

Macraes Phase 4 Fast-track

Invertebrate Values Assessment

for: OceanaGold New Zealand Limited



Document Approval and Revision History

Document title	Macraes Phase 4 Fast-track
	Invertebrate Values Assessment
Prepared for	OceanaGold New Zealand Limited
Version	Final
Date	20 August 2026
Filename	E3_MP4Fast_Invertebratevaluesassessment_Rev 0

Author(s)	D. van Winkel Senior Ecologist
Reviewer(s)	Chris Wedding Ecology Manager

Rev. no.	Date	Author(s)
Final	20 August 2026	D. van Winkel

Reference: Bioresearches (2026). Invertebrate Values Assessment. Report for OceanaGold New Zealand Limited. 187 p.

Cover Illustration: New Zealand red admiral butterfly (*Vanessa gonerilla gonerilla*), Macraes, Otago.

Disclaimer

This document has been produced for New Zealand consenting purposes only. Information contained herein must not be relied on for investment purposes.

Table of Contents

Document Approval and Revision History.....	i
Table of Contents	ii
List of abbreviations	5
Executive summary.....	7
1 Introduction	9
1.1 Purpose and scope.....	9
2 Macraes Phase Four Project.....	11
2.1 Site location and description	11
3 Methods	19
3.1 Survey areas.....	19
3.2 Literature review and desktop assessment	19
3.3 Invertebrate surveys.....	20
3.4 Ecological value and ecological significance assessments	28
4 Invertebrate survey results	30
4.1 Literature review and desktop assessment	30
4.2 Field survey results	35
5 Ecological value and ecological significance assessments	60
6 Summary of invertebrate values	76
7 References	77
Applicability and Limitations.....	79

List of Tables

Table 1.1. Ecology documents prepared for the proposed Macraes Phase 4 Project. Current document highlighted.....	10
Table 2.1. MP4 Project Areas, showing the extent of the Area footprint, the extent of suitable invertebrate habitat Directly and Indirectly impacted by the project for both areas that are Unconsented (those requiring consent under MP4 Fast Track) and Consented (those with existing resource consents).	18
Table 3.1. Terrestrial invertebrate survey periods and sampling effort across the Project area between April 2022 and March 2026.	20
Table 4.1. Occurrence records for species, with NZTCS listings, recorded in the GBIF database. 'Threatened', 'At Risk', and 'Data Deficient' are highlighted in red.....	33
Table 4.2. High level results of moth sampling undertaken on OGNZL landholdings over February to April 2026.....	44
Table 4.3. Locations at which 'At Risk' and 'Data Deficient' moth species were detected during the February to April 2026 moth survey.	45
Table 4.4. eDNA sampling results for insects, showing the number of records for each rank.	48
Table 4.5. Threatened', 'At Risk', and 'Data Deficient' invertebrate species reported from OGNZL Macraes landholdings.	50
Table 4.6. Broad habitat types identified in the MP4 Project impact area. All habitat types considered suitable for invertebrates.....	56

Table 4.7. Areal (ha) extents of each identified habitat type within the MP4 Project area (includes impact area + 20 m buffer).....	59
Table 5.1. Assessment of ecological value for invertebrate communities/ habitat within the MP4 Project Areas only.	61
Table 5.2. Ecological value for ‘Threatened’, ‘At Risk’, ‘Data Deficient’, and other notable invertebrates present in the MP4 Project area, as per the EIANZ EclA Guidelines.	68
Table 5.3. Assessment of invertebrate values in each of the Project areas against the National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB) significance criteria.	73
Table 5.4. Assessment of invertebrate values in each of the Project Areas against the Otago Regional Policy Statement 2021 (ORPS 2021) significance criteria.	74
Table 5.5. Assessment of invertebrate values in each of the Project Areas against the Waitaki District Plan significance criteria.	75

List of Figures

Figure 2.1. Existing site layout at the Macraes Operation (as of July 2026). Figure supplied by OceanaGold.	13
Figure 2.2. MP4 Overview Plan (as of July 2026). Figure supplied by OceanaGold.	15
Figure 3.1. Heath moth traps set up in Golden Bar WRS; left, and the Macraes Road Realignment; right.	22
Figure 3.2. Ecologist undertaking sweep netting.	24
Figure 4.1. Taxonomic distribution of occurrences for Arthropods from the GBIF database (n = 1077 records within 10 km of the MP4Fast Project area). Source: GBIF.	32
Figure 4.2. Composition of invertebrate taxonomic orders (and subclass Acari) and number of specimens sampled across all surveyed areas in April and May 2022.	36
Figure 4.3. Images of some Lepidoptera (moths) and larger Coleoptera (beetles) encountered during the survey of the MP4 Project.	38
Figure 4.4. Invertebrate community composition across the survey areas using sweep netting methods in April and May 2022.	39
Figure 4.5. Invertebrate community composition across the survey areas using moth light trapping methods in April and May 2022. Numbers shown in bars represent the sample size for each taxonomic group.	40
Figure 4.6. Moth abundance at RHIMSPIM, BRWRS, and in ecological covenants (Island Block Covenant, Cranky Jims Creek Ecology Covenant, and Highlay Creek Ecology Covenant) on OGNZL Macraes landholdings in September 2022.	41
Figure 4.7. Moth fauna composition (to level of Superfamily [SF] or Family [F]) recorded at RHIMSPIM, BRWRS, and in ecological covenants (Island Block Covenant, Cranky Jims Creek Ecology Covenant, and Highlay Creek Ecology Covenant) on OceanaGold Macraes landholdings in September 2022.	41
Figure 4.8. Images of notable terrestrial invertebrates found during surveys on OGNZL landholdings between 2022 and 2026. Upper central: Otago ground wētā. Lower left: putative new species of <i>Mecodema</i> “Oamaru”; lower right: <i>Megadromus bullatus</i> . Images by D. van Winkel.	47
Figure 4.9. ‘Threatened’, ‘At Risk’, and ‘Data Deficient’ species recorded on OGNZL landholdings between 24 February and 4 April 2026. No images available for <i>Pasiphila</i> sp. A (NZAC 04285480 “Carmichaelia”) and <i>Zelandobius uniramus</i>	54
Figure 4.10. A selection of photographs of showing the identified habitat types within the MP4 Project area.	58

List of Appendices

- Appendix A Deepdell North III invertebrate list (Thorsen 2019)
- Appendix B Taxonomic inventory of invertebrates recorded during surveys in April and May 2022 in the MP4 Project area, Macraes.
- Appendix C Taxonomic inventory of Lepidoptera recorded during moth light trapping on OceanaGold Macraes landholdings (including several covenants) in September 2022.
- Appendix D Moth species recorded during targeted searches for *Orocrambus sophistes* in April to May 2025
- Appendix E Moth species recorded during surveys between February and April 2026
- Appendix F Invertebrates recorded during hand searching efforts over February and March 2026
- Appendix G eDNA Insecta results provided by Viridis, via Wilderlab, April 2026
- Appendix H EIANZ key tables for assessing level of effect
- Appendix I April to May 2025 moth survey maps (Bauckham 2025)
- Appendix J Overview invertebrate survey map: 2022 – 2026 survey efforts

List of abbreviations

Abbreviation	Full term
ACO	Artificial Cover Object
BRWRS	Back Road Waste Rock Stack
CCP2	Continuity Consents Project Stage 2
CMR	Capture-mark-recapture
CO6	Coronation 6 Pit
CPUE	Catch per unit effort
DOC	Department of Conservation
EcIA	Ecological Impact Assessment
ED	Ecological District
EIANZ	Environment Institute of Australia and New Zealand
FTAA	Fast-track Approvals Act 2024
FTSF	Frasers Tailings Storage Facility
FTSF3	Frasers Tailings Storage Facility Stage 3
FWFD	Frasers West French Drain
FWWRS	Frasers West Waste Rock Stack
GB	Golden Bar
GB HR	Golden Bar Haul Road
GB2-3	Golden Bar Pit Extension (Stages 2–3)
GBWRS	Golden Bar Waste Rock Stack (Extension)
GIS	Geographic Information System
GPUG	Golden Point Underground (mine expansion)
ha	Hectare
IMMP	Invertebrate Management and Monitoring Plan
MEEA	Murphys Ecological Enhancement Area
MP4	Macraes Phase 4 Project
MRR1	Macraes Road Realignment Stage 1
MRR2	Macraes Road Realignment Stage 2
MTI	Mixed Tailings Impoundment
MWMS	Mine Water Management System
n/a	Not applicable
NPS-IB	National Policy Statement for Indigenous Biodiversity 2023
NZTCS	New Zealand Threat Classification System
NZTM	New Zealand Transverse Mercator
OGNZL	OceanaGold (New Zealand) Limited
ORPS	Otago Regional Policy Statement
PC	Project component
QEII	Queen Elizabeth II [National Trust]
RMA	Resource Management Act
RTCS	Regional Threat Classification System
SP10	Southern Pit Option 10 Tailings Storage Facility
SP11	Southern Pit Option 11A Tailings Storage Facility
TSF	Tailings Storage Facility
VES	Visual encounter search(es)

Abbreviation	Full term
WDP	Waitaki District Plan 2010
WRS	Waste Rock Stack

Executive summary

This report presents an assessment of invertebrate values associated with the proposed Macraes Phase 4 Project (MP4 Project or the Project) at the OceanaGold (New Zealand) Limited (OGNZL) Macraes Operation, Otago. The assessment was undertaken to identify invertebrate species present within the Project area, describe invertebrate habitats and communities, and assess ecological value and significance in accordance with the Environment Institute of Australia and New Zealand Ecological Impact Assessment (EclA) guidelines and relevant policy frameworks.

The overall MP4 Project area extends over several hundreds of hectares of land within the OGNZL landholdings, across several mining and infrastructure development areas, together with proposed ecological mitigation areas within the wider Murphys Creek catchment. The Project area comprises land for which resource consents are required under the FTAA for mining and associated activities (approximately 440 ha), and land that is already consented under existing resource consents, but where mine development has not yet been undertaken (approximately 345 ha).

Targeted invertebrate investigations were undertaken between April 2022 and March 2026 and included literature and database reviews, sweep-netting, hand searching, moth light trapping, targeted Lepidoptera investigations, and environmental DNA (eDNA) sampling. The assessment identified a diverse terrestrial invertebrate fauna across OGNZL landholdings. Historical records, contemporary field surveys, and eDNA analyses collectively confirmed the presence of a broad range of native invertebrate taxa, including numerous moths, beetles, spiders, true bugs, caddisflies, stoneflies, orthopterans, and other arthropod groups.

Moth surveys represented the most detailed component of the assessment, due to the potential occurrence of 'Threatened' and 'At Risk' species. Sampling undertaken between February and April 2026 alone recorded 720 individuals representing 24 families and 209 distinctive taxa.

The assessment also confirmed the presence of several notable invertebrate species of conservation interest within OGNZL landholdings, including 14 species listed as 'Threatened', 'At Risk', and 'Data Deficient' under the New Zealand Threat Classification System (NZTCS) listings. Other nationally significant species recorded historically from the wider Macraes Ecological District (Macraes ED) were either not detected during current surveys or are associated with habitats that are absent or uncommon within the Project footprint.

Suitable invertebrate habitat is distributed throughout the Project area and is primarily associated with indigenous tussock grasslands, shrublands, schist outcrops, riparian margins, wetlands, and areas of indigenous vegetation. Habitat quality and ecological value vary across the Project area, with the highest values generally associated with less-modified indigenous habitats that support greater structural diversity and native plant species richness.

Overall, the Project area supports indigenous terrestrial invertebrate communities that are characteristic of the wider Macraes landscape, including species with high ecological value. While several species of conservation interest occur within OGNZL landholdings, most recorded species are widespread and there was no evidence that the Project footprint supports nationally exceptional

concentrations of 'Threatened' or 'At Risk' terrestrial invertebrates. Nevertheless, several areas contain habitats of elevated ecological value that contribute to the persistence of indigenous invertebrate communities and species of conservation interest.

Based on the ecological value assessment framework, indigenous invertebrate habitats and communities within the Project area are High, with variation in ecological values (ranging from low to high) within the small project components, depending on habitat condition, diversity, and the occurrence of notable species. Areas supporting indigenous tussock grassland, shrubland, riparian habitats, and records of 'Threatened', 'At Risk', or 'Data Deficient' species are considered to contribute most strongly to ecological value. These findings provide the foundation for the assessment of ecological effects and inform the development of appropriate avoidance, mitigation, effects management, and residual effects management measures for the Project.

This report is limited to the assessment of terrestrial invertebrate values and does not evaluate the magnitude or significance of ecological effects arising from the Project. Assessment of effects, together with recommendations for avoidance, mitigation, management, offsetting, and compensation, are addressed separately in the accompanying Ecological Impact Assessment (document E7; Bioresearches 2026f) and Invertebrate Management and Monitoring Plan (document E10; Bioresearches 2026i) prepared for the Project.

1 Introduction

OceanaGold (New Zealand) Limited (“OGNZL”) currently undertakes open pit and underground gold mining operations at the Macraes Operation located at Golden Point Road, Macraes Flat, East Otago. As part of their ongoing operations, OGNZL continually review the remaining life of the Macraes Operation in light of updated knowledge of the gold resource and the economics of mining.

Reflecting recent exploration success and optimisation work, together with higher gold prices, the Macraes Phase Four Project (“MP4” or “the Project”) seeks to extend the life of mining at the Macraes Operation until at least 2039. The Project, which will enable ongoing gold production at a rate of approximately 130,000 ounces per annum, is identified as a Listed Project in Schedule 2 of the Fast-track Approvals Act 2024 (“FTAA”) as a project providing significant national or regional benefits.

To support the development of the substantive application for the Project, OGNZL has engaged Bioresearches (Babbage Consultants Ltd) to provide an assessment of the Project’s effects on ecological values and, to the extent required, identify any necessary management and operation measures to address any such effects.

1.1 Purpose and scope

The purpose of the assessment was to document and describe the terrestrial invertebrate community and invertebrate habitat values present within the Project area and to guide an assessment of the project’s effects on those values.

Specifically, the scope/ objectives of this report includes:

- 1) A description of the methods used to investigate terrestrial invertebrate communities and invertebrate habitat within the MP4 Project area, including existing consented areas;
- 2) Descriptions of invertebrate presence within the MP4 Project area;
- 3) Identifying and quantifying areas of suitable terrestrial invertebrate habitat in the MP4 Project area;
- 4) An assessment of terrestrial invertebrate values contained within the MP4 Project area; and
- 5) An assessment of the ecological significance criteria with respect to terrestrial invertebrates.

This document (E3) sits within a series of 16 ecology-focused documents relating to the Project (Table 1.1). The scope of this report is limited to assessing terrestrial invertebrate values and does not include an assessment of the Project’s effects on those values. The effects of the Project on invertebrate communities and species are addressed separately in the EclA prepared by Bioresearches (E7).

Table 1.1. Ecology documents prepared for the proposed Macraes Phase 4 Project. Current document highlighted.

Document #	Document name	Aspects covered	Author
E1	Terrestrial and Wetland Ecology Summary		Bioresearches (2026a)
Ecological Assessments			
E2	Assessment of Vegetation and Wetland Values	Terrestrial vegetation and wetlands	Whirika (2026)
E3	Assessment of Invertebrate Values		Bioresearches (2026b)
E4	Assessment of Lizard Values		Bioresearches (2026c)
E5	Assessment of Avifauna Values		Bioresearches (2026d)
E6	Assessment of Bat Values		Bioresearches (2026e)
E7	Ecological Impact Assessment	Terrestrial and wetland ecosystems and fauna	Bioresearches (2026f)
Ecological Management			
E8	Vegetation and TAR Flora Management Plan	Indigenous vegetation and threatened plants (wetland and terrestrial)	Bioresearches (2026g)
E9	Wetland Management Plan	Wetlands and TAR wetland plants	Bioresearches (2026h)
E10	Invertebrate Management & Monitoring Plan		Bioresearches (2026i)
E11	Lizard Management & Monitoring Plan		Bioresearches (2026j)
E12	Avifauna Management Plan		Bioresearches (2026k)
Residual Effects Analysis and Management			
E13	Residual Effects Analysis: Terrestrial Ecology	Residual effects analyses for vegetation and fauna	Bioresearches (2026l)
E14	Residual Effects Analysis: Wetlands	Residual effects analyses for wetlands	Bioresearches (2026m)
E15	Residual Effects Terrestrial Restoration Plan	Compensation planting and vegetation restoration	Bioresearches (2026n)
E16	Residual Effects Wetland Management Plan	Planting and restoration for wetlands	Bioresearches (2026o)
E17	Ecological Impact Assessment: Pest-proof Fence Construction	Terrestrial and wetland ecosystems and fauna	Bioresearches (2026p)
E18	Pest Control and Elimination Plan	Animal pest management	Alliance Ecology (2026)

2 Macraes Phase Four Project

2.1 Site location and description

OGNZL owns and operates the Macraes Operation at Macraes, approximately 30 km northwest of Palmerston in the Otago Region. The Macraes Operation is the largest gold mine in New Zealand and, since commissioning in 1990, has produced more than 6 million ounces of gold.

