor team during implementation. Because of the scale of the change, engagement with the Department of Conservation and the Ministry for Primary Industries (who part-regulate the 'take' of fish species) is also recommended, as there are additional obligations on the transfer of fish species from this type of network to a receiving waterbody.

5.4 Further Work

5.4.1 Ecological Impact Assessment (EcIA)

Based on the results of this initial assessment of ecological value within the Methven Auxiliary stockwater network, and the conclusions from the Preliminary Planning Assessment[8] previously prepared for the assessment of the Pudding Hill stockwater network in 2024 that highlighted the requirement for the consideration of potential adverse effects (including ecological effects) as a result of the proposed closure of a stockwater race network, a full Ecological Impact Assessment (EcIA) is required to understand the likely impacts on the ecological values (identified in this assessment).

The proposed methodology or mechanism of closure for the race network (or the range of options currently being considered by ADC) will heavily inform this assessment.

[8] Beca. Preliminary Planning Assessment – Pudding Hill Intake. October 2024.

A

Appendix A – Results Analysis Table (Water Quality)

Results Analysis Table - Methven Auxiliary Stockwater Races

Sample Location	Site A	Site C	Site D	Site E	Site F	Site B	Site G	Site H	Site I	Site J	Site K	Site L	Site M	Site N	Site O	Site P	Site Q	Site R	Site S	Assessment Criteria		
Sample Date	4.6.25									10.6.25										ANZG Physical and Chemical Stressor CW/H DGVs [1]	ANZG Physical and Chemical Stressor CD/L DGVs [1]	LWRP Region Wide Water Quality Limit [2]
Catchment Type	Upper					Middle								Lower								
Race Type	Artificial		Natural		Artificial	Artificial								Artificial								
Race Size	Local	Local	Main	Main	Main	Local	Local	Local	Local	Main	Local	Local	Main	Main	Local	Local	Local	Local	Local			
River Environment Classification (REC)	Cool-Wet Hill (CW/H)					Cool-Dry Low Elevation (CD/L)								Cool-Dry Low Elevation (CD/L)								
Lab Number	3908285.1	3908285.3	3908285.4	3908285.5	3908285.6	3908285.2	3908285.7	3908285.8	3908285.9	3913044.1	3913044.2	3913044.3	3913044.4	3913044.5	3913044.6	3913044.7	3913044.8	3913044.9	3913044.1			
Analytical Water Quality Parameters																						
Total Suspended Solids (g/m^3)	**4**	**13**	< 3	**6.0**	**21.0**	**6.0**	**20.0**	**26.0**	**96.0**	**54.0**	**4.0**	< 3	**46.0**	**56.0**	**11.0**	**21.0**	< 3	**7.0**	**3.0**	2.6	2.1	-
Escherichia coli (MPN/100mL)	33	33	76	161	687	249	261	980	1,414	488	140	108	219	238	276	179	158	44	64	-	-	1000
Total Kjeldahl Nitrogen (TKN) (g/m^3)	< 0.10	< 0.10	< 0.10	0.1	0.16	0.1	0.16	0.21	0.45	0.24	0.36	0.42	0.26	0.3	0.29	0.31	0.4	0.48	0.5	-	-	-
Total Phosphorus (g/m^3)	0.005	0.006	0.011	0.01	**0.023**	0.013	**0.029**	**0.037**	**0.149**	**0.086**	**0.03**	**0.045**	**0.072**	**0.096**	**0.048**	**0.069**	**0.046**	**0.09**	**0.081**	0.016	0.014	-
Total Nitrogen (g/m^3)	**0.51**	0.17	**1.13**	**1.1**	**1.12**	0.34	**1.33**	**1.34**	**1.47**	**2.5**	**2.5**	**2.9**	**2.5**	**2.6**	**2.6**	**2.6**	**2.7**	**2.1**	**2.5**	0.238	0.91	-
Total Ammoniacal-N (g/m^3)	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	**0.013**	**0.045**	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	**0.016**	0.142	< 0.010	**0.012**	**0.013**	0.006	0.01	0.05
Nitrite-N (g/m^3)	< 0.002	< 0.002	< 0.002	< 0.002	0.002	0.003	0.005	0.006	0.009	0.004	0.019	0.012	0.007	0.01	0.012	0.012	0.013	0.012	0.014	-	-	-
Nitrate-N (g/m^3)	**0.42**	**0.107**	**1.07**	**1**	**0.95**	0.23	**1.16**	**1.12**	**1.01**	**2.2**	**2.1**	**2.4**	**2.2**	**2.3**	**2.3**	**2.3**	**2.2**	**1.64**	**1.94**	0.087	0.27	-
Nitrate-N + Nitrite-N (g/m^3)	0.43	0.107	1.07	1	0.96	0.23	1.16	1.12	1.02	2.2	2.1	2.4	2.2	2.3	2.3	2.3	2.3	1.65	1.95	-	-	-
Dissolved Reactive Phosphorus (g/m^3)	< 0.004	< 0.004	< 0.004	0.005	< 0.004	0.006	**0.009**	**0.009**	**0.013**	**0.013**	**0.014**	**0.032**	**0.016**	**0.02**	**0.02**	**0.02**	**0.025**	**0.033**	**0.044**	0.008		-
Field Measured Parameters																						
Temperature (^{0}C)	8.9	7.2	7.8	7.9	8.1	7.5	8	8.8	8.3	3.1	3.4	3	4.5	5.2	5	6.2	6.6	7.2	6.6	-	-	-
pH (pH units)	7.8	7.6	**7.3**	7.7	**8.1**	**7.3**	**7.5**	7.9	7.7	**7.91**	7.69	7.6	**8.33**	7.75	**7.85**	**7.93**	**7.86**	7.7	7.7	7.35 - 7.8	7.23 - 7.8	-
Dissolved Oxygen (mg/L)	11.61	12.64	12.43	12.46	13.27	10.82	12.62	12.6	12.06	16.46	16.5	14.06	15.44	15.71	14.68	14.2	14.29	13.28	14.55	-	-	<5
Specific Conductivity (µS/cm)	91.5	77.4	90.9	**97.4**	88.4	91.8	**133.4**	109.3	105.5	105.3	**119.3**	109.3	106.9	107.9	105.6	103.3	102.2	90.8	97.4	95	116	-
Oxidation Reduction Potential (mV)	87.4	87.6	93.7	99.8	107.8	93.8	-47.6	49.2	35.8	37.3	24.5	51.4	53.2	45.9	53.7	49.3	43.2	20.4	37.9	-	-	-
Turbidity (NTU)	**4.38**	**12.8**	**15.3**	**11.7**	**25.8**	0.41	**20**	**15.1**	**27**	**16.9**	**9**	**7.45**	**15**	**24.1**	**16.4**	**33.4**	**10.4**	**19.2**	**10.6**	2.4	1.3	-