Macraes Flat is located within the Macraes Ecological District (ED), part of the Lammerlaw Ecological Region in Otago. The district is characterised by distinctive topography associated with the northeast–southwest trending Taieri Ridge and a series of smaller faulted ridges to the southeast, along with dendritic drainage systems. Terrain is generally gentle below 600 m, with higher ridges exceeding 800 m. The geology is dominated by Paleozoic Haast Schist, with minor Miocene sediments and volcanic features. The climate is cool and dry montane, with moderate annual rainfall (600–800 mm), frequent north-westerly winds, and occasional winter snowfall (McEwen 1987).

The Macraes Operation is situated on an elevated plateau at approximately 500 m above sea level. The plateau is flanked by the Taieri Ridge to the northwest, Shag Valley and Horse Range to the east, and the coastal hills and extinct volcanic cones of Palmerston and Waikouaiti to the southeast. Macraes Road provides access to Macraes Flat and the Macraes Operation, connecting to State Highway 85 to the east and State Highway 87 (SH87, the Middlemarch–Hyde Road) to the west.

Historically, the Macraes ED supported a mosaic of tussock grassland interspersed with mixed hardwood–podocarp forest, kānuka forest, and coprosma–flax shrubland (Bibby 1997). Since European settlement, however, extensive burning and pastoral development have significantly modified this vegetation, resulting in widespread exotic grasslands and a highly altered landscape (Thompson 1949, McGlone *et al.* 1995, Whitaker 1996). The current ecosystems and vegetation types within the Project area are described in detail by Whirika (2026) (document E2) but are broadly characterised by narrow-leaved tussock and exotic grassland, interspersed with grey shrubland, schist outcrops, riparian vegetation along gullies, and both permanent and ephemeral wetlands. Native terrestrial invertebrates occur widely across the Project area.

The environment within and surrounding the Macraes Operation has been shaped by historic and current mining activities. Figure 2.1 shows the arrangement of the major mine features at the Macraes Operation. In summary, the current components of the Macraes Operation include:

- Numerous open pits (both operational and non-operational);
- Two underground mines (Fraser's, now closed, and Golden Point, which is actively mined);
- Waste rock stacks at various stages of operation and rehabilitation;
- A network of haul roads and general mine service tracks;
- A Processing Plant;
- Five tailings storage facilities (three inactive, one active but nearing capacity, and one under construction and currently receiving tailings);

- An extensive network of water management infrastructure, including diversion drains, silt ponds, sumps, pit lakes, and freshwater storage reservoirs;
- Two consented but not yet constructed water storage reservoirs (Camp Creek Dam and Coal Creek Dam); and
- Associated infrastructure supporting ongoing operations, including district roads, powerlines, workshops, offices, and associated water and amenity facilities.

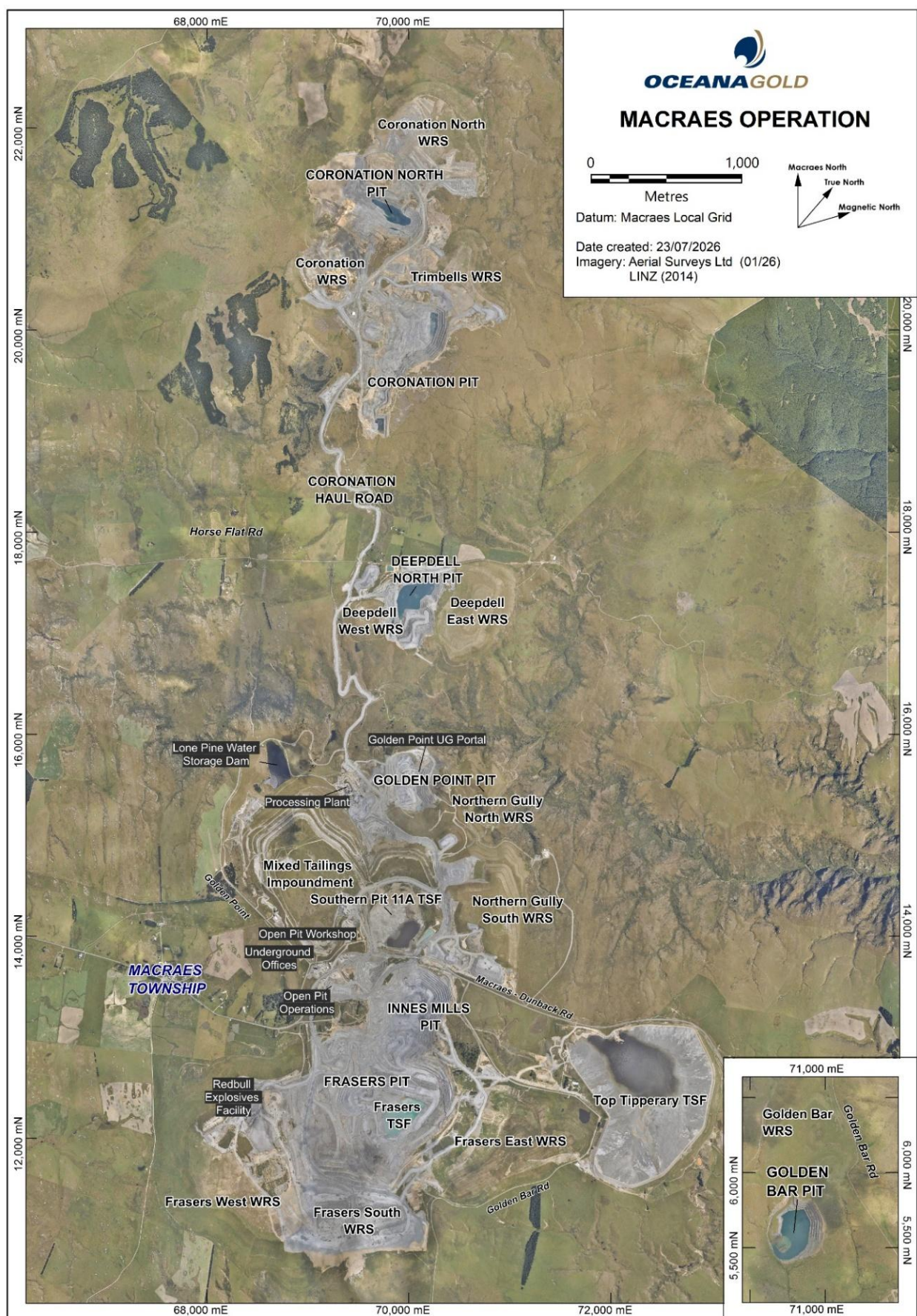


Figure 2.1. Existing site layout at the Macraes Operation (as of July 2026). Figure supplied by OceanaGold.

a. Project overview

The Project is made up of the following proposed key activities:

- **Open pit extensions** at Coronation, Coronation North, Innes Mills, and Golden Bar.
- **Underground mine expansion** through further development of the Golden Point Underground mine (“GPUG”).
- **Tailings management**, including:
 - Construction of the Frasers Tailings Storage Facility (“FTSF”) Stage 3 to accommodate a total tailings storage of up to 153 Mt; and
 - Hydraulic mining and relocation of tailings from the Mixed Tailings Impoundment (“MTI”), Southern Pit Option 10 TSF (“SP10”), and Southern Pit Option 11A TSF (“SP11”) to FTSF.
- **Waste rock disposal**, including increased storage capacity within open pits and at existing waste rock stacks at Coronation, Coronation North, Innes Mills, Golden Bar, Golden Point, and Frasers.
- **Water management infrastructure and operations**, including:
 - Construction of Camp Creek and Coal Creek water storage dams for flow and water quality management;
 - Construction, operation and maintenance of a Water Treatment Plant; and
 - Ongoing operation and maintenance of the Mine Water Management System (“MWMS”).
- **Infrastructure and roading works**, including:
 - Realignment of Macraes Road in two stages; and
 - Relocation of the Open Pit Mining Workshop.
- **Ecological enhancements**, including establishment of:
 - Murphys Ecological Enhancement Area (“MEEA”) near Murphys Creek, including predator fencing, access tracks, and site facilities;
 - Mt Highlay restoration area;
 - Cranky Jims Link shrubland enhancement area;
 - Murphys Link tussock protection area; and
 - Additional compensation measures for residual ecological impacts.
- **Mine closure and rehabilitation activities**, including rehabilitation of mining landforms, creation of pit lakes, dry capping of tailings storage facilities, and revegetation in accordance with closure objectives.

An overview of the proposed activities which make up the Project is shown in Figure 2.2 below.

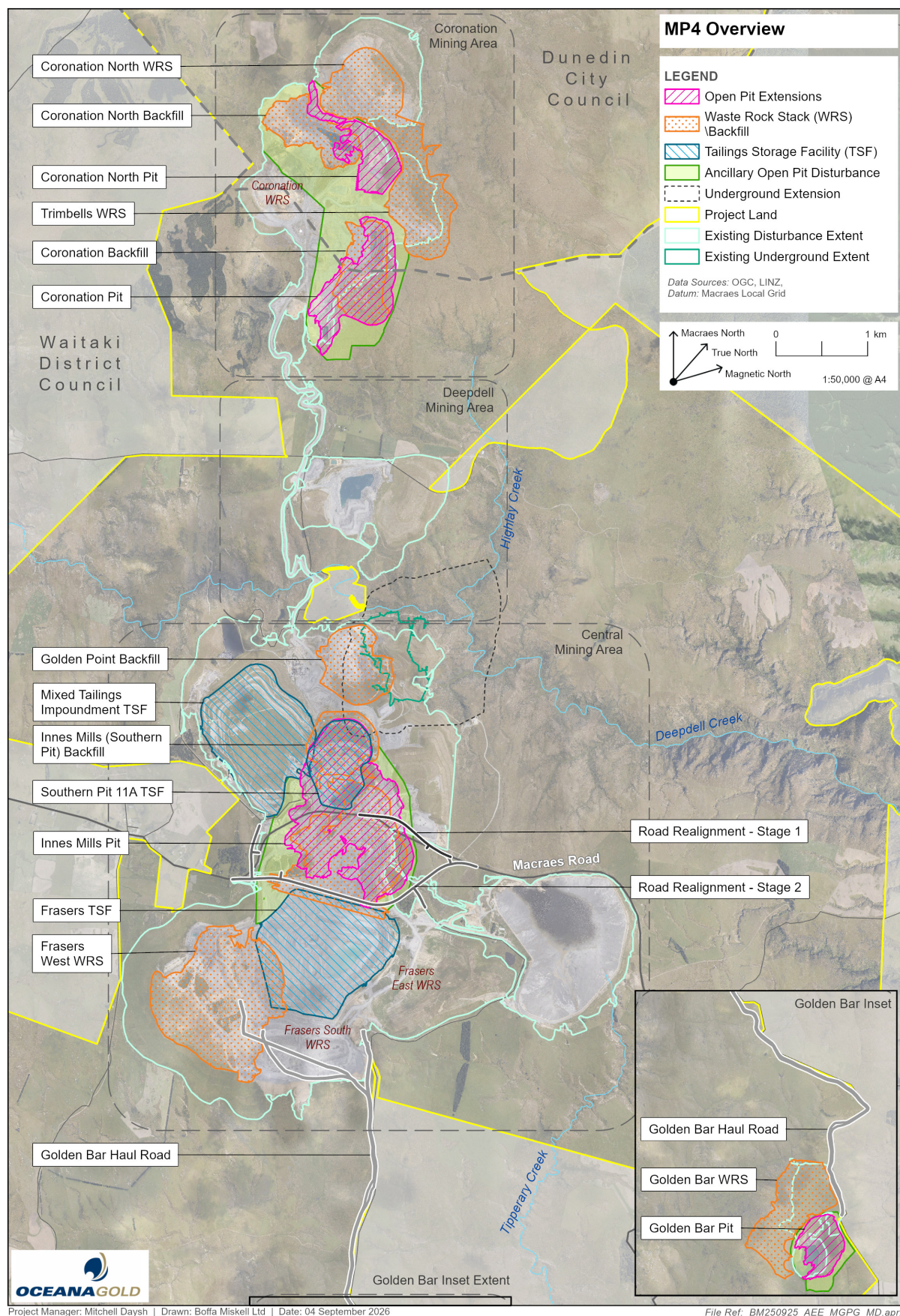


Figure 2.2. MP4 Overview Plan (as of July 2026). Figure supplied by OceanaGold.

The Project area extends over approximately 785 ha of land within the OGNZL landholdings (Table 2.1). This comprises land for which resource consents are required under the FTAA for mining and associated activities (approximately 440 ha), and land that is already consented under existing resource consents, but where mine development has not yet been undertaken (approximately 345 ha).

The unconsented and consented footprints are further broken down as follows.

2.1.1 Unconsented areas

- An approximately 325 ha surface impact footprint where mining and ancillary mining activities are proposed.
- An approximately 58 ha precautionary buffer applied around parts of the direct impact footprint, where direct adverse ecological effects are not anticipated, but total loss of ecological values has been conservatively assumed for the purpose of the MP4 application.
- An approximately 63 ha area of proposed underground mine expansion, where ecological values have been assessed but underground activities are not considered to have measurable adverse ecological effects on the surface.
- An additional approximately 200 ha buffer surrounding the impact area, combined with a 20 m precautionary buffer, providing for potential indirect effects on ecological features up to 80 m away.

2.1.2 Consented areas

- An approximately 172 ha Back Road Waste Rock Stack (BRWRS) area, for which the resource consents providing for construction of the BRWRS will be surrendered as part of the MP4 Project.
- Approximately 14.4 ha for construction of the Camp Creek dam and reservoir, and approximately 14.9 ha for construction of the Coal Creek dam and reservoir.
- Approximately 144 ha of previously disturbed and rehabilitated land within several MP4 Project areas (e.g., parts of Coronation, Golden Bar WRS, Golden Bar Pit, and the Innes Mills Pit disturbance area), which will be re-worked as part of the Project.

In addition, resource consents will be required for land management activities associated with mitigation and compensation sites as part of the Project. These areas include:

- Approximately 1,500 ha of the wider Murphys Creek catchment, where Project mitigation and compensation measures are proposed, including but not limited to construction of a 252 ha predator-exclusion fence, implementation of surrounding landscape predator management, and restoration planting.
- An approximately 300 ha area of the recently acquired Mt Highlay Station, where fencing and habitat enhancement activities will take place.

For already consented areas (Table 2.1), the ecological values and effects on invertebrates have already been considered and addressed elsewhere under existing consents, and the consents authorising construction, operation, and maintenance of these areas may be implemented at any time prior to their expiry.

Accordingly, these consented areas have been included within the survey scope of this Invertebrate Values Assessment, only to develop an understanding of the value of these sites within the wider landscape context. The consented areas have been excluded from the ecological value assessments used to inform the Ecological Impact Assessment for the MP4 Fast-track application.

Table 2.1. MP4 Project Areas, showing the extent of the Area footprint, the extent of suitable invertebrate habitat Directly and Indirectly impacted by the project for both areas that are Unconsented (those requiring consent under MP4 Fast Track) and Consented (those with existing resource consents).

			Directly affected habitat			Indirectly affected habitat	
Project component (PC)	Acronym	Area footprint (ha)	Impact area	20 m buffer (impact assumed) (ha)	Total impact (Impact + 20 m buffer) (ha)	Surrounding 80 m buffer area (ha)	Total project area (Impact footprint + 20 m buffer + 80 m buffer) (ha)
Unconsented areas							
Coronation Mining Area	Coronation	79.1	73.7	9.3	83.1	37.9	121.1
Golden Point Underground	GPUG	172	0 ^A	0	0	0	0
Central Mining Area	Central	107.1	41.3	8.6	49.9	23.6	73.5
Frasers West French Drain	FWFD	5.5	5.5	0 ^B	5.5	0	5.5
Golden Bar Haul Road	GB HR	9.3	5.5	20.9	26.4	86.8	113.2
Golden Bar Mining Area	GB	66.8	62.7	11.1	73.8	32.4	106.3
Sub total		439.8	188.7	49.9	238.7	180.6	419
Consented areas							
Back Road Waste Rock Stack	BRWRS	172.0	0 ^C	0	0	0	0
Camp Creek	Camp Creek	14.4	14.4	0	14.4	0	14.4
Coal Creek	Coal Creek	14.9	14.9	0	14.9	0	14.9
Other consented areas	Other consented areas	144	144	0	144	0	144
Sub total		345.3	173.3	0	173.3	0	173.3
Total		785.1	362	49.9	412	180.6	592.3

^A GPUG underground mining activity is not expected to lead to measurable adverse impacts on invertebrates at the surface.

^B The 20 m surrounding precautionary buffer has not been applied to FWFD because the footprint already encompasses a 20 m-wide footprint, with surplus to allow the construction of the 0.6 m base width drain as well as benches or batters to facilitate safe excavation.

^C Not constructed under MP4.

3 Methods

The methods used to identify and value terrestrial invertebrate species and communities of the Project area can be categorised in four broad stages:

1. Literature review and desktop assessment;
2. Invertebrate field surveys;
3. Habitat mapping and habitat suitability assessments;
4. Assignment of ecological value and significance, under the Environment Institute of Australia and New Zealand Ecological Impact Assessment (EclA) guidelines and policy frameworks, respectively.

3.1 Survey areas

Invertebrate surveys were undertaken across OGNZL Macraes landholdings, including areas within the Project impact footprint, surrounding buffer areas, ecological covenants, and the Murphys Creek catchment.

Given that many invertebrate species are widespread across OGNZL Macraes landholdings, individual project components have been grouped and assessed collectively as Project or Mining Areas, using the terminology outlined in Table 2.1.

3.2 Literature review and desktop assessment

A desktop literature and database review of the diversity and distribution of terrestrial invertebrates within Project area and surrounding landscape was undertaken.

The desktop survey encompassed a 10 kilometre buffer around the Project area. The 10 km search radius was selected to capture species that may utilise the site intermittently, seasonally, or as part of larger home ranges, particularly highly mobile or wide-ranging flighted species.

The following data sources were reviewed:

- Global Biodiversity Information Facility (GBIF; GBIF.org) (accessed 20/02/2026) for all “Class Arthropoda” occurrence records within 10 km of the Project area. This database does not reflect a complete inventory of all invertebrates recorded in the 10 km search area. Rather it contains published invertebrate records held by contributing institutions and external databases including iNaturalist, Otago Regional Council, Canterbury Museum New Zealand, New Zealand Arthropod Collection Manaaki Whenua – Landcare Research, CSIRO, and

Auckland Museum.

- iNaturalist New Zealand (<https://inaturalist.nz/>)¹ (accessed 20/02/2026) filtered for “Arthropoda” records within 10 km of the Project area (note: iNaturalist records are contained within the GBIF database);
- Department of Conservation species conservation status listings (New Zealand Threat Classification System);
- Information extracted from unpublished technical reports and ecological assessments commissioned by OceanaGold (between 1986 and 2025) (e.g., Deepdell North III Project)
- Species occurrence records collected in the field by Bioresearches during previous resource consent projects.

3.3 Invertebrate surveys

3.3.1 Sampling periods

Invertebrate surveys were conducted primarily by Bioresearches ecologists, with support from Whirika ecologists, between April 2022 and April 2026. In addition, two targeted Lepidoptera (moths and butterflies) surveys were undertaken by specialist consultant lepidopterist Ryan Bauckham. Table 3.1 summarises the survey periods, survey areas, and sampling methods employed.

Table 3.1. Terrestrial invertebrate survey periods and sampling effort across the Project area between April 2022 and March 2026.

Date	Areas surveyed	Sampling method
18/04/2022 – 20/04/2022	Coronation, Golden Bar, Central (Macraes Road Realignment)	Sweep netting, hand searches and visual observations, and moth light trapping
9/05/2022 – 12/05/2022	Coronation, Golden Bar, Central (Macraes Road Realignment)	Moth light trapping
8/09/2022 – 10/09/2022	Round Hill Innes Mills Southern Pit Innes Mills (RHIMSPIM), BRWRS, and ecological covenants – Island Block Covenant, Cranky Jims Creek Ecology Covenant, and Highlay Creek Ecology Covenant	Moth light trapping
03/04/2025 – 09/05/2025	Golden Bar Pit, Golden Bar WRS	Moth light trapping (automated and manual), sweep netting, hand searching. Surveys targeting Crambidae: <i>Orocrambus</i> species.
1/10/2025 – 5/12/2025	Coronation North 5	Opportunistic invertebrate collection during CN5 lizard salvage at Coronation.

¹ iNaturalist is a website that serves the purpose of sharing information about identification, distribution, and biodiversity of all organisms, and is used worldwide by a variety of individuals from amateurs to specialists. iNaturalistNZ provides useful information into the distribution of species in New Zealand and provides insight into the species observed in the Macraes ED. Records were scrutinised by Bioresearches ecologists and only used to inform the assessment when certainty could be given regarding the identification (i.e., “Research Grade” observations or those identified by a recognised New Zealand experts[s]).

24/02/2026 – 11/04/2026	Coronation, Murphys Creek, Innes Mills (CCP2 lizard salvage area), Coal and Camp Creek, Mt Highlay plantation, GPUG,	Opportunistic searches (hand searches, sweep netting) and invertebrate collection during CCP2 lizard salvage at Innes Mills.
24/02/2026 – 04/04/2026	Coronation, Golden Bar, GB Road Realignment, BRWRS, Murphys EEA, Cranky Jims covenant, Redbank covenant.	Moth light trapping (Bauckham 2025)
10/03/2026 and 13/03/2026	Highlay Hill, Trimbells Gully, Camp Creek, Cranky Jims, Murphys Creek, and Coal Creek	Environmental DNA sampling in watercourses.

3.3.2 Moth light trapping

3.3.2.1 General moth sampling methods

Moths and other flying nocturnal insects were sampled using Heath moth traps. Heath moth traps consist of a fluorescent bulb (that emits actinic light in the 420-nanometre range) positioned on top of a funnel, on top of a plastic base. The bulb was surrounded by plastic fins that deflected moths flying towards the light down through the funnel and into the base. A mesh bag inserted into the hole in the plastic base acted to contain the captured individuals. Pieces of egg carton were placed inside the mesh bag to provide a place for the insects to settle once inside the trap. Each trap was powered by a 12 V battery, and a light sensor automatically activated the light on dark to attract insects. On sunrise, the light sensor automatically deactivated the lighting unit.

The 'light reach' from a Heath moth trap, which effectively attracts mobile invertebrates to the trap, is relatively small (e.g., less than 50 m radius from the trap itself). Therefore, captures in a Heath moth trap may represent either local species (i.e., those occurring in the area immediately surrounding the trap), or species dispersing through the landscape at the time of trapping.

3.3.2.2 April and May 2022 sampling

Nine trap locations across the Project area were selected based on areas of suitable invertebrate habitat. The locations were recorded on a handheld GPS (trap locations shown in Appendix J and examples of trap positioning shown in Figure 3.1).

Traps were typically left for one night during calm and dry weather. Each trap was disassembled the following morning and the contents collected. The mesh bag (containing the captured invertebrates) was placed inside an invertebrate killing jar, which consisted of a small amount of ethyl acetate, for a minimum of 15 minutes to euthanise the specimens. Once euthanised, the contents of the mesh bag were placed in a plastic vial and labelled. The vials were kept in the freezer for later identification.



Figure 3.1. Heath moth traps set up in Golden Bar WRS; left, and the Macraes Road Realignment; right.

3.3.2.3 September 2022 sampling

Whirika Consultant ecologists and entomologist Claas Damken surveyed 12 locations across the wider OGNZL landscape between 8–10 September 2022. The 12 moth trap locations were selected in and around: Round Hill, Innes Mills, and Southern Pit/ Innes Mills (RHIMSPIM; within the Central Mining Area), BRWRS, and in nearby covenants, Highlay Creek Ecology Covenant, Island Block Covenant, Cranky Jims Creek Ecology Covenant, and Redbank Covenant (Appendix J). Traps were run over a consecutive two-night period at each location.

The specific purpose of this survey was to gather information on the distribution and relative abundance of two ‘At Risk’/ ‘Threatened’ moth species (*Theoxena scissaria* and *Orocrambus sophistes*) previously recorded on OGNZL landholdings and obtain comparative moth diversity data from covenants outside of the MP4 Project impact area. Advice from Manaaki Whenua – Landcare Research lepidopterist, Dr. Robert Hoare, indicated that the Autumn period was suitable for the detection of *Theoxena scissaria* but less suitable for *Orocrambus sophistes*, which should be targeted in the months of March to May.

3.3.2.4 April and May 2025 sampling

Surveys targeting *O. sophistes* in the Golden Bar Mining Area were undertaken by lepidopterist Ryan Bauckham between the 3 April and the 9 May 2025. The purpose of the surveys was to confirm the presence of the species at the site, and if found, attempt to quantify the resident population.

A summary of the survey methods described by Bauckham (2025) are outlined below.

Three surveys were conducted in the tussock habitats within the GB Pit and GB WRS. Each survey involved three successive nights of light-trapping, using both automated traps (heath traps), and manual sampling using an entomological lamp (IepiLED). Light trapping was supplemented by three days of sweep-netting and hand searching hard tussock (*Festuca novae-zelandiae*) plants for the presence of flightless females.

Six heath traps were deployed at different locations around GB Pit and GB WRS (Appendix I, J). Locations were selected for their proximity to sizeable tracts of hard tussock, whilst conforming to White's (2002) tussock grasslands light trapping methodology, that locations should optimize visibility across open space with a targeted minimum visibility radius of 200–300 m.

Manual sampling was performed nightly for up to three hours. Various sampling locations were selected, with a focus on areas close to stands of hard tussock. A white sheet was spread across the ground at each location to ensure moths attracted to the lamp would easily be detected and a lepiLED entomological lamp was placed on the centre of the sheet, elevated with a tripod. The lamp was switched on at sunset and actively monitored for the duration of the sampling session. As moths were attracted to the lamp and settled on the sheet, they were identified, recorded, and where necessary collected.

Approximately 65 ha was manually searched (sweep-netted) over approximately 36 daylight hours, using a net to capture moths that were disturbed from vegetation. Search efforts were primarily focused in areas of tussock grassland but also included surrounding areas of other vegetation types including exotic pasture, indigenous shrubland, and riparian vegetation (Appendix I). The search areas were systematically walked through in a zig-zag motion, using a stick to deliberately disturb vegetation and flush out flying insects. This was typically done in 3–5 m stretches before the contents of the net were checked for potential specimens of interest. Once insects were sighted, they were captured, identified, and where appropriate collected for further analysis.

Specimens collected in the field were immediately euthanized using ethyl acetate inside a entomological killing jar. Specimens were then transferred to glassine envelopes labelled with their collection data (i.e. date, GPS coordinates, and method of capture). At the end of each survey specimens were rehydrated where necessary, before being mounted on pinning boards and their wings spread to assist with identification. Once dried, specimens were examined and compared with material from R. Bauckham's reference collection and a series of specimens were sent to Dr Robert Hoare (Manaaki Whenua Landcare Research) for further confirmation of identification through dissection.

3.3.2.5 February to April 2026 sampling

Moth surveys were undertaken across the OGNZL landholdings, including within the MP4 Project area, by lepidopterist R. Bauckham between 24 February and 4 April 2026. Moth light trapping was conducted using both automated traps (Heath traps) and manual sampling with an entomological lamp (LepiLED) within the following areas: Macraes Road Realignment, Golden Bar, BRWRS, the Murphys Creek catchment, Cranky Jims Covenant, Redbank Covenant, and Coronation. Sampling locations are shown in Appendix J.

The survey aimed to sample broadly across the OGNZL landholdings and the Project area during the summer months, when many moth species are active, including the Threatened *Orocrambus sophistes*. Sampling within BRWRS (which will be avoided by the Project), the Murphys Creek catchment, Cranky Jims Covenant, and Redbank Covenant was undertaken to characterise the local moth diversity and

relative abundance in areas not affected by the Project, thereby providing ecological context for the moth fauna recorded within the wider study area.

3.3.3 Sweep netting/ beat sampling

3.3.3.1 General sweep netting/ beat sampling methods

Sweep net samples were undertaken in areas that contained suitable invertebrate habitat (e.g., tussock grasses, riparian/ wetland habitat) particularly densely vegetated ground cover. No sweep netting was conducted in the ecological covenants. Similar-sized sweep nets were used throughout the survey period to standardise sampling effort as far as practicable. Sweep netting was undertaken by slowly walking and making sweeping motions with a fine mesh net through low-growing vegetation (Figure 3.2). Where woody vegetation was present, beat sampling was also undertaken. This involved holding the net under a variety of trees/ shrubs and hitting the branches above to collect invertebrates as they became dislodged.

A combination of sweep netting and beat sampling was undertaken for 20–30 minutes at each site, with a representative sample being collected from each of the main habitat types identified within each site.

Track logs were recorded using a handheld GPS unit during each sweep netting/ beat sampling session. Once the sampling at each site was completed, the net containing all collected invertebrates and plant debris was placed into a killing jar to euthanise the specimens. The contents were then transferred into plastic zip-lock bags, labelled, and kept in the freezer until later identification.



Figure 3.2. Ecologist undertaking sweep netting.

3.3.4 Hand searches and visual observations

Hand searches for invertebrates were opportunistically undertaken during day excursions to sites within the Project area where suitable searchable habitat (e.g., ground debris, rocks) was identified. Rocks and woody debris were searched and lifted, and invertebrates either identified and released (where confident in identification) or euthanised in a killing jar and collected for identification. All disturbed habitats were returned to their original positions. All specimens encountered were recorded.

Additional visual and acoustic observations (e.g., calling invertebrates such as cicadas) were recorded opportunistically throughout the Project area. No hand or visual searches were carried out in the ecological covenants.

3.3.5 Environmental DNA (eDNA) sampling

Environmental DNA (eDNA) sampling of watercourses—carried out as part of the freshwater investigations for the Project (Viridis 2026)—provided an opportunistic (rather than targeted) means of gathering additional information on terrestrial invertebrate presence in the wider landscape, since terrestrial inputs such as DNA from dead specimens or fragments can be detected in the water column. Sampling was undertaken at six sites across OGNZL Macraes landholdings between 10 and 13 March 2026, using a 'comprehensive freshwater panel (NZ) assay' to detect faunal DNA. The sites were Highlay Hill, Trimbells Gully, Camp Creek, Cranky Jims, Murphys Creek, and Coal Creek.

The full set of eDNA results were filtered to extract the “Insects” Group, and these were analysed to determine the presence of invertebrate species at or in the vicinity of the eDNA sampling locations. Since eDNA can persist in the environment and be carried downstream in the water column, the presence of invertebrate species DNA could indicate the species was present upstream of the sampling location.

Environmental DNA provides a snapshot in time of species presence and does not provide a comprehensive inventory of all species present in the surrounding landscape at the time of sampling due to several factors, including:

- the distance of organisms from the sampling point,
- the type and size of organisms,
- the presence of dead/ decaying organisms, and
- environmental factors that can speed up or slow down eDNA breakdown.

Furthermore, contamination of samples cannot be ruled out. Thus, eDNA results can be helpful for species detection but there are several limitations, and caution must be taken when interpreting results.

3.3.6 General invertebrate survey limitations

- Detectability presents a significant challenge for invertebrate surveys. Many of the species of interest, including several ‘At Risk’ moth taxa, are small-bodied, cryptic, and have short or

highly seasonal periods of adult activity, meaning survey timing must closely match narrow flight or emergence windows or individuals will simply not be recorded. Detection is further complicated by strong weather dependence: light trapping and other active survey methods for moths are highly sensitive to temperature, wind, and moonlight, such that even well-timed surveys can yield low catch rates under unfavourable conditions. The tussock grassland and schist landscape typical of the Macraes area also supports naturally patchy and low-density invertebrate populations, so absence of a species from trap or search data cannot be taken as reliable evidence of true absence from a site.