Key:

Above ANZG Criteria (bold)

Above LWRP Criteria (red text)

Annotations:

1. The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018). 80th perecentile, River
2. The Canterbury Land and Water Regional Plan (LWRP) region wide water quality limits applied (Schedule 8 - LWRP, 2022).

BDL = Below laboratory limit of detection.

Results Analysis Table: Relative Percentage Difference

Sample Location	Site S	DUP_1	RPD
Sample Date	10.10.24	10.10.24	
Lab Number	3913044.1	3913044.1	
Analytical Water Quality Parameters			
Total Suspended Solids (g/m^3)	3.0	< 3	-
Escherichia coli (MPN/100mL)	64.0	67.0	4.6
Total Kjeldahl Nitrogen (TKN) (g/m^3)	0.5	0.4	19.8
Total Phosphorus (g/m^3)	0.081	0.1	0.0
Total Nitrogen (g/m^3)	2.5	2.4	4.1
Total Ammoniacal-N (g/m^3)	0.013	< 0.010	-
Nitrite-N (g/m^3)	0.014	0.0	7.4
Nitrate-N (g/m^3)	1.94	2.0	1.0
Nitrate-N + Nitrite-N (g/m^3)	1.95	2.0	1.0
Dissolved Reactive Phosphorus (g/m^3)	0.044	0.0	6.6

Average RPD	5.6

B

Appendix B – Full eDNA Dataset

Full eDNA Dataset (Fish and Insects)