- Terrestrial invertebrate presence and abundance vary seasonally, and community-level surveys are typically undertaken during spring or summer when temperatures are warmer and species diversity and activity are generally highest. It is acknowledged that some invertebrate sampling was undertaken outside the summer months, including during late autumn and a short survey period in early spring (September), which may have influenced detection rates for some invertebrate groups. However, surveys conducted during specific months or seasons are necessary to target specific life stages of some species (e.g., autumn surveys for the moth *Theoxena scissaria*). Accordingly, the surveys were undertaken across a range of seasons to capture variation in species activity and are considered to provide a representative sample of the invertebrate community present.
- Taxonomic identification adds a layer of uncertainty, as many 'At Risk' invertebrates require specialist expertise to distinguish from closely related and more common species. For the Project used entomological experts where practicable to ensure accurate identification of specimens. But overall, survey effort can only ever provide an imperfect estimate of species presence, distribution, and abundance, and this residual uncertainty is acknowledged and addressed through a precautionary approach when assessing potential values and effects for the Project.
- More resource intensive survey methods such as invertebrate kill pitfall and malaise trapping were not employed as part of the invertebrate assessment for the following reasons:
 - Invertebrate kill pitfall traps present a high risk of incidental bycatch of protected lizards. Even when fitted with 'lizard guards', the risk to juvenile lizards remains. Since terrestrial invertebrates could be sampled through systematic searches (e.g., lifting rocks and other debris, and searching rock outcrops) and during lizard surveys as bycatch in non-kill pitfall traps and Gees Minnow funnel traps, it was determined that invertebrate kill pitfall traps were not appropriate or required.
 - Malaise trapping predominantly captures flighted species such as Hymenoptera and Diptera, which are understudied groups in New Zealand and the NZTCS listings for both groups are outdated and unlikely to reflect current conservation statuses. Flying hymenopteran and dipterans are much less likely to be directly impacted by mine development because they can freely disperse. Furthermore, neither of the two listed 'Threatened – Nationally Critical' hymenopterans (*Gasteruption scintillans* and *Nesocolletes nunui*) are found in Otago.
- Other diverse invertebrate groups (e.g., Araneae/ spiders) were sampled but typically not identified to lower taxonomic levels (genus/ species) due to the difficulty in finding suitably qualified experts to provide identification services. Therefore, while abundance (i.e., number

of individuals sampled) is provided, the survey is limited in terms of describing diversity and identifying threatened or 'At Risk' species of Araneae.

- Some sites within the Project area were not surveyed for invertebrates because they were either devoid of suitable invertebrate habitat (e.g., existing mining activities) or considered highly unlikely to be impacted by the proposed MP4 Project (i.e., invertebrate communities and species above the Golden Point Underground footprint). Strong flying invertebrates are likely to pass through active mining areas but because the habitat value was negligible, these areas were not surveyed.
- Aquatic invertebrates were not included as part of the invertebrate survey. However, flighted adults of some aquatic groups (e.g., Odonata, Trichoptera) were captured in the current surveys and included in the results. Furthermore, aquatic invertebrates were detected in the eDNA results and have been presented.
- During dedicated moth surveys conducted between April and May 2025 and February and April 2026, diurnal moths were recorded opportunistically while retrieving and deploying moth traps. These observations provided information on species presence but not absence, as targeted search effort for diurnal species was relatively limited. However, sweep-netting surveys undertaken during 2022 provided a more systematic and targeted approach for sampling this component of the invertebrate fauna.

3.3.7 Sample processing

All specimens collected using the Heath moth traps were visually examined and pinned following specimen curation techniques generally as per Walker and Crosby (1988).

Most of the specimens collected in the Heath traps were represented by moths (Lepidoptera). Where it was evident that there were multiples of the same species present from a single trapping site, at least two representative specimens were pinned. Any larger invertebrates that were collected by hand or found within the sweep/ beat samples were also pinned; these included beetles (Coleoptera), ichneumonid wasps (Hymenoptera: Ichneumonidae), and some true bugs (Hemiptera).

All samples collected during the sweep/ beat sampling and hand searches were processed in the Bioresearches Auckland laboratory. A stereo microscope was used to assist with sorting and extracting invertebrates from amongst plant matter that was inadvertently collected during the sweep netting/ beat sampling. Specimens were grouped and identified to the level of Order (e.g., Coleoptera, Hemiptera) and counted. No attempt was made to identify specimens to lower taxonomic groupings during sorting. Macro photographs were taken of some specimens for later identification.

3.3.8 Identification of specimens

Each specimen collected at Macraes was assessed using a stereo microscope and examined by Bioresearches' ecologists with experience in invertebrate taxonomy. Each specimen was identified to the lowest taxonomic unit that could be assigned with confidence. Where there was uncertainty in the identity of a specimen, the assistance of taxonomic specialists via the *iNaturalistNZ* platform was sought. These specialists included Associate Professor Steve Kerr (Otago Museum), Stephen Thorpe (freelance entomologist), and Dr Dave Seldon (University of Auckland).

Pinned Lepidopterans were identified by Ryan Bauckham (consultant Lepidopterist), Claas Damken (consultant Lepidopterist), or Dr Robert Hoare (Manaaki Whenua Landcare Research) for specialist identification.

3.3.9 Habitat mapping

During the site visits, broad habitat types were identified in both the footprint (i.e., areas directly impacted by the proposed activities) and a 100 m buffer zone (i.e., areas in which some impact on ecological features might be expected), and the areal extents (hectares; ha) of these were subsequently mapped.

The mapped extents of these identified habitat types were used to inform the ecological value and effects assessments pertaining to invertebrate communities within the Project area.

3.4 Ecological value and ecological significance assessments

Ecological values for invertebrate communities/ habitats and invertebrate species were assigned in accordance with the Environment Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment (EclA) Guidelines (Roper-Lindsay *et al.* 2018). The EclA Guidelines provide a clear and nationally consistent framework for assessing ecological values, ecological effects, and the management of ecological effects associated with development projects.

This report addresses only the assessment of ecological value for invertebrates and does not constitute a full EclA under the EclA Guidelines, which would also include assessments of effect magnitude and overall levels of effect. These assessments, along with recommendations to avoid, remedy, or mitigate adverse effects, are instead provided in the accompanying Ecological Impact Assessment report (Bioresearches 2026f; document E7).

Ecological values were assigned to invertebrate communities/ habitats and individual species within each Project Area using a scale ranging from 'Negligible' to 'Very High'.

- For invertebrate communities/ habitats, values were determined based on the following criteria: representativeness, rarity or distinctiveness, diversity and pattern, and ecological context. Each matter was assigned a value, and these values were then combined (see Appendix B, Table 7) to determine an overall ecological value score for each Project Area.
- For individual species, ecological value was determined based on their level of conservation concern (as per Tables 5 and 6 in Appendix B). The national New Zealand Threat Classification System (NZTCS; Hitchmough *et al.* 2026) listings were considered.

Ecological significance was assessed using the criteria for assessing ecological significance in the following policy documents:

- 1) National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB). Appendix 1 of the NPS-IB sets out criteria for assessing Significant Natural Areas (i.e., areas of significant indigenous vegetation and significant habitats of indigenous fauna).

- 2) The Otago Regional Policy Statement 2021 (ORPS 2021). The criteria for identifying areas of significant indigenous vegetation and significant habitats of indigenous fauna are set out in Appendix 2 (APP2) of the ORPS 2021.
- 3) The Waitaki District Plan 2010 (WDP), under *16.9.3 Policies - Policy 3 "...criteria to identify areas with significant indigenous vegetation or significant habitats of indigenous fauna..."*.

Under each of these frameworks, a site need only satisfy a single criterion to be classified as ecologically significant.

4 Invertebrate survey results

4.1 Literature review and desktop assessment

4.1.1 Review of Whitaker (1986) - Terrestrial fauna of the Deepdell catchment

Sampling undertaken during February 1986 identified 66 invertebrate species across 19 orders (Whitaker 1986). All recorded species were widespread and common in the Otago region, and a few had known regional distributions. Of the 800 specimens collected during this sampling, the orders Diptera, Hymenoptera, and Orthoptera collectively totalled 69% of these specimens, and the study considered these results typical of Otago grassland fauna. No rare or localised species were recorded at that time.

4.1.2 Review of Patrick (1997) - Insects of the Macraes Ecological District

Patrick (1997) collected more extensive records of the insects within the Macraes ED over an 11-year period between 1983 and 1994 across all seasons. A total of 367 species across 12 orders were found (terrestrial and aquatic), the majority of these being native. Of these, 257 specimens were from the order Lepidoptera (noting that the author was experienced in this group). The study noted that several nationally rare insect species (four moths: *Gingidiobora nebulosa*, *Asterivora antigrapha*, *Cephalissa siria*, and *Tmetolophota* n. sp.; and one caddisfly: *Neurochroma pilosum*) occurred within the Macraes ED.

Supplementary commentary on these nationally rare species provided by specialist lepidopterist R. Bauckham and the author, DvW, based on recent literature, is summarised below.

- *Gingidiobora nebulosa* – a rare moth with a paucity of modern records. It has not been recorded in the MP4 Project area, but a single individual was reported in Redbank in 1995 (B. Patrick, unpub. data). Hoare *et al.* (2026) list it as ‘Threatened – Nationally Vulnerable’ under the NZTCS. Patrick & Dugdale (2000) list its host plant as being *Gingidia montana*, which is not known to be present in the MP4 Project area but the closely related *Gingidia grisea* is present in the 20 m buffer surrounding Golden Bar (Whirika 2026). It is unknown whether the moth is restricted to feeding on a single species of *Gingidia* but it is likely that it also feeds on *G. grisea*. Hudson (1928) reported that the species flies in March (more modern records indicate from August to December).
- *Cephalissa siria* – Hoare *et al.* (2026) lists this species as ‘Threatened – Nationally Endangered’. There are six observations of this moth on *iNaturalistNZ* (from Bucklands Crossing, Otago southwards, and approximately 25 km southeast of the OGL Macraes Operation) and over 20 records in the notebooks of B. Patrick (B. Patrick, unpub. data). The moth is a day flier and is on the wing in spring only. Its host plant is *Fuchsia perscandens*, which is present in Cranky Jims Covenant but is not present in the MP4 Project area (Whirika 2026).
- *Asterivora antigrapha* – a small diurnal moth that is relatively common in the North Island. However, there is only one Otago or southern New Zealand location (Taieri Ridge), which is why it was highlighted by Patrick (1997). Its host plant is unknown.
- *Tmetolophota* n. sp. – The genus *Tmetolophota* was subsumed within the genus *Ichneutica* in 2019 (Robert 2019), and Patrick’s *Tmetolophota* n. sp. was described as *Ichneutica prismatica*.

This species is listed as ‘Threatened – Nationally Vulnerable’ (Hoare *et al.* 2026). It is a day flying noctuid and a *Chionochloa* tussock grassland specialist. The species appears to be confined to Central Otago and only reaches the far western edge of the Dunedin region (Hoare 2019).

4.1.3 Review of Thorsen (2019) – Invertebrates of the Deepdell North III Project

An invertebrate survey undertaken for the OceanaGold Deepdell North III Project² recognised 68 species across nine orders over a short survey period in January 2018 (Thorsen 2019; Appendix A). The survey did not record any ‘Threatened’, ‘At Risk’, rare, genetically/ morphologically distinct species, or species at their known distribution limit.

4.1.4 Records held in the Global Biodiversity Information Facility (GBIF) and iNaturalistNZ databases

The GBIF database returned 1,077 occurrence records for Arthropods from within 10 km radius of the Project area. Of those, 751 occurrences were related to Insecta, 45 Arachnida, and 1 Collembola (Figure 4.1). The other 280 occurrence records were related to freshwater arthropods (Malacostraca, Ostracoda, and Copepoda) and were not considered as part of this assessment.

Insecta occurrences were represented by 15 Families and 229 species, excluding ‘sp. indet.’ category (i.e., indeterminate or unidentified species).

A significant proportion of recorded Lepidoptera were endemic species, and some are regionally restricted (e.g., *Hierodoris polita*, a moth listed as ‘Threatened – Nationally Vulnerable’ due to its restricted range within Central Otago and Dunedin; Hoare *et al.* 2026).

Fifty nine species were listed under the NZTCS as ‘Data Deficient’, ‘Threatened’, ‘At Risk – Declining’, ‘At Risk – Uncommon’, or ‘Not Threatened’ (Table 4.1). This included one ‘Nationally Vulnerable’, four ‘Data Deficient’, seven ‘At Risk – Declining’, two ‘At Risk – Uncommon’, and 45 ‘Not Threatened’ species (Table 4.1).

Larger invertebrate species recorded included: large black hunting wasp (*Priocnemis monachus*), beetles in the genus *Mecodema*, *Megadromus bullatus*, and *Oregus aereus*, and giant alpine dragonfly (*Uropelata chiltoni*).

Other endemic taxa recorded within the area included species of weevils (e.g., *Praolepra squamosa*, *Nonnotus albicans*), the orb-weaver spider *Colaraea verutum*, and endemic flies (e.g., *Saropogon fugiens*, *Empidadelpha propria*). One observation of velvet worm/ peripatus (*Peripatoides* sp.) was recorded.

² Deepdell North III project footprint lies between the MP4 Project Coronation and Frasers/ Innes Mills impact areas.

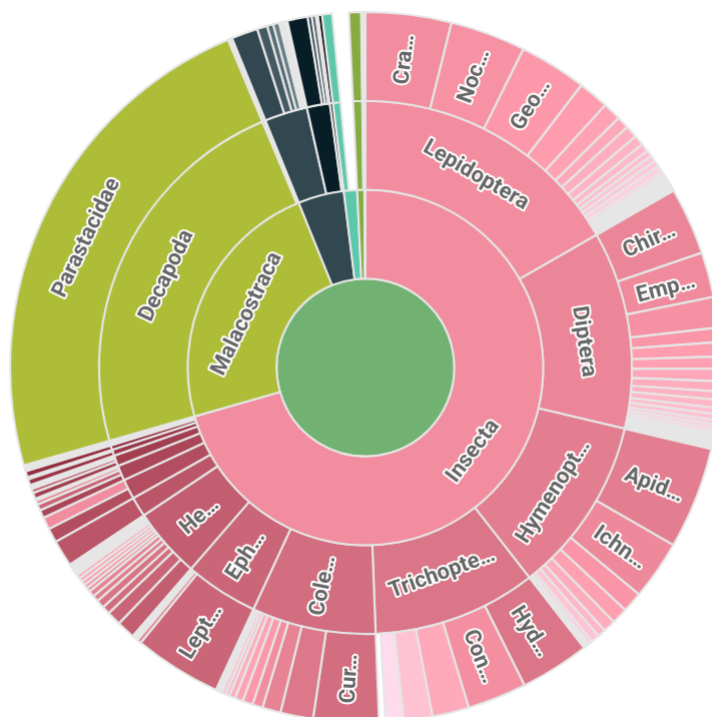


Figure 4.1. Taxonomic distribution of occurrences for Arthropods from the GBIF database (n = 1077 records within 10 km of the MP4Fast Project area). Source: GBIF.

Table 4.1. Occurrence records for species, with NZTCS listings, recorded in the GBIF database. 'Threatened', 'At Risk', and 'Data Deficient' are highlighted in red.

Family & species	Threatened – Nationally Vulnerable	Data Deficient	At Risk - Declining	At Risk - Uncommon	Not Threatened	Total
Acrididae			1		2	3
<i>Phaulacridium marginale</i>					2	2
<i>Sigauss campestris</i>			1			1
Anostomatidae					2	2
<i>Hemiandrus maia</i>					2	2
Coenagrionidae					2	2
<i>Xanthocnemis zealandica</i>					2	2
Conoesucidae					5	5
<i>Olinga feredayi</i>					3	3
<i>Pycnocentria evecta</i>					2	2
Corydalidae					12	12
<i>Archichauliodes diversus</i>					12	12
Dytiscidae				2	1	3
<i>Rhantus suturalis</i>					1	1
<i>Carabdytes plantaris</i>				2		2
Elmidae		1				1
<i>Hydora nitida</i>		1				1
Erebidae			5			5
<i>Nyctemera annulata</i>			4			4
<i>Metacrias strategica</i>			1			1
Eustheniidae					6	6
<i>Stenoperla prasina</i>					6	6
Geometridae			3		2	5
<i>Archesthes catapryrha</i>					1	1
<i>Dasyuris partheniata</i>			2			2
<i>Ischalis fortinata</i>					1	1
<i>Samana acutata</i>			1			1
Gripopterygidae		2			2	4
<i>Zelandobius uniramus</i>		2				2
<i>Zelandoperla decorata</i>					1	1
<i>Zelandoperla fenestrata</i>					1	1
Hepialidae		1			2	3
<i>Aoraia rufivena</i>					1	1
<i>Wiseana copularis</i>					1	1
<i>Wiseana mimica</i>		1				1
Hydrobiosidae					16	16
<i>Hydrobiosis clavigera</i>					4	4
<i>Hydrobiosis umbripennis</i>					6	6
<i>Neurochorema forsteri</i>					1	1
<i>Psilochorema bidens</i>					5	5
Leptoceridae					8	8
<i>Hudsonema amabile</i>					7	7
<i>Triplectides obsoletus</i>					1	1
Leptophlebiidae					2	2
<i>Austroclima jollyae</i>					1	1
<i>Neozephlebia scita</i>					1	1
Lestidae					3	3
<i>Austrolestes colenonis</i>					3	3
Lycaenidae					2	2
<i>Zizina oxleyi</i>					2	2
Mantidae			2			2
<i>Orthodera novaezealandiae</i>			2			2
Noctuidae				1	17	18
<i>Bityla sericea</i>				1		1
<i>Ichneutica agorastis</i>					1	1
<i>Ichneutica arotis</i>					1	1

Family & species	Threatened – Nationally Vulnerable	Data Deficient	At Risk - Declining	At Risk - Uncommon	Not Threatened	Total
<i>Ichneutica atristriga</i>					1	1
<i>Ichneutica cuneata</i>					1	1
<i>Ichneutica insignis</i>					1	1
<i>Ichneutica lignana</i>					1	1
<i>Ichneutica moderata</i>					1	1
<i>Ichneutica morosa</i>					1	1
<i>Ichneutica mutans</i>					1	1
<i>Ichneutica nullifera</i>					1	1
<i>Ichneutica omoplaca</i>					1	1
<i>Ichneutica propria</i>					1	1
<i>Ichneutica semivittata</i>					1	1
<i>Ichneutica skelloni</i>					1	1
<i>Physetica cucullina</i>					1	1
<i>Physetica phricias</i>					1	1
<i>Proteuxoa comma</i>					1	1
Nolidae			1			1
<i>Nola parvitis</i>			1			1
Oecophoridae	1					1
<i>Hierodoris polita</i>	1					1
Oniscigastridae					1	1
<i>Oniscigaster distans</i>					1	1
Petaluridae					1	1
<i>Uropetala chiltoni</i>					1	1
Phasmatidae					1	1
<i>Niveaphasma annulatum</i>					1	1
Rhaphidophoridae					1	1
<i>Isoplectron armatum</i>					1	1
Tortricidae		1				1
<i>Tortrix demiana</i>		1				1
Total	1	5	12	3	88	109

4.2 Field survey results

4.2.1 General overview of MP4 Project area

A total of 748 individual specimens were recorded during the survey, comprising 719 specimens recorded from trapping and sampling (moth light and sweep netting) and 29 specimens recorded during hand-searches and/ or opportunistic observations.

A total of 14 taxonomic orders were represented, (excluding an “Unknown” category for damaged specimens), and Araneae (spiders), Diptera (flies), Hemiptera (true bugs), and Lepidoptera (moths/ butterflies) collectively totalled 64% of the overall sample size (Figure 4.2).

Of the 14 orders identified across all survey methods, most (92.8%; n = 13) were represented in the sweep samples and only 42.9% (n = 6) were represented in the moth light trap samples.

Of the total 748 specimens collected or observed, 56 taxa were assigned to either a genus or species. A list of the identified taxa is provided in Appendix A. Photographs of some invertebrates encountered during the survey are shown in Figure 4.3.

Of note, one threatened moth species (Crambidae: *Orocrambus sophistes*) was caught in the Golden Bar WRS in May 2022 (Figure 4.3). This species is listed as ‘Nationally Vulnerable’ under the NZTCS (Hoare *et al.* 2026). It is an endemic species that presumably feeds on tussock and has a very localised distribution (confined to the inland drier Mackenzie and Central Otago areas of the South Island). The specimen caught during the survey was a winged male, but females of this species are short-winged and flightless; thus, their dispersal abilities are severely limited (R. Hoare pers. comm. 2022). Repeated dedicated attempts to find additional specimens at Golden Bar have been unsuccessful.

One of the NZTCS-listed taxa (moth: *Bityla sericea*; ‘At Risk – Naturally Uncommon’) reported from the surrounding landscape (within 10 km) was recorded inside the MP4 Project footprints at Golden Bar (Bauckham per. obs).

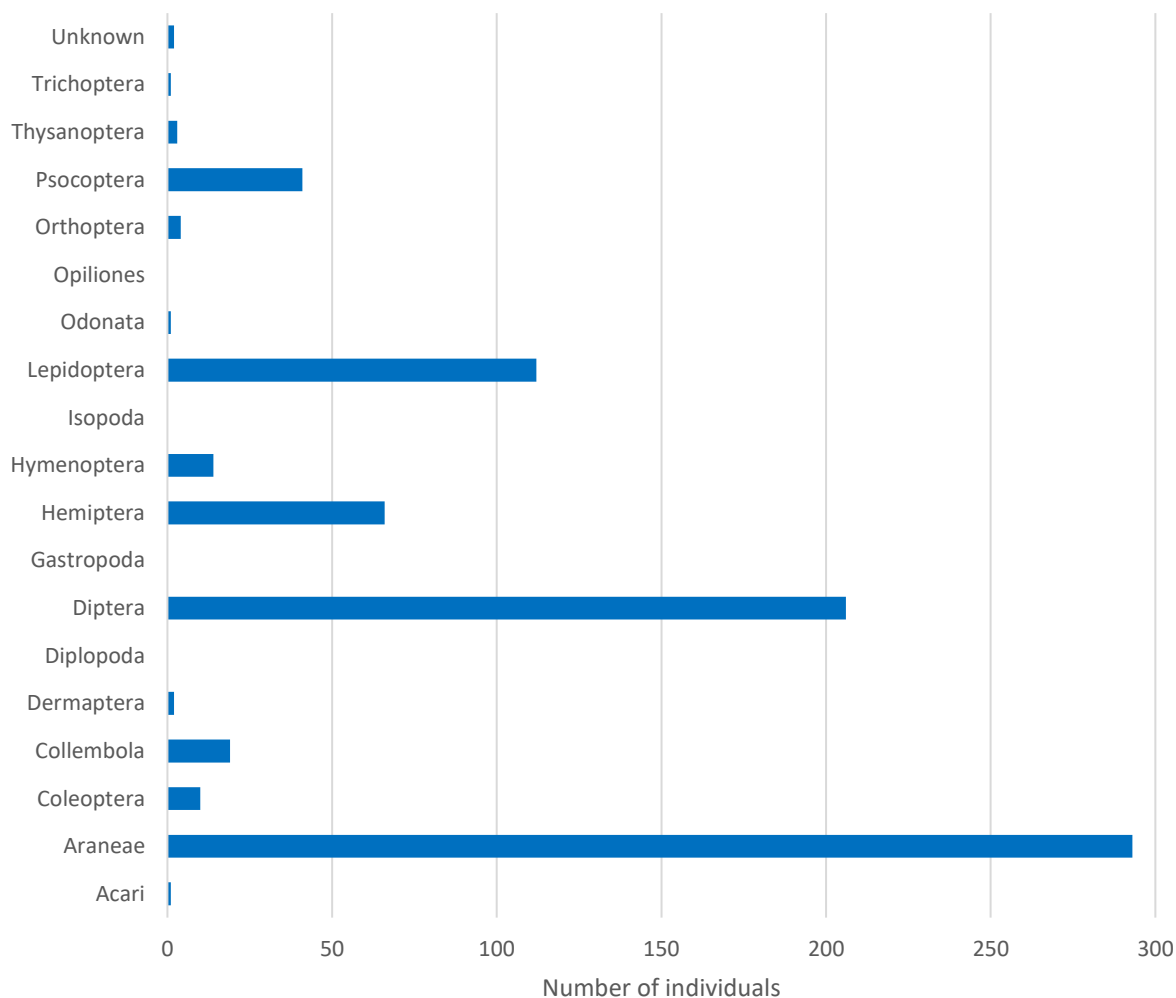


Figure 4.2. Composition of invertebrate taxonomic orders (and subclass Acari) and number of specimens sampled across all surveyed areas in April and May 2022.



Orocrambus sophistes (male) (©Landcare Research)



Homodotis falcata (male) (©Landcare Research)



Agrotis ipsilon (female) (©Landcare Research)



Bityla defigurata (female) (©Landcare Research)



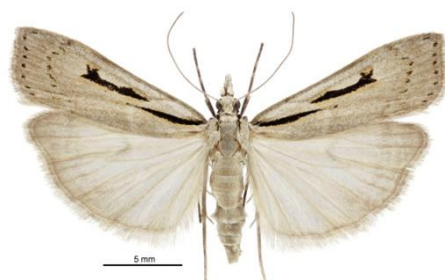
Aponotoreas insignis (male) (©Landcare Research)



Deana hybreasalis (male) (©Landcare Research)



Epyaxa rosearia (male) (©Landcare Research)



Scoparia rotuella (female) (©Landcare Research)



Elvia glaucata (male) (©Landcare Research)



Ichneutica plena (female) (©Landcare Research)



Samana acutata (©Landcare Research)



Zermizinga indocilisaria (male) (©Landcare Research)



Vanessa gonerilla gonerilla (©Tony Wills)



Vanessa itea (© Peter Waters)



Oregonus aereus (Source: Bioresearches)



Megadromus sp. (Source: Bioresearches)



Zeanecrophilus prolongatus (Source: Bioresearches)



Megadromus bullatus (Source: Bioresearches)

Figure 4.3. Images of some Lepidoptera (moths) and larger Coleoptera (beetles) encountered during the survey of the MP4 Project.

4.2.2 Sweep netting

Thirteen taxonomic orders (excluding an “Unknown” category) were recorded from sweep net sampling across the survey areas, and the invertebrate community composition differed markedly between the sites (Figure 4.4). Araneae, Diptera, Hymenoptera, and Hemiptera were the most represented groups at each of the survey areas.

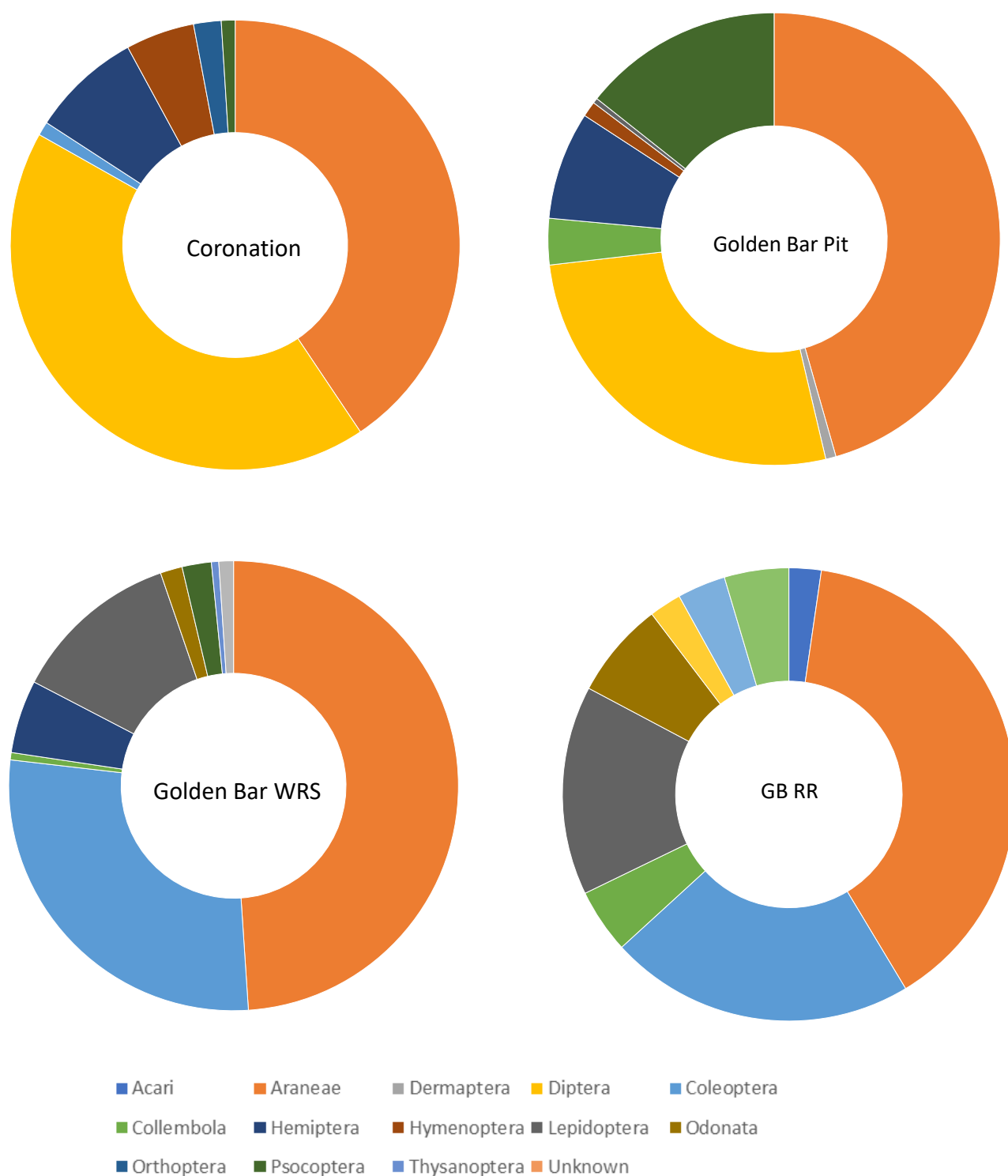


Figure 4.4. Invertebrate community composition across the survey areas using sweep netting methods in April and May 2022

4.2.3 Moth light trapping

4.2.3.1 April and May 2022 surveys

Six taxonomic orders were recorded from moth light trapping across the survey areas and invertebrate community compositions were dominated by Lepidoptera and Diptera, though sample sizes were generally low (Figure 4.5). Significantly more Lepidopterans were caught in the GB RR ($n = 21$), compared to all other sites (Coronation = 2; Golden Bar Pit = 1; Golden Bar WRS = 4).

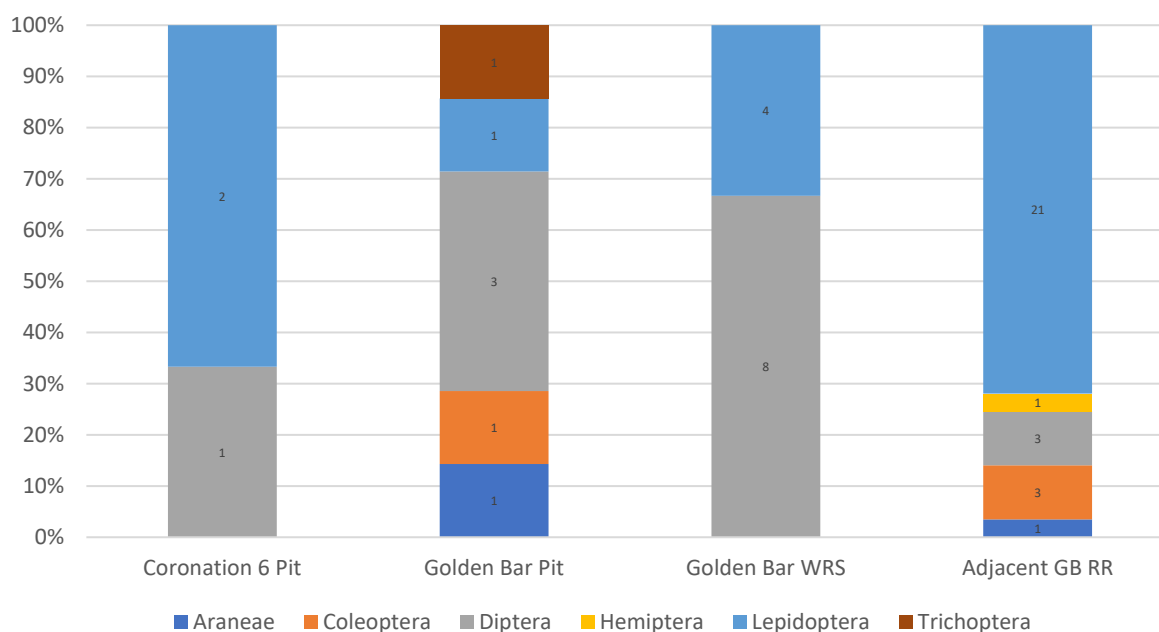


Figure 4.5. Invertebrate community composition across the survey areas using moth light trapping methods in April and May 2022. Numbers shown in bars represent the sample size for each taxonomic group.

4.2.3.2 September 2022 moth sampling results

Moth surveys undertaken at RHIMSPIM, BRWRS, and in three covenants: Island Block Covenant, Cranky Jims Creek Ecology Covenant, and Highlay Creek Ecology Covenant recorded 154 specimens, comprising 11 families (one individual could not be assigned to family level due to poor condition, but was assigned to the superfamily Gelechioidea), and 43 species. Two additional specimens could not be identified to species level due to poor condition.

Moth abundance (number of individuals) was highest at RHIMSPIM ($n = 67$) and BRWRS ($n = 27$) and lowest at Highlay Creek Ecology Covenant ($n = 13$) (Figure 4.6). Noctuid moths ($n = 77$) were the highest represented group followed by Geometrids ($n = 46$). The remainder of the groups were poorly represented (Figure 4.7).