Scientific Name	TaxID	Common Name	Group	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I	Site J	Site K	Site L	Site M	Site N	Site O	Site P	Site R	Site S
Gobiomorphus breviceps	300741	Upland bully	Fish	83055	24813	1058	34423	55190	79022	61193	74587	28334	58800	63139	23492	66323	48667	51570	34656	3964	13583
Salmo trutta	8032	Brown trout; taraute; tarauta	Fish	4165	0	1050	24204	51544	928	7083	791	103	12468	0	10	5814	14566	2274	2225	0	0
Rhopalosiphum padi	40932	Bird cherry-oat aphid	Insects	401	2159	66	121	428	788	425	4755	10	1981	1510	120	2580	2652	1455	3443	2315	941
Amblygaster sirm	997022	Northern pilchard	Fish	0	20	0	0	1303	136	2519	432	0	10	78	1921	0	0	0	0	5828	0
Triplectides obsoletus	697963	NZ caddisfly	Insects	1109	0	0	188	5366	62	149	0	0	484	0	0	0	0	0	59	0	0
Galaxias vulgaris	66449	Canterbury galaxias	Fish	1023	0	913	2519	646	0	0	0	0	541	0	0	0	0	0	0	0	0
Acyrthosiphon pisum	7029	Pea aphid	Insects	0	0	0	0	187	91	236	4626	0	221	0	0	0	0	0	0	0	0
Austrosimulium australense	10000005	Sandfly	Insects	1654	0	0	175	564	0	104	0	308	155	0	1051	212	198	0	106	27	0
Myzus ornatus	44658	Ornate aphid; violet aphid	Insects	529	0	0	0	0	92	0	2582	0	0	11	0	22	423	0	0	179	308
Hudsonema alienum	699955	Cased caddisfly	Insects	247	15	144	228	618	37	780	71	24	373	242	0	523	359	223	87	0	0
Aoteapsyche colonica	177870	NZ caddisfly	Insects	803	0	60	743	814	70	347	24	0	225	0	0	205	163	19	44	0	0
Hydropsyche catherinae	1875486	Netspinning caddisfly	Insects	11	0	326	1453	276	188	192	0	30	234	45	0	94	0	0	35	0	0
Coloburiscus humeralis	241031	NZ spinygilled mayfly	Insects	2018	0	0	507	151	20	94	0	0	21	0	0	37	0	0	0	0	0
Hydroptilidae sp. 12KH6B	1877717	Purse-case caddisfly	Insects	312	0	0	91	112	0	85	0	83	47	483	236	0	316	189	327	338	66
Paratanytarsus grimmii	288873	Chironomid	Insects	0	0	0	0	0	147	119	0	167	20	16	0	0	77	293	548	609	151
Cricotopus sp. NZeP20	1667446	NZ mining midge	Insects	1048	0	0	0	41	37	161	0	0	323	23	0	183	65	106	26	0	0
Corynoneura scutellata	611450	Non-biting midge	Insects	21	20	0	0	0	0	74	26	109	21	58	104	61	18	62	122	1051	44
Capitophorus elaeagni	527612	Artichoke aphid	Insects	50	451	0	12	0	0	130	0	101	8	485	0	0	0	121	0	128	0
Forficula auricularia	13068	Common earwig	Insects	9	0	0	0	914	0	174	0	210	0	0	0	0	0	0	9	0	0
Tuberolachnus salignus	96551	Giant willow aphid	Insects	32	0	366	574	239	24	11	0	0	19	0	0	0	0	25	0	0	0
Anguilla dieffenbachii	61127	Longfin eel; tuna; kūwharuwharu; reherehe; kirirua	Fish	285	551	189	38	41	0	17	0	0	0	0	0	0	0	0	0	0	0
Cheimarrichthys fosteri	206139	Torrentfish; panoko; pānokonoko; pānonoko	Fish	0	0	0	0	422	0	431	0	0	0	115	0	0	0	0	0	0	0
Psilochorema bidens	1968986	NZ caddisfly	Insects	406	0	0	96	221	0	0	0	0	10	77	0	47	0	65	41	0	0
Aulacorthum solani	202456	Foxglove aphid	Insects	5	0	572	21	13	29	0	0	23	0	57	0	57	23	17	34	0	28
Galaxias maculatus	61620	Inanga; īnanga	Fish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	876
Myzus persicae	13164	Green peach aphid	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500	0	266	0
Anguilla australis	7940	Shortfin eel; tuna; hao; aopori; hikumutu	Fish	0	0	0	0	0	0	0	590	0	0	0	0	29	0	26	0	110	0
Aploneura lentisci	136345	Root aphid	Insects	0	0	0	0	0	27	0	0	0	702	0	0	0	0	19	0	0	0
Nasonovia ribisnigri	269403	Lettuce aphid	Insects	258	0	0	0	0	0	39	0	116	157	0	0	173	0	0	0	0	0
Neozephlebia scita	551888	Mayfly	Insects	738	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Procladius sp.	3002600		Insects	0	0	0	0	0	0	468	0	0	0	0	0	0	0	0	0	0	0
Pycnocentria evecta	633187	NZ caddisfly	Insects	257	0	137	0	63	8	0	0	0	0	0	0	0	0	0	0	0	0
Wiseana umbraculata	107019	Bog porina	Insects	0	0	0	0	329	0	12	0	0	27	39	0	0	0	0	0	0	0
Sphaeroceridae sp. BOLD:AAV0772	2661057		Insects	0	0	0	0	0	0	0	371	0	0	0	0	0	0	0	0	0	0
Ectopsocus briggsi	322492	Psocopteran fly	Insects	61	0	0	224	0	38	0	44	0	0	0	0	0	0	0	0	0	0
Wiseana copularis	107014		Insects	186	0	0	11	17	0	0	32	36	0	0	0	0	0	51	11	13	0
Drepanosiphum platanoidis	527648	Sycamore aphid	Insects	0	0	0	47	207	23	39	25	10	0	0	0	0	0	0	0	0	0
Brevicoryne brassicae	69196	Cabbage aphid	Insects	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0	0	139	0
Trichoptera sp. 12KH6A	1878438		Insects	102	0	39	79	55	0	18	0	0	0	29	0	0	0	0	0	0	0