Species diversity (number of species) was highest at RHIMSPIM (26 species) and Island Block Covenant (15 species). Thirteen species were recorded in BRWRS.

The Noctids *Ichneutica plena* ($n = 27$) and *Ichneutica ustistriga* ($n = 22$) were the most recorded species, followed by the Geometrid *Zermizinga indocilisaria* ($n = 12$). Two specimens of 'At Risk – Declining'

Samana acutata were recorded: one in RHIMSPIM and the other in Island Block Covenant. This species is a *Carmichaelia* specialist (i.e., feeds exclusively on *Carmichaelia*) (Figure 4.3).

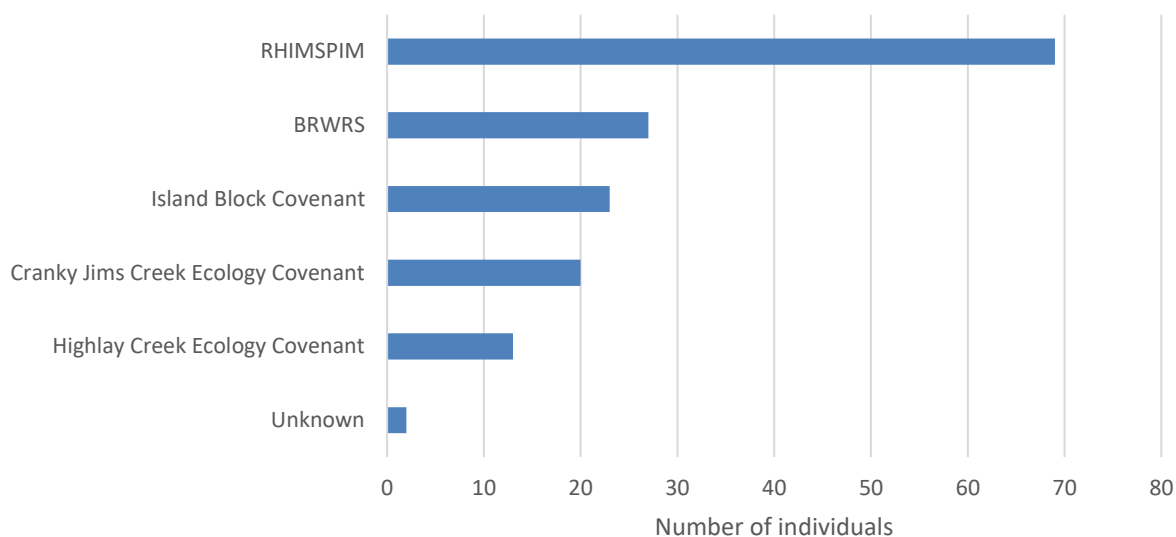


Figure 4.6. Moth abundance at RHIMSPIM, BRWRS, and in ecological covenants (Island Block Covenant, Cranky Jims Creek Ecology Covenant, and Highlay Creek Ecology Covenant) on OGNZL Macraes landholdings in September 2022.

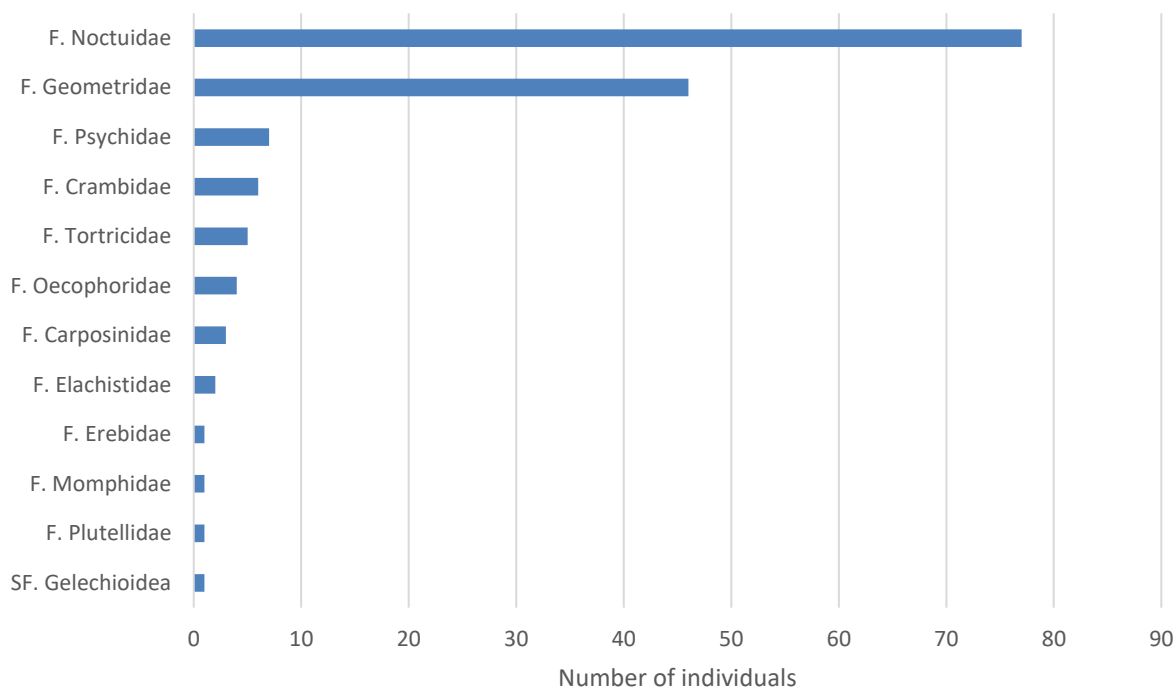


Figure 4.7. Moth fauna composition (to level of Superfamily [SF] or Family [F]) recorded at RHIMSPIM, BRWRS, and in ecological covenants (Island Block Covenant, Cranky Jims Creek Ecology Covenant, and Highlay Creek Ecology Covenant) on OceanaGold Macraes landholdings in September 2022.

4.2.3.3 April and May 2025 survey results

The following presents a summary of the results outlined by Bauckham (2025).

Over the course of the three surveys, a total of 64 Lepidoptera species were recorded (see Appendix D). Of these species 80% were endemic to New Zealand, a further 6% were considered native, and 14% were found to be introduced.

Species richness was greatest in early April, during the first set of surveys (46 species). The number of species recorded declined progressively with each successive survey (37 species late April; 35 species May). The quantity of Lepidoptera individuals was also noted to significantly decrease as the surveys commenced.

Of note was a record of Noctuidae: *Bityla sericea* from a light trap during the first set of surveys. Classified as 'At Risk – Naturally Uncommon' under the NZTCS (Hoare *et al.* 2026), this species is reasonably widespread though not found in large numbers. Its hostplant is unknown, but it has been suggested to potentially be *Muehlenbeckia* spp. (Patrick & Dugdale 2000).

A total of 29 *Orocrambus* specimens were collected using a variety of sampling methods. All specimens were collected during the first two (April) surveys; no specimens were collected during the final (May) survey.

Upon examination, heavily marked individuals and macropterous (large-winged) females were able to be discounted as *O. sophistes* and identified as *O. cyclopicus*. More weakly marked males appeared to conform to some forms of *O. cyclopicus* and were tentatively identified as such. However, enough ambiguity existed to be unable to be fully confident of these identifications and fully discount the possibility of *O. sophistes*. A series of eight specimens were sent to Dr R. Hoare for formal identification and examination through dissection.

This examination confirmed the presence of *O. cyclopicus* and the absence of *O. sophistes* amongst samples collected in this study. It was also found that the genitalia of two weakly marked "brownish" individuals did not conform to either *O. cyclopicus* or *O. sophistes* and appear to be a previously unknown species, close to *O. cyclopicus*, which may represent an *O. cyclopicus*-like segregate (*Orocrambus* cf. *cyclopicus*) that could possibly be endemic to inland tussock grasslands (R. Hoare, pers. comm, 2025). The status of this new entity remains unclear, with its presence known from two Central Otago sites—Bendigo and Macraes (R. Hoare, pers. comm. 2025). Its apparent absence from Canterbury and Nelson support the assumption that it may be endemic to inland Otago drylands. Work is currently underway by Dr R. Hoare to dissect material from the Mackenzie Basin to further elucidate the range of this new species.

With a total of 64 Lepidoptera species, including tussock specialists, recorded during the survey the site supports a relatively healthy and diverse tussock moth fauna.

Bauckham (2025) suggested that the relative lateness of the surveys (i.e., undertaken in Autumn) likely underestimated the true diversity of moths from the site and meant fewer adult *O. sophistes* were on the wing, decreasing the probability of their detection.

4.2.3.4 February to April 2026 survey results

Moth sampling over February to April 2026 resulted in the collection of 720 individuals comprising 24 families and 209 distinctive taxa (Table 4.2).

BRWRS, followed by Murphys Creek and Redbank Covenant, supported the highest moth diversity of all the areas surveyed. However, diversity was broadly similar across most of the sampled sites, with the exception of the Macraes Road Realignment area, where moth diversity appeared to be noticeably lower (Table 4.2).

Of the species recorded during the survey, 44 a current NZTCS listing. These comprised six species classified as 'At Risk – Declining' (*Agrotis admirationis*, *Asaphodes recta*, *Nyctemera annulata*, *Pasiphila* sp. A (NZAC 04285480 "Carmichaelia", *Patagoniodes farinaria*, *Samana acutata*), one species listed as 'At Risk – Uncommon' (*Bityla sericea*), one species listed as 'Data Deficient' (*Wiseana mimica*), and 36 taxa listed as 'Not Threatened' (Appendix E).

At least one 'At Risk' species was recorded at each survey location and Table 4.3 summarises the locations at which 'At Risk' moth species were detected and Figure 4.3 shows images of each species.

Table 4.2. High level results of moth sampling undertaken on OGNZL landholdings over February to April 2026.

Survey area	Number of distinctive taxa ('species')	No. of Families
BRWRS	129	21
Murphys Creek catchment	100	22
Redbank Covenant	100	19
Coronation	102	19
Cranky Jims Covenant	113	16
Golden Bar	109	19
Macraes Road Realignment	67	17
Total	720	24

Table 4.3. Locations at which 'At Risk' and 'Data Deficient' moth species were detected during the February to April 2026 moth survey.

Species	NZTCS listing	BRWRS	Coronation	Cranky Jims	Golden Bar	Murphys Creek	Redbank	Road Realignment
<i>Agrotis admirationis</i>	At Risk - Declining		•					
<i>Asaphodes recta</i>	At Risk - Declining		•			•		
<i>Bityla sericea</i>	At Risk - Uncommon	•			•	•	•	
<i>Nyctemera annulata</i>	At Risk - Declining		•	•	•			•
<i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia")	At Risk - Declining	•		•	•		•	
<i>Patagoniodes farinaria</i>	At Risk - Declining	•	•			•	•	•
<i>Samana acutata</i>	At Risk - Declining	•					•	
<i>Wiseana mimica</i>	Data Deficient					•		

4.2.4 Hand searches and visual observations

Numerous species of terrestrial invertebrates were observed during opportunistic hand searches between 2022 and April 2026. Species of particular note are highlighted below.

- Numerous observations of larger-bodied ground beetles, including *Megadromus bullatus*, *Mecodema sculpturatum*, and *Oregus aereus* were made across the MP4 Project area. Ground beetles were frequently found beneath rocks, wood debris, and in pitfall and funnel traps used to capture lizards. None of the larger bodied beetles encountered are listed under the NZTCS.
- Observations of the New Zealand praying mantis (*Orthodera novaezealandiae*; 'At Risk – Declining'). An ootheca (egg casing) was recorded in GPUG, and live adult individuals were observed in Cranky Jim's shrubland and in vegetation near the crib rooms on Golden Point Road (the latter two locations were both outside of the MP4 Project impact area). This species is in decline but is still relatively common across its national range.
- A single observation of a putative new species of *Mecodema* from the Innes Mills area of the Central Mining Area. This taxon is currently undescribed and purportedly known only from the wider Oamaru area (Dr D. Seldon, pers. comm. 20 October 2025 via iNaturalistNZ) (Figure 4.8). No other information on its distribution, abundance, or ecology could be found.
- Numerous observations of Otago ground wētā (*Hemiandrus maia*; 'Not Threatened') from tussock and grassland habitats, particularly in Coronation, Central Mining Area (e.g., Macraes Road Realignment, Innes Mills), and Murphys Creek Catchment. Despite its common name, this species is widely distributed across both Otago and Southland, and it can occur in high abundance in suitable habitat.



Figure 4.8. Images of notable terrestrial invertebrates found during surveys on OGNZL landholdings between 2022 and 2026. Upper central: Otago ground wētā. Lower left: putative new species of *Mecodema* “Oamaru”; lower right: *Megadromus bullatus*. Images by D. van Winkel.

4.2.5 Environmental DNA (eDNA) results

The eDNA analysis produced 232 records assigned to the group ‘Insects’ (Table 4.4).

At least 13 insect orders and 31 families were detected, with 72.4% of all records resolved to genus, subgenus, or species-level taxonomic categories. A total of 107 species were identified, with records dominated by aphids (Hemiptera), moths (Lepidoptera), and caddisflies (Trichoptera) (Appendix G).

Two species are currently listed as ‘Data Deficient’ under the NZTCS: the moth *Wiseana fuliginea* and the stonefly *Zelandobius uniramus*. Although stoneflies are technically classified as freshwater invertebrates, *Z. uniramus* has been included here because its presence was detected and as a precautionary and conservative component of the terrestrial invertebrate assessment. A further 29 species are classified as ‘Not Threatened’ (Appendix G).

Zelandobius uniramus DNA was not found in any of the MP4 Project impact areas. However, genetic material was collected from the Highlay, Camp Creek, Cranky Jims, Murphys, and Coal Creek, and because adults are flighted, there is a possibility that this species could be present more widely in the surrounding landscape, including in the MP4 Project area.

Wiseana fuliginea DNA was detected in a headwater tributary of Māori Hen Creek in the Trimbells WRS area of Coronation Mining Area. DNA was present in two of the five replicates.

While water-derived eDNA is not considered to completely characterise terrestrial invertebrate communities, it provided an opportunistic and supplementary sampling method for invertebrates. Indeed, several terrestrial invertebrate species that were not detected using traditional invertebrate sampling methods (e.g., moth light trapping) were recorded in the eDNA samples, including the notable and 'Data Deficient' moth *Wiseana fuliginea*.

Table 4.4. eDNA sampling results for insects, showing the number of records for each rank.

Rank	No. of records
Class	1
Infraclass	1
Order	13
Clade	2
Infraorder	1
Subsection	1
Superfamily	1
Family	31
Subfamily	12
Tribe	1
Genus	57
Subgenus	4
Species	107
Total	232

4.2.6 Threatened, At Risk, and Data Deficient species

Fourteen 'Threatened', 'At Risk', or 'Data Deficient' invertebrate species have been recorded within the Project impact area or the immediately surrounding landscape on OGNZL landholdings.

These records include the moth *Orocrambus sophistes* ('Threatened – Nationally Vulnerable'); the moths *Agrotis admirationis*, *Asaphodes recta*, *Dasyuris partheniata*, *Nyctemera annulata*, *Pasiphila* sp. A (NZAC 04285480 "Carmichaelia"), *Patagoniodes farinaria*, *Samana acutata*, *Theoxena scissaria* (all 'At Risk – Declining'); the praying mantis *Orthodera novaezealandiae* ('At Risk – Declining'); the moth *Bityla sericea* ('At Risk – Uncommon'); and the moths *Wiseana fuliginea* and *Wiseana mimica* and stonefly *Zelandobius uniramus* ('Data Deficient'). All species except *D. partheniata* were recorded during dedicated surveys undertaken as part of the MP4 Project.

Of these species, nine were recorded within areas that will be directly affected by proposed mining activities. The remaining four species were recorded from sites in the surrounding landscape, including areas that will not be disturbed, and in some cases, where habitat will be enhanced. However, because they are all strong flying species, their occurrence within the Project impact area is considered likely.

The full list of 'Threatened', 'At Risk', and 'Data Deficient' species, together with associated comments, is presented in Table 4.5 and images shown in Figure 4.9.

In addition, a record of the 'Threatened – Nationally Vulnerable' moth *Hierodoris polita* was identified during the desktop assessment. A single individual was photographed floating in a rock pool atop a rock outcrop within a tussock-dominated landscape in the Macraes Flat area (precise location unknown) in March 2021 (observation by "possumsend", and identification provided by Dr Robert Hoare on iNaturalistNZ). Although this observation is notable, the species has not been included in the list of species considered for the MP4 Project due to the lack of precise locality information and the absence of any subsequent records despite several years of moth trapping within both the MP4 Project area and the wider Macraes landscape.

Table 4.5. Threatened', 'At Risk', and 'Data Deficient' invertebrate species reported from OGNZL Macraes landholdings.

Species	NZTCS listing	Date and location of record	Detected in the MP4 Project impact area	Comments
<i>Orocrambus sophistes</i>	Threatened – Nationally Vulnerable	May 2022. Golden Bar	Yes	Caught on the wing in GB WRS. An obligate tussock inhabitant. The identification of this moth was made by Dr. R. Hoare (expert lepidopterist from Manaaki Whenua Landcare Research). Despite targeted and intensive surveys for this species both at the original detection location (Golden Bar) and across the wider OGNZL landholdings, no further specimens have been detected. Surveys have detected numerous specimens of the closely related <i>Orocrambus cyclopicus</i> / <i>Orocrambus cf. cyclopicus</i> . Concerted efforts to detect further individuals of this species both at GB WRS and across the wider OGL Macraes landholdings have not been successful. Accordingly, its presence is notable but there is no evidence to suggest GB WRS nor surveyed areas of OGL Macraes landholdings support detectable populations of this taxon.
<i>Agrotis admirationis</i>	At Risk – Declining	February to April 2026. Coronation.	Yes	Single individual caught but it has also been recorded in the Redbank Covenant (C. Damken, unpub, data). This species has a patchy distribution throughout both the North and South Islands. Its host plant is unknown and is likely polyphagous. Patrick et al. (2011) mention it feeds on herbs in open areas.
<i>Asaphodes recta</i>	At Risk – Declining	February to April 2026. Coronation and Murphys Creek catchment.	Yes	Two individuals caught day-flying over wetted areas in MEEA (other individuals observed); and one individual collected at light at Coronation. Has been found in Canterbury, Otago, and Southland tussocklands; appears to be quite local and associated with wetted boglands. Larvae have been raised on <i>Ranunculus</i> , <i>Senecio</i> , and <i>Bellis</i> (Patrick 2000).
<i>Dasyuris partheniata</i>	At Risk – Declining	2014. Coronation.	Yes	The record of <i>D. partheniata</i> (orange speargrass looper) derives from a historical observation of a larva found on speargrass (<i>Aciphylla subflabellata</i>) in the Coronation area in August 2014. The observation was made by M. Thorsen, with identification subsequently confirmed by B. Patrick and reported via iNaturalist.
<i>Nyctemera annulata</i>	At Risk – Declining	February to April 2026. Coronation, Macraes Road Realignment,	No	Captured in moth traps and observed flying during the day. All records were of single individuals captured at each site. Host plant include Cineraria, groundsel, ragwort, and other plants in the Senecio family.

		GPUG, Cranky Jims, Golden Bar, MEEA, and Redbank Covenant.		
<i>Orthodera novaezealandiae</i>	At Risk – Declining	March 2026. GPUG, Cranky Jim's shrubland, and crib rooms on Golden Point Road	Yes	An egg casing of the New Zealand praying mantis was recorded in GPUG, and live adult individuals were observed in Cranky Jim's shrubland and in vegetation near the crib rooms on Golden Point Road (both locations outside of the MP4 Project footprint).
<i>Pasiphila</i> sp A (NZAC 04285480 "Carmichaelia")	At Risk – Declining	February to April 2026. BRWRS, Cranky Jims, Golden Bar, and Redbank Covenant.	Yes	Undescribed species with a patchy distribution across both the North and South Islands. Found in association with native <i>Carmichaelia</i> spp. Widespread but fragmented populations. Has been reared from <i>Carmichaelia petriei</i> and <i>Clianthus</i> sp. Probably feeds on other <i>Carmichaelia</i> spp. Like <i>S. acutata</i> has been given the 'Range Restricted' qualifier under the NZTCS recognising its dependence on areas of good quality <i>Carmichaelia</i> shrubland.
<i>Patagoniodes farinaria</i>	At Risk – Declining	March 2026. Road Realignment, Golden Bar, BRWRS, Coronation, Cranky Jims, MEEA, and Redbank Covenant.	Yes	Captured in moth traps. All records were of single individuals captured at each site. Host plants include shore groundsel or ragwort which are common in the landscape.
<i>Samana acutata</i>	At Risk – Declining	September 2022 and February to April 2026. RHIMSPIM, BRWRS, Island Block Covenant, and Redbank Covenant.	No	Captured in moth traps. All records were of single individuals captured at each site. Host plant is <i>Carmichaelia</i> spp.
<i>Theoxena scissaria</i>	At Risk – Declining	September 2022. BRWRS.	No	Single individual caught in moth trap in BRWRS. Larvae unknown; related species (in genus <i>Samana</i>) feed on <i>Carmichaelia</i> . Considered local and rare. It is almost certainly associated with dry shrublands. Female unknown and possibly flightless, limited dispersal and increasing need for conservation.

<i>Bityla sericea</i>	At Risk – Uncommon	April and May 2025, February and March 2026. Golden Bar, BRWRS, Murphys Creek, and Redbank Covenant.	Yes	Captured in moth traps. All records were of single individuals captured at each site. Host plant likely <i>Muehlenbeckia</i> sp.
<i>Wiseana fuliginea</i>	Data Deficient	March 2026. Coronation (Trimbells WRS).	Yes	Very poorly known species. Generalist feeder primarily found in grasslands, shrublands, and improved pastures. Of economic importance because the penultimate and final-instar larvae compete with stock for spring pasture growth (Barratt <i>et al.</i> 1990) (Dugdale 1994). Dedicated surveys for this species at several South and North Island sites over twenty years prior to 2017 did not yield a single adult specimen. A larva of this species, collected from a pasture at Mararoa Downs, Te Anau, Southland in May 2016, was positively identified at <i>W. fuliginea</i> based on genetic analysis comparisons with old voucher specimens held in the New Zealand Arthropod Collection (Richards <i>et al.</i> 2017). However, summer light trapping in January 2017 at the larva collection site did not detect this species.
<i>Wiseana mimica</i>	Data Deficient	March 2026 Murphys Creek	No	Poorly known species. Of economic importance because the penultimate and final-instar larvae compete with stock for spring pasture growth (Barratt <i>et al.</i> 1990) (Dugdale 1994). Characteristic of open country east of Fiordland and the Southern Alps. Present at 1,100 m asl on the Lammermoor Range Central Otago and at 1,200 m asl on the Kyeburn (Mt Buster) diggings Central Otago, and a dead specimen was found at 1,700 m on Mt Pisa by B.H. Patrick. Higher-altitude populations appear to be associated with moss/ sedge bogs, e.g., the Mt Kyeburn/ Mt Buster Diggings. Such populations are sympatric with <i>Dioxycanus fuscus</i> (B.H. Patrick, pers. comm.) (Dugdale 1994).
<i>Zelandobius uniramus</i>	Data Deficient	March 2026. Highlay, Camp Creek, Cranky Jims, Murphys, and Coal Creek.	No	Species is poorly known but occurs across the South Island of New Zealand and on Stewart Island.



Orocrampus sophistes (male) (©Landcare Research)



Agrotis admirationis (female). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.



Asaphodes recta (male). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.



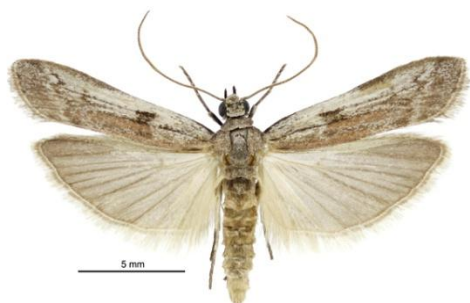
Samana acutata (male). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.



Dasyuris partheniata (female). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.



Nyctemera annulata © Auckland War Memorial Museum.



Patagoniodes farinaria (male). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.



Orthodera novaezealandiae (female). Image by B. McQuillan.



Bityla sericea (male). Image by Birgit E. Rhode,
Landcare Research New Zealand Ltd.



Wiseana fuliginea (male). Image by Birgit E. Rhode,
Landcare Research New Zealand Ltd.



Wiseana mimica (female). Image by Birgit E. Rhode,
Landcare Research New Zealand Ltd.



Theoxena scissaria (male). Image by Birgit E. Rhode,
Landcare Research New Zealand Ltd.

Figure 4.9. 'Threatened', 'At Risk', and 'Data Deficient' species recorded on OGNZL landholdings between 24 February and 4 April 2026. No images available for *Pasiphila* sp. A (NZAC 04285480 "Carmichaelia") and *Zelandobius uniramus*.

4.3 Invertebrate habitat suitability

4.3.1 Habitat types and quality

Twenty-two ecosystem types were identified within the MP4 Project area and detailed descriptions of these are provided by Whirika (2026). For simplicity, these were pooled into twelve broad and distinctive habitat types. Each habitat type is briefly described in Table 4.6 and illustrated in Figure 4.10. The areal extents of each habitat type within each of the MP4 Project areas is presented in Table 4.7.

Due to the diverse habitat, microhabitat, and resource requirements of different invertebrate taxa, all habitat types within the survey area were assessed as providing potentially suitable habitat for indigenous terrestrial invertebrates.

Table 4.6. Broad habitat types identified in the MP4 Project impact area. All habitat types considered suitable for invertebrates.

Broad habitat category	Brief description
Rock outcrop	Rock outcrops or rock tors are schist rock features that protrude from the ground, often surrounded by tussock or shrubland vegetation. They provide important habitat for many invertebrate species, especially those specialised to dryland environments. Crevices and loose rock provide stable microclimates and shelter from temperature extremes, predators, and desiccation. Schist outcrops, particularly large complex ones provide key habitat for terrestrial invertebrates, supporting spiders, beetles, wētā, and other cryptic taxa.
Tussock	Tussock grasslands are among the most significant terrestrial invertebrate habitats in inland Otago, supporting diverse assemblages of moths, beetles, grasshoppers, spiders, and native flies. Indigenous tussock species provide important food resources, oviposition sites, and microhabitats, while the inter-tussock environment supports species adapted to open, seasonally dry conditions. Indeed, the larva of many moth species are obligate tussock feeders. Tussock habitats are particularly important for dryland and alpine invertebrates, including several range-restricted and nationally threatened species. Tussock habitat quality can vary depending on grazing pressure and historical modification, but generally tussock habitat supports a diversity and abundance of invertebrates.
Exotic grass	Exotic grassland habitats generally support lower indigenous invertebrate diversity than native vegetation communities due to reduced structural complexity and the dominance of introduced plant species. However, these habitats can still provide foraging and dispersal habitat for generalist indigenous invertebrates, particularly where they occur adjacent to native vegetation or contain remnant native plant species. The herbaceous weeds that grow amongst exotic grasslands provide important food resources for some invertebrates such as moths and butterflies, crickets, grasshoppers and wētā, and beetles. In modified Otago landscapes, exotic grasslands may contribute to landscape connectivity and support common disturbance-tolerant taxa. Exotic grass is sufficiently dense and interspersed with ground cover such as rocks or logs provides a suitable habitat for many terrestrial invertebrates.
Shrubland	Shrubland habitats in Otago can support a diverse assemblage of terrestrial invertebrates by providing a structurally complex environment with varied microclimates, host plants, and shelter resources. Native shrublands are particularly important for moths, beetles, spiders, and orthopterans, including species associated with matagouri, kānuka, and speargrass communities. Dense ground cover and accumulated litter also provide important refugia for moisture-sensitive taxa and nocturnal invertebrates.
Felled pine	Felled pine habitats generally provide low to moderate habitat value for indigenous terrestrial invertebrates. While recent disturbance reduces vegetation structure and plant diversity, coarse woody debris, slash, and regenerating ground cover can provide temporary refuge for detritivores, spiders, beetles, and some generalist indigenous species. Habitat suitability is typically transitional and dependent on the extent of native regeneration following harvesting or replacement plantation.

Riparian	Riparian habitats are highly important for terrestrial invertebrates due to their elevated moisture levels, structural diversity, and connectivity between terrestrial and freshwater ecosystems. These areas support a wide range of taxa, including beetles, flies, caddisflies, moths, and spiders, and provide important habitat for species reliant on damp soils, leaf litter, and stream-edge vegetation. Riparian margins also function as dispersal corridors and can support high invertebrate productivity.
Woody exotic	Woody exotic habitats generally support lower indigenous invertebrate diversity than native vegetation but can still provide habitat for a range of generalist and disturbance-tolerant species. Exotic woody vegetation (e.g., gorse) may offer shelter, litter accumulation, and nectar resources, particularly where native understorey species are present. In some landscapes, these habitats can contribute to habitat connectivity and provide supplementary refuges for mobile indigenous taxa.
Ephemeral wetland	Ephemeral wetlands are ecologically important habitats that support specialised invertebrate assemblages adapted to fluctuating hydrological conditions. Seasonal inundation and drying cycles create unique ecological niches for aquatic and semi-terrestrial insects, including flies and beetles, while also supporting terrestrial predators and scavengers. In Otago, these habitats can be locally uncommon and contribute disproportionately to regional invertebrate diversity.
Wetland	Wetlands provide highly valuable habitat for terrestrial and semi-aquatic invertebrates due to their consistently moist conditions, high plant diversity, and complex vegetation structure. Wetlands support a broad range of taxa, including moths, beetles, flies, and spiders, many of which are sensitive to drying and habitat disturbance. Indigenous wetlands in Otago may also support locally uncommon or specialised species associated with sedges, rushes, and permanently damp substrates.
Pond	Pond habitats are important for both aquatic and terrestrial invertebrates, supporting species that rely on standing freshwater for part or all their life cycle. Marginal vegetation, shallow water zones, and surrounding damp soils provide habitat for flies, beetles, dragonflies, damselflies, and other moisture-associated taxa. Ponds can also function as local biodiversity hotspots and provide important breeding and foraging habitat within modified landscapes.
Pine	Pine plantation habitats typically support lower indigenous terrestrial invertebrate diversity than native vegetation due to simplified vegetation structure and limited native host plants. Nevertheless, pine forests can provide shaded, humid conditions and litter accumulation that support some beetles, spiders, and detriticolous taxa. Indigenous invertebrate diversity is often higher on the edges of pine plantations, where native understorey vegetation is present, or where plantations are adjacent to indigenous habitats.
Existing mine/ disturbed	Existing mine and disturbed habitats generally support reduced indigenous invertebrate diversity due to vegetation removal, soil disturbance, and altered microclimatic conditions. However, these areas can still be utilised by disturbance-tolerant, mobile, or early successional species, particularly where coarse substrate or regenerating vegetation persists. Over time, disturbed habitats may provide opportunities for recolonisation and ecological succession if restoration occurs.

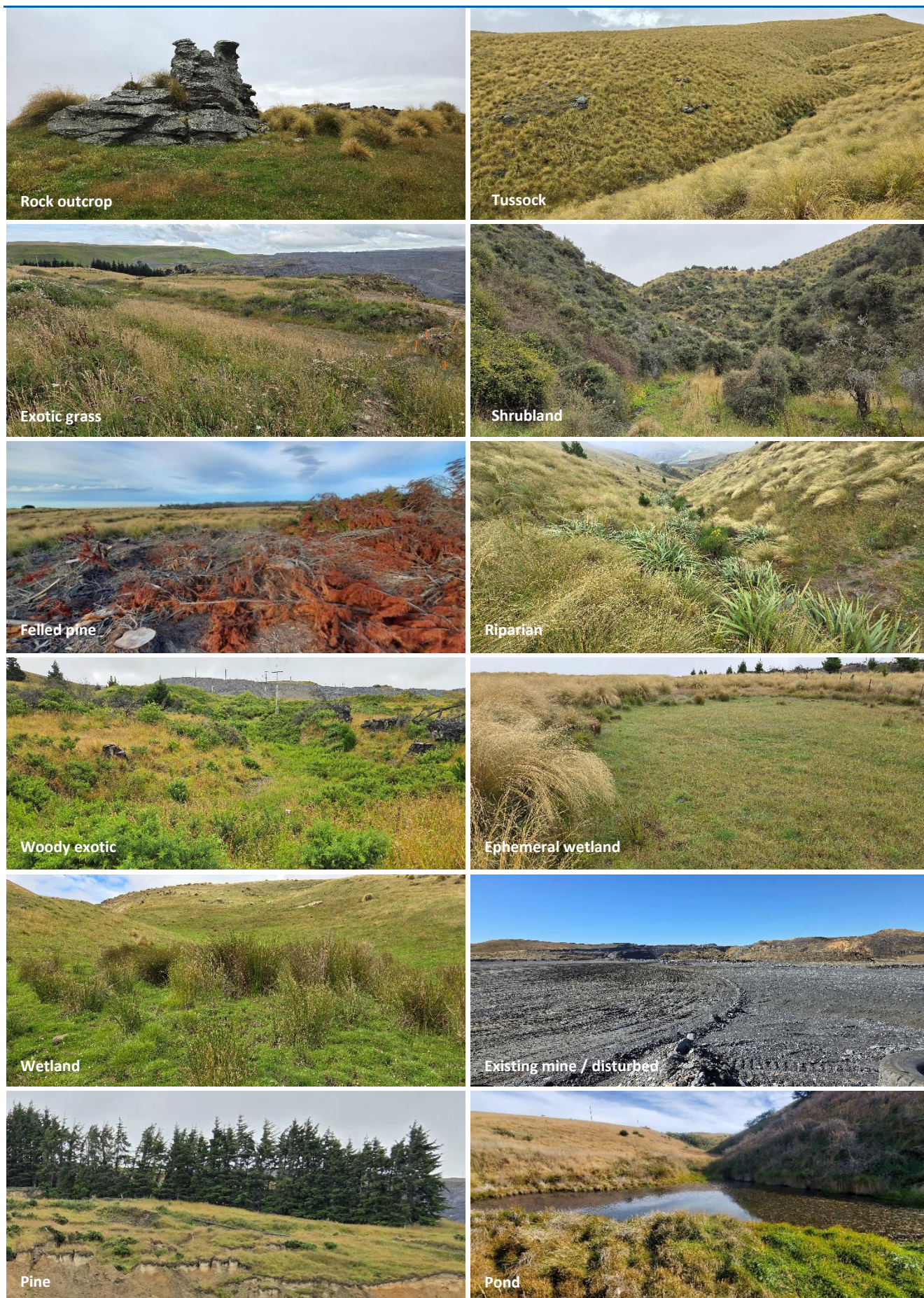


Figure 4.10. A selection of photographs of showing the identified habitat types within the MP4 Project area.