Scientific Name	TaxID	Common Name	Group	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I	Site J	Site K	Site L	Site M	Site N	Site O	Site P	Site R	Site S
Olinga feredayi	177813	Hornycased caddisfly	Insects	110	0	70	13	79	0	0	0	0	10	0	0	0	26	0	0	0	0
Lycoriella castanescens	767459		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	307
Oxyethira albiceps	697957	Micro caddisfly	Insects	38	0	0	0	0	36	0	0	0	0	97	0	0	0	65	53	0	0
Deleatidium vernale	1968931	NZ mayfly	Insects	244	0	0	25	0	0	0	0	0	6	0	0	0	0	0	0	0	0
Deleatidium magnum	1968927	NZ mayfly	Insects	0	0	131	0	101	0	41	0	0	0	0	0	0	0	0	0	0	0
Aoteapsyche tipua	599792		Insects	0	0	31	210	12	0	0	0	0	0	0	0	0	0	0	0	0	0
Psilochorema tautoru	2567403	NZ caddisfly	Insects	245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephydridae sp.	2938421		Insects	47	0	0	25	0	0	59	76	0	0	0	0	0	0	0	9	0	26
Pleioplectron sp. PL63knd1	2341100		Insects	22	0	0	54	140	0	0	0	0	23	0	0	0	0	0	0	0	0
Wiseana cervinata	107013	Porina moth	Insects	0	0	0	0	0	7	28	63	105	14	0	0	0	0	12	0	0	0
Oeconesus maori	177761	NZ caddisfly	Insects	209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudolycoriella tonnoiri	2664624	Fly	Insects	0	0	0	16	175	0	0	0	0	0	0	0	0	0	0	0	0	0
Liposcelis decolor	209926	Booklouse	Insects	0	0	0	0	0	0	0	0	0	0	171	0	0	0	0	0	0	0
Exapion sp.	2944792		Insects	0	0	0	0	170	0	0	0	0	0	0	0	0	0	0	0	0	0
Zelandobius furcillatus	1777204	Stonefly	Insects	0	0	0	86	74	0	0	0	0	5	0	0	0	0	0	0	0	0
Veliidae sp.	3078955		Insects	0	0	0	0	0	0	0	0	0	43	0	49	73	0	0	0	0	0
Smittia sp. 8ES	1473756		Insects	0	0	0	0	55	0	0	16	18	0	45	0	12	14	0	0	0	0
Diptera sp.	2922255		Insects	0	0	0	0	0	0	0	0	0	67	36	0	7	0	46	0	0	0
Myzus ascalonicus	51993	Shallot aphid	Insects	0	0	0	0	0	43	0	35	24	0	0	43	0	0	9	0	0	0
Hydrobiosis clavigera	1875463	Caddisfly	Insects	128	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0
Scaptomyza flava	928822	Turnip leafminer	Insects	0	0	0	0	15	0	55	0	43	16	0	0	0	0	12	0	0	0
Bradysia pallipes	1313105		Insects	0	0	0	0	20	0	41	0	0	47	10	0	0	0	0	0	18	0
Archichauliodes diversus	1763602	NZ dobsonfly; puene	Insects	0	0	0	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bryophaenocladius sp. 8ES	1721116	Non-biting midge	Insects	0	0	0	0	31	0	0	31	14	0	0	0	0	0	0	18	36	0
Hudsonema amabile	699956	Long-horned caddisfly	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	28	58	40	0	0
Hydropsyche tepoka	1875516	Netspinning caddisfly	Insects	0	0	0	57	45	9	0	9	0	0	0	0	0	0	0	0	0	0
Rhopalosiphum nymphaeae	253253	Waterlily aphid	Insects	0	0	0	0	0	0	0	0	0	0	0	9	0	0	108	0	0	0
Hydora sp.	3050713		Insects	41	0	49	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0
Triplectides cephalotes	144281	Caddisfly	Insects	0	24	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	5
Vanessa itea	311058	Yellow admiral	Insects	93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0
Orfelia nemoralis	1588145	Fungus gnat	Insects	0	0	0	0	0	0	0	0	50	0	0	0	0	0	14	36	0	0
Geometridae sp.	2795337		Insects	0	0	0	0	0	0	14	0	31	0	0	9	29	9	0	0	0	0
Pleioplectron thomsoni	2735427		Insects	87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pterocomma pilosum	198314		Insects	0	0	0	0	0	0	0	0	83	0	0	0	0	0	0	0	0	0
Jacksonia papillata	527711		Insects	0	0	0	0	5	23	16	0	0	10	0	11	7	0	0	0	10	0
Megadromus antarcticus	571953		Insects	0	0	0	0	0	0	0	0	24	0	0	0	0	54	0	0	0	0
Isoplectron armatum armatum	3114791		Insects	77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Merophyas divulsana	1375107	Lucerne leaf roller	Insects	0	0	0	0	0	0	0	0	0	0	44	0	0	27	0	0	0	0
Lipaphis pseudobrassicae	511022		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0
Lepidoptera sp. NZAC 03012277	1597328		Insects	0	26	0	0	0	16	0	0	12	0	0	0	0	13	0	0	0	0
Acyrthosiphon kondoi	34664	Blue alfalfa aphid	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	0
Psyllopsis fraxinicola	1585347	Jumping plant lice	Insects	0	0	0	0	62	0	0	0	0	0	0	0	0	0	0	0	0	0
Lonchoptera bifurcata	385268		Insects	0	0	0	0	0	0	31	9	0	0	0	0	21	0	0	0	0	0

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Hudsonema sp. NZCAD669	1969062	Cased caddisfly	Insects	0	0	0	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0
Powellia bifida	3033065		Insects	0	0	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Proteuxoa tetronycha	3056926		Insects	0	0	0	0	56	0	0	0	0	0	0	0	0	0	0	0	0	0
Pycnocentrodes aureolus	633183	Caddisfly	Insects	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanytarsus sp. EJD-2015	1763607	Non-biting midge	Insects	0	0	0	0	0	21	22	0	0	5	0	0	0	6	0	0	0	0
Chloroclystis filata	1371973	Filata moth	Insects	0	0	0	0	46	0	0	0	0	0	0	0	0	0	0	7	0	0
Cionus sp. 2 ZM-2022a	2920723		Insects	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0
Endrosis sarcitrella	1073585	White-shouldered house moth	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52	0
Arytaina genistae	178938		Insects	12	0	0	23	15	0	0	0	0	0	0	0	0	0	0	0	0	0
Caeciliusidae sp.	2938376		Insects	0	0	0	8	0	17	0	0	0	24	0	0	0	0	0	0	0	0
Cinara tujafilina	198323	Cypress pine aphid	Insects	0	0	0	0	0	0	0	0	0	48	0	0	0	0	0	0	0	0
Brachycaudus helichrysi	330452	Leaf curl plum aphid	Insects	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	0	0	0
Zelandoperla agnetis	143713	Stonefly	Insects	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0
Zelandobius pilosus	1921466	Stonefly	Insects	0	0	0	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sitobion fragariae	44665	Blackberry-cereal aphid	Insects	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0	0	0	0
Schrankia costaestrigalis	411963	Pinion-streaked snout	Insects	0	0	0	0	0	0	0	0	0	38	0	0	0	0	0	0	0	0
Costachorema xanthopterum	697976	Caddisfly	Insects	0	0	0	24	0	13	0	0	0	0	0	0	0	0	0	0	0	0
Nyctemera annulata	2170630		Insects	0	0	0	0	0	0	0	0	0	0	0	0	16	0	20	0	0	0
Declana leptomera	1007355		Insects	0	0	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0
Liriomyza chenopodii	1659329		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0
Costelytra zealandica	50579	Grass grub	Insects	0	0	0	0	0	0	0	0	27	0	0	0	0	5	0	0	0	0
Pollenia pediculata	1266492		Insects	0	0	0	0	0	0	0	0	23	0	0	0	9	0	0	0	0	0
Psychoda sp. BIOUG22048-B12	2411555	Drain fly	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0	0
Stephanitis pyrioides	369450	Azalea lace bug	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	31	0	0	0	0
Xanthocnemis zealandica	481685	Red damselfly	Insects	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0
Mayetiola destructor	39758	Hessian fly	Insects	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0
Anisodactylus binotatus	247341		Insects	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capua dura	1371741		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0
Psylla apicalis	2044778		Insects	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epiphyas postvittana	65032	Light brown apple moth	Insects	0	0	0	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0
Dysaphis aucupariae	1425391	Aphid	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	21	0
Xanthorhoe semifissata	3069135		Insects	0	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0	0	0
Deleatidium sp. DI_S24_10	1814511	Mayfly	Insects	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0
Psychoda sigma	2680904		Insects	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0
Propsocus pulchripennis	1476843	Damp barklouse	Insects	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	0	0
Symmetrischema tangolias	1216959	South American potato tuber moth; Andean potato tuber moth; tomato stemborer	Insects	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0
Hygraula nitens	1374232	Australian water moth	Insects	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Psocoptera sp. BOLD:AAY6680	1646931		Insects	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0
Eurhopalus vespulae	3044625		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0
Hydrellia tritici	504561	Shore fly	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	6
Trioxys sunnysidensis	2340088	Parasitoid wasp	Insects	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0