Table 4.7. Areal (ha) extents of each identified habitat type within the MP4 Project area (includes impact area + 20 m buffer).

Habitat type	Coronation	GPUG•	Central	FWFD	Golden Bar	Golden Bar Haul Road	BRWRS	Total	Total (excl. GPUG & BRWRS)
No. of rock outcrops	48	-	0	0	14	2	420	484	64
Rock outcrop	0.171	-	0	0	0.077	0.012	0	0.260	0.260
Tussock	63.240	12.800	2.372	0	20.886	3.512	38.525	141.335	90.011
Exotic grass	9.834	-	45.757	5.500	52.090	22.679	105.020	240.879	135.859
Shrubland	2.666	49.000	0.051	0	0.227	0.018	17.164	69.126	2.961
Felled pine	5.802	-	0	0	0	0	0	5.802	5.802
Riparian	0.907	-	0	0	0.378	0	2.898	4.182	1.285
Woody exotic	0.092	-	1.120	0	0.056	0	0	1.269	1.269
Ephemeral wetland	0.388	-	0.618	0	0.133	0.147	0	1.287	1.287
Wetland	0.774	-	0.159	0.000	0.822	0.028	0.000	1.783	1.783
Pond	0.024	-	0.135	0	0.189	0	0	0.347	0.347
Pine	0.021	-	1.172	0	0	0	0	1.193	1.193
Existing mine/ disturbed	4.709	-	68.046	0.000	3.941	6.490	8.423	91.608	83.185
Total all habitat	88.628	61.800	119.430	5.500	78.799	32.886	172.030	559.074	325.243

• Habitat types within GPUG broadly estimated from aerial imagery.

5 Ecological value and ecological significance assessments

5.1 Assessment of ecological value

Ecological values were assigned to both invertebrate communities and individual species ('Threatened', 'At Risk', 'Data Deficient', and large-bodied 'Not Threatened' or notable species only) within each of the Mining Areas, using the criteria in the EclAG (see Appendix H, Tables 5–10).

- For invertebrate communities and habitats, values were determined based on the following criteria: representativeness, rarity or distinctiveness, diversity and pattern, and ecological context.
- For individual species, ecological value was determined according to their level of conservation concern. Where available, only national New Zealand Threat Classification System (NZTCS) listings were considered. However, most invertebrate groups have not been formally assessed under the NZTCS, and regional conservation threat listings are generally unavailable for invertebrates. The exception is Onychophora (velvet worms), for which regional threat rankings exist; however, no Onychophora were recorded within the MP4 Project area.

The assessments are presented in Table 5.1 and Table 5.2.

Table 5.1. Assessment of ecological value for invertebrate communities/ habitat within the MP4 Project Areas only.

Area	Criteria	Justification and value assignment
MP4 Project overall		
	Representativeness	A wide variety of habitats considered suitable for terrestrial invertebrates are present in the Project area, including modified grassland, exotic treeland, weed-dominated vegetation, tussock, shrubland, ephemeral wetlands, riparian habitat, and small, isolated rock outcrops present. The invertebrate community is considered representative of these modified and more natural habitats. The larger-bodied invertebrates, including <i>Mecodema</i> and <i>Megadromus</i> ground beetles and the Otago ground wētā, appear to be well represented in the area. Moderate value
	Rarity/ Distinctiveness	Fourteen 'Threatened', 'At Risk', or 'Data Deficient' species recorded within the Project area. High value
	Diversity and pattern	The invertebrate diversity and abundance are likely to be representative of the modified and more natural habitats present in the area and like the diversity of invertebrates found in similar habitats in the surrounding landscape on the OGNZL landholdings and Macraes ED. Moderate value
	Ecological context	The invertebrate community fills ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, detritivores, and pollinators. Introduced mammalian predators and habitat modification (e.g., grazing) are the likely drivers of decline in some more sensitive invertebrate groups, though for the most part many species likely persist despite these anthropogenic influences. The area shares ecological connectivity with connections with modified and more natural tussock grassland and tussock–grey shrubland habitats to the north, east, and south and thus, the invertebrate community will be contributing to gene flow within the wider population. High value
	Overall value	High
Coronation Mining Area		
	Representativeness	Habitats are primarily modified (grazed) tussock land typical of the surrounding landscape, with ephemeral wetlands, riparian habitat, and small, isolated rock outcrops present. The invertebrate community in this area is representative of the modified tussock habitats. The larger-bodied invertebrates, including <i>Mecodema</i> and <i>Megadromus</i> ground beetles and the Otago ground wētā, appear to be well represented in the area. Furthermore,

Area	Criteria	Justification and value assignment
		the detection of rare and poorly known species such as <i>Wiseana fuliginea</i> suggests that the invertebrate assemblage may be broadly representative of the predominantly tussock-dominated habitats characteristic of the wider area. Moderate value
	Rarity/ Distinctiveness	Five 'At Risk – Declining' (<i>Agrotis admirationis</i>, <i>Asaphodes recta</i>, <i>Dasyuris partheniata</i>, <i>Nyctemera annulata</i>, and <i>Patagoniodes farinaria</i>) and one 'Data Deficient' (<i>Wiseana fuliginea</i>) species recorded. Despite only a few individuals of each species recorded, and <i>Wiseana fuliginea</i> recorded only from eDNA, it is likely that the area provides important habitat for these 'At Risk' and 'Data Deficient' species. High value
	Diversity and pattern	The invertebrate diversity is likely to be typical of modified tussock habitat, interspersed with riparian habitats, found on the OGNZL landholdings and in the Macraes ED. Moderate value
	Ecological context	The invertebrate community fills ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, detritivores, and pollinators. Introduced mammalian predators and habitat modification (e.g., grazing) are the likely drivers of decline in some more sensitive invertebrate groups, though for the most part many species likely persist despite these anthropogenic influences. The area shares ecological connectivity with similar modified tussock habitat to the north, east, and south and thus, the invertebrate community will be contributing to gene flow within the wider population. Moderate value
	Overall value	Moderate
Golden Point Underground		
	Representativeness	Habitats within the area comprise a mosaic of modified (grazed) tussock grassland and tussock–grey shrubland communities, interspersed with rock outcrops characteristic of the more intact surrounding landscape. Densely vegetated gullies, representative of those typical of the Deepdell Creek catchment, are also present. Collectively, these habitat features are likely to support invertebrate assemblages broadly representative of the more natural habitats occurring across OGNZL landholdings and the wider Macraes Ecological District. High value
	Rarity/ Distinctiveness	Two 'At Risk – Declining' invertebrate species, <i>Nyctemera annulata</i> and <i>Orthodera novaezealandiae</i>, are known to occur within the area. Although only single individuals of each species were recorded during surveys, the

Area	Criteria	Justification and value assignment
		presence and extent of relatively undisturbed habitat suggest that both species are likely to be supported by viable local populations. High value
	Diversity and pattern	The invertebrate diversity is likely to be typical of relatively intact tussock grassland and tussock–grey shrubland habitat, with riparian habitats, found on the OGNZL landholdings and in the Macraes ED. Moderate value
	Ecological context	The invertebrate community fills ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, detritivores, and pollinators. Introduced mammalian predators and habitat modification (e.g., grazing) are the likely drivers of decline in some more sensitive invertebrate groups, though for the most part many species likely persist despite these anthropogenic influences. The area shares ecological connectivity with connections with modified and more natural tussock grassland and tussock–grey shrubland habitats to the north, east, and south and thus, the invertebrate community will be contributing to gene flow within the wider population. High value
	Overall value	Very High
Central Mining Area		
	Representativeness	Habitat is largely highly modified grassland, exotic treeland, and weed-dominated vegetation. While the habitat is a poor representation of the typical dryland Otago environment, the invertebrate fauna in the area is likely to be representative of modified or degraded habitats that occur throughout the wider landscape. Low value
	Rarity/ Distinctiveness	Two ‘At Risk – Declining’ invertebrate species, <i>Nyctemera annulata</i> and <i>Patagoniodes farinaria</i> , are known to occur within the area. These species are probably present in reasonable numbers given that they feed on exotic plants like groundsel, cineraria, and other <i>Senecio</i> plants which are growing in the modified Central Mining Area. High value
	Diversity and pattern	The invertebrate diversity and abundance are likely to be representative of the modified vegetation present in the area and like the diversity of invertebrates found in other exotic vegetation dominated sites in the surrounding landscape on the OGNZL landholdings and Macraes ED. Moderate value

Area	Criteria	Justification and value assignment
	Ecological context	The invertebrate community fills ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, detritivores, and pollinators. Introduced mammalian predators and edge habitat modification because of existing mining activities are the likely drivers of decline in some more sensitive invertebrate groups, though for the most part many species likely persist despite these anthropogenic influences. The area exhibits lower ecological connectivity relative to other MP4 Project areas due to the surrounding active mining footprint. However, because many invertebrate species are capable of strong flight and dispersal, the area is still likely to function as a stepping-stone habitat for invertebrates moving through the wider landscape. Additionally, the extent of exotic-dominated vegetation is sufficiently large to support the complete life cycle of some invertebrate species within the area, reducing the need for dispersal to adjacent habitats. Low value.
	Overall value	Moderate
Frasers West French Drain		
	Representativeness	Habitat is almost entirely highly modified, short grassland. The habitat poorly represents typical invertebrate habitat of the surrounding landscape. It is expected that the invertebrate community is underrepresented compared to other more densely vegetated areas on OGNZL landholdings and the wider Macraes ED. Low value
	Rarity/ Distinctiveness	No invertebrate species of conservation concern are known to occur in the area. However, the presence of common indigenous invertebrates with 'Not Threatened' conservation statuses could be present. Low value
	Diversity and pattern	Considering the relatively simple environment (i.e., short, grazed pasture grass), invertebrate diversity is likely to be low compared to surrounding habitats on the OGNZL landholdings and Macraes ED, and the invertebrate community is likely to be dominated by exotic species. Low value
	Ecological context	The invertebrate community—likely to be dominated by exotic species—fills some ecological niches (terrestrial nocturnal and diurnal roles) and will be contributing to ecosystem function as predators, prey, detritivores, and pollinators. Species that are tolerant of highly modified environments and those that feed on pasture grasses may persist. Ecological connectivity is considered low though wetland and pond environments, which provide suitable habitat for a range of freshwater species, are present to the north. Strong flighted species may use the area as a stepping-stone for moving through the wider landscape.

Area	Criteria	Justification and value assignment
		Low value
	Overall value	Low
Golden Bar Haul Road		
	Representativeness	Habitat for invertebrates is largely absent inside the proposed haul road footprint, with some low to moderate value habitat (e.g., degraded tussock and rock tors) present on the edges and within the 20 m buffer of the footprint. The invertebrate community within the haul road footprint will be underrepresented compared to the surrounding areas, but the community occupying the vegetated edges will be representative of modified environments in the wider landscape. Low value
	Rarity/ Distinctiveness	No invertebrate species of conservation concern are known to occur in the area. However, the presence of common indigenous invertebrates with 'Not Threatened' conservation statuses likely to be present. Low value
	Diversity and pattern	The invertebrate diversity is considered low compared to surrounding areas that support more natural vegetation and habitats (e.g., modified tussock) on the OGNZL Macraes landholdings and Macraes ED. Low value
	Ecological context	The footprint mostly supports disturbed vegetation (historical mine haul road and frequent grazing by stock) and is largely devoid of suitable invertebrate habitat (the habitat on the edges and within the 20 m buffer much more suitable). Accordingly, many of the potential ecological niches are not filled and ecosystem function will be poor. The area shares good ecological connections with modified and more natural tussock habitat in the immediate surrounding landscape and thus, the invertebrate community will be contributing to gene flow within the wider population. Low value
	Overall value	Low
Golden Bar Mining Area		
	Representativeness	Habitats are primarily modified (grazed) tussock typical of the surrounding landscape, with large areas of short, grazed pasture, ephemeral wetlands, riparian habitat, and isolated rock outcrops present. The invertebrate community in this area is representative of the modified tussock habitats. The larger-bodied invertebrates, including <i>Mecodema</i> and <i>Megadromus</i> ground beetles are well represented in more densely vegetated areas

Area	Criteria	Justification and value assignment
		within the site. Furthermore, the detection of rare and poorly known species such as <i>Orocrambus sophistes</i> and <i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia") suggests that the invertebrate assemblage may be broadly representative of the predominantly tussock-dominated habitats characteristic of the wider area. Moderate value
	Rarity/ Distinctiveness	A single specimen of the 'Threatened – Nationally Vulnerable' moth <i>Orocrambus sophistes</i> was recorded in GB WRS in May 2022. Despite intensive targeted survey effort since, this species has not subsequently been redetected. Two 'At Risk – Declining' (<i>Nyctemera annulata</i> and <i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia")) and one At Risk – Uncommon (<i>Bityla sericea</i>) species present. Very High value
	Diversity and pattern	The invertebrate diversity is likely to be typical of modified tussock habitat, interspersed with riparian habitats, found on the OGNZL landholdings and in the Macraes ED. Moderate value
	Ecological context	The invertebrate community fills ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, detritivores, and pollinators. Introduced mammalian predators and habitat modification (e.g., grazing) are the likely drivers of decline in some more sensitive invertebrate groups, though for the most part many species likely persist despite these anthropogenic influences. The area shares ecological connectivity with similar modified tussock habitat to the north, east, west, and south and thus, the invertebrate community will be contributing to gene flow within the wider population. Moderate value
	Overall value	High
BRWRS		
	Representativeness	Habitats include areas of modified (grazed) and relatively undisturbed tussockland, with extensive areas of regenerating grey shrubland and vegetated gullies. Rock outcrops are present both within the gully systems and interspersed within tussock. The habitat is typical of the more natural habitats found in the surrounding landscape. Invertebrate communities in this area are considered representative of the modified tussock habitats found more widely across the OGNZL landholdings and Macraes ED. High value
	Rarity/ Distinctiveness	Four 'At Risk – Declining' (<i>Samana acutata</i>, <i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia"), <i>Theoxena scissaria</i>, and <i>Patagoniodes farinaria</i>), and one 'At Risk – Uncommon' (<i>Bityla sericea</i>) species are present.

Area	Criteria	Justification and value assignment
		High value
	Diversity and pattern	The invertebrate diversity is likely to be typical of mixed modified and undisturbed tussock habitat, interspersed with riparian and shrubland habitats, found on the OGNZL landholdings and in the Macraes ED.
		Moderate value
	Ecological context	The invertebrate community fills ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, detritivores, and pollinators. Introduced mammalian predators and habitat modification (e.g., grazing) are the likely drivers of decline in some more sensitive invertebrate groups, though for the most part many species likely persist despite these anthropogenic influences. The area shares ecological connectivity with similar modified tussock habitat to the north, east, and south and thus, the invertebrate community will be contributing to gene flow within the wider population.
		High value
	Overall