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Oniscigaster distans	309670	Mayfly	Insects	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0
Phoridae sp. BOLD:AAU5541	2660288		Insects	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0
Lucida lucia oebasus	2867879		Insects	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0
Sitona discoideus	430899	Lucerne weevil	Insects	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0
Ptenidium pusillum	878394		Insects	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0
Culex quinquefasciatus	7176	Southern house mosquito	Insects	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Palpita vitrealis	1858049	Jasmine moth	Insects	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomus sp.	7152		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
Glyphipterix simpliciella	1405621		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
Contarinia jongi	1846296		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0
Anacharis zealandica	44355		Insects	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
Powellia vitreoradiata	1950761		Insects	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
Coccinella undecimpunctata	185878	Eleven-spotted ladybird beetle	Insects	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gobiomorphus	86236	Bullies	Fish	40590	42966	5715	20905	64070	32468	37502	50682	34258	25617	44094	9216	27448	63369	28212	22958	1272	9578
Chironomus	7150	Midges	Insects	1113	163	0	410	346	630	131	44	0	101	142	89	251	358	229	459	3102	13
Deleatidium	551873	NZ mayfly	Insects	641	0	7	327	610	10	201	42	0	356	156	7	241	178	45	17	0	0
Galaxias	51242	Galaxiids	Fish	1365	0	0	0	0	0	0	0	697	0	0	0	0	0	0	0	0	0
Aulacorthum	202455	Foxglove aphid	Insects	0	0	1986	0	7	0	0	0	0	0	5	0	16	0	0	0	0	0
Hydrobiosis	697982	NZ Caddisfly	Insects	533	0	0	238	129	0	0	0	67	370	89	0	154	151	0	0	0	0
Lycoriella	170626		Insects	0	0	0	0	32	0	0	6	0	0	0	0	0	0	0	0	6	1589
Ectopsocus	239222	Psocopteran fly	Insects	0	0	0	0	111	508	534	0	108	20	0	12	0	0	0	0	0	0
Pycnocentrodes	177810	Stony cased caddisfly	Insects	273	0	84	38	46	0	0	0	0	88	0	0	111	0	0	17	0	0
Limnophyes	190098	Non-biting midge	Insects	0	80	0	0	81	9	29	0	17	0	0	38	0	27	86	14	71	12
Drepanepteryx	560897		Insects	0	11	149	189	0	0	0	23	0	0	0	0	0	0	0	0	0	0
Costachorema	697968	Caddisfly	Insects	0	0	0	236	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmo	8028	Trout; taraute	Fish	0	100	0	0	124	0	0	0	0	0	0	0	0	0	0	0	0	0
Amblygaster	392304	Pilchards	Fish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	178	0
Pieris	7115		Insects	14	0	0	0	0	19	0	86	40	0	0	0	0	0	0	0	0	0
Hydropsyche	50443	Netspinning caddisfly	Insects	0	0	0	40	0	31	0	0	0	0	0	0	18	40	9	0	0	0
Brachycaudus	224525	Aphid	Insects	0	0	0	62	0	0	24	36	0	0	13	0	0	0	0	0	0	0
Izatha	1073642	NZ small lichen moth	Insects	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	55	0	0
Rhopalosiphum	40931	Aphid	Insects	39	0	0	0	0	0	0	0	0	49	0	0	43	0	0	0	0	0
Zelandobius	466846	Stonefly	Insects	0	0	104	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apis	7459	Honeybee	Insects	0	0	96	0	0	0	0	0	0	0	0	0	7	11	0	0	0	0
Cortinicara	295910		Insects	0	0	0	0	0	0	0	0	0	0	0	10	90	0	0	0	0	0
Ctenopseustis	65023	Brownheaded leafroller moth	Insects	0	0	0	0	0	0	44	0	0	0	0	0	15	26	0	0	0	0
Phytomia	1463626		Insects	0	0	0	0	0	0	0	0	0	0	0	0	84	0	0	0	0	0
Cavariella	330420		Insects	0	0	0	0	0	0	0	0	79	0	0	0	0	0	0	0	0	0
Hudsonema	699954	Cased caddisfly	Insects	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ablabesmyia	46216		Insects	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	0	0	0
Sigara	446485	Waterboatmen	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	0
Pnyxia	1781626		Insects	0	0	0	0	39	0	0	0	0	0	0	0	0	0	0	0	0	0
Alloxysta	154054		Insects	0	0	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Polyplectropus	600663	Caddisfly	Insects	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sitona	122856		Insects	0	0	0	0	0	0	0	0	0	31	0	0	0	0	0	0	0	0
Philaenus	30087		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0
Elachista	315910		Insects	11	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0
Amischa	347263		Insects	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0
Melangyna	414825		Insects	0	0	0	0	0	0	0	11	0	14	0	0	0	0	0	0	0	0
Diolcogaster	64874		Insects	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Culex	53527		Insects	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0
Acrotrichis	280319		Insects	0	0	0	7	0	0	15	0	0	0	0	0	0	0	0	0	0	0
Trichocera	52759		Insects	0	0	0	0	0	0	0	0	5	0	0	13	0	0	0	0	0	0
Lipaphis	223994		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0
Smittia	315559	Flies	Insects	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0
Chironomus	72537		Insects	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calliphora	7372		Insects	0	9	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
Micromus	186121		Insects	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0
Coloburiscus	241030	Mayfly	Insects	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mocyta	619408		Insects	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0
Eupithecia	214137	Introduced moth	Insects	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0
Aptinothrips	1291242		Insects	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0
Pleioplectron	912341		Insects	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
Psychoda	7201	Drainfly; mothfly	Insects	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0
Helophilus	226173		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Aphidinae	133076		Insects	995	61	2242	78	1000	178	404	842	9	1042	1696	2250	1474	946	1720	1374	607	1292
Chironomidae	7149	Nonbiting midges	Insects	3359	31	0	685	889	693	957	103	153	864	220	0	723	381	386	247	0	31
Simuliidae	7190	Blackflies	Insects	990	2490	0	0	0	0	235	0	0	200	88	0	51	76	0	0	0	0
Syrphidae	34680	Drone flies	Insects	0	0	0	0	0	0	0	0	12	19	0	0	1667	0	0	0	24	0
Salmonidae	8015	Salmonids	Fish	0	0	0	158	196	0	0	0	0	164	0	0	0	0	0	795	0	0
Simuliinae	43813		Insects	320	18	0	7	64	0	0	0	0	0	25	87	8	0	0	0	0	0
Aphididae	27482	Aphids	Insects	23	10	55	0	12	14	9	286	22	23	8	0	9	0	0	19	0	5
Trichoceridae	52747	Winter crane flies	Insects	0	0	0	101	0	0	0	96	133	0	0	0	0	0	0	0	48	90
Sciaroidea	41830		Insects	0	0	0	0	52	0	0	0	7	15	0	0	0	0	0	0	0	227
Veliidae	95677	Small water striders	Insects	0	0	0	247	0	0	0	0	0	0	0	0	0	0	44	0	0	0
Orthocladiinae	43808		Insects	56	0	0	5	0	13	0	0	0	91	0	8	18	11	0	0	26	18
Oecophoridae	57992	Concealer moths	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73	0
Sciaridae	7184	Black fungus gnats	Insects	0	0	0	0	20	0	0	0	5	19	0	0	16	0	0	6	0	0
Sphaeroceridae	114620	Small dung flies	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	0
Psychodidae	7197	Sandflies and mothflies	Insects	5	5	0	24	19	0	0	0	0	0	0	0	0	0	0	0	0	0
Diamesinae	43807		Insects	32	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salmoninae	504568	Salmon and trout	Fish	0	0	0	0	0	0	0	0	0	0	0	0	41	0	0	0	0	0
Hydroptilidae	57995	Purse casemaker caddisflies	Insects	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	0
Philopotaminae	177894	Caddisflies	Insects	0	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutelinae	7062	Shining leaf chafers	Insects	0	0	0	13	0	0	0	0	13	0	0	0	0	0	0	0	0	0
Thripidae	45053	True thrips	Insects	0	0	0	0	0	0	0	9	9	0	0	0	0	0	0	0	0	6
Culicidae	7157	Mosquitos	Insects	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0

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Tanypodinae	43810		Insects	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cecidomyiidae	33406	Gall midges	Insects	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0
Braconidae	7402		Insects	0	0	0	0	0	0	0	0	0	0	13	0	5	0	0	0	0	0
Staphylinidae	29026	Rove beetles	Insects	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
Chironominae	54970		Insects	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tipulidae	41042	Crane flies	Insects	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0
Miridae	30083	Leaf bugs	Insects	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0
Cercopoidea	33366		Insects	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0
Coenagrionidae	70895	Narrow-winged damselflies	Insects	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
Dixidae	41824	Dixid midges	Insects	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemiptera	7524		Insects	613	0	370	1654	1324	174	596	164	489	696	12	93	196	568	236	911	8	38
Trichoptera	30263	Caddisflies	Insects	530	189	241	578	233	7	9	70	61	1139	634	50	421	340	134	543	5	5
Diptera	7147	Flies	Insects	565	45	0	158	234	45	118	253	21	236	176	155	424	164	101	67	119	177
unclassified Limnophyes	2640025		Insects	247	87	0	0	202	40	739	175	164	73	94	157	163	213	157	148	116	201
unclassified Deleatidium	2617549	Mayflies	Insects	256	0	204	135	398	0	119	47	0	194	70	0	120	14	10	0	0	0
Lepidoptera	7088	Butterflies and moths	Insects	78	0	0	128	98	53	0	57	31	58	0	0	53	23	80	0	35	15
Ephemeroptera	30073	Mayflies	Insects	160	0	308	154	34	7	0	0	0	25	0	0	13	0	0	0	0	0
unclassified Trichoceridae	1577619		Insects	0	0	0	0	0	0	0	0	0	0	48	274	53	0	0	0	0	0
Macrosiphini	33386		Insects	0	0	221	12	0	0	0	116	0	0	0	6	0	0	7	0	0	0
Psocoptera	30259	Booklice and barklice	Insects	0	0	0	0	33	90	131	75	8	0	0	0	0	0	0	0	0	0
Gobiiformes	1489878	Gobies and sleepers	Fish	0	0	0	0	38	0	0	0	0	0	0	0	0	0	214	0	0	0
unclassified Cecidomyiidae	329961		Insects	0	0	0	50	0	0	10	8	23	79	12	0	26	0	0	0	6	0
Coleoptera	7041	Beetles	Insects	0	0	0	83	5	0	8	21	12	0	0	0	0	69	11	0	0	0
Athetini	619357		Insects	0	0	0	0	0	0	0	0	43	102	0	0	0	0	5	0	0	0
Plecoptera	50622	Stoneflies	Insects	0	0	0	0	65	0	0	0	0	0	0	0	0	0	0	62	0	0
Endopterygota	33392		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	106
unclassified Trichoptera	473556	Caddisflies	Insects	21	0	0	0	59	0	10	0	0	0	8	0	0	0	0	0	0	0
Neoptera	33340	Winged insects	Insects	0	0	0	0	18	0	8	0	0	0	28	9	0	0	17	0	0	0
unclassified Smittia	2638258		Insects	0	6	0	0	14	0	0	0	0	0	0	0	21	0	0	25	8	0
Orthoptera	6993	Grasshoppers locusts and crickets	Insects	0	0	0	0	0	0	0	0	0	10	0	0	0	26	26	0	0	0
Calyptratae	43742		Insects	0	0	0	0	0	0	0	0	0	14	0	0	16	0	0	29	0	0
unclassified Hydroptilidae	1106121	Caddisflies	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	0
unclassified Veliidae	411051		Insects	0	0	0	0	0	0	58	0	0	0	0	0	0	0	0	0	0	0
unclassified Austrosimulium	1665017		Insects	0	0	0	0	0	0	0	0	0	49	0	0	0	0	0	0	0	0
Ditrysia	37567		Insects	12	0	0	6	0	0	0	0	0	0	7	0	0	15	0	0	0	0
Hydropsyche incertae sedis	3395254		Insects	0	0	0	0	0	0	0	37	0	0	0	0	0	0	0	0	0	0
unclassified Dolichogenidea	2630112		Insects	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
unclassified Cricotopus	2639155		Insects	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eremoneura	480118		Insects	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0
unclassified Cortinicara	2624113		Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0
Blattodea	85823	Cockroaches	Insects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0
Hymenoptera	7399	Hymenopterans	Insects	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
unclassified Aphidinae	666137		Insects	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0

C

Appendix C – Site Photos (Rapid Habitat Assessment)

Site Name	Site Photos
Site A	 
Site B	 

Site C

Site D

Site E

Site F

Site G

Site H

Site I

Site J

Site K

Site L

Site M

Site N

Site O

Site P

Site Q

Site R

Site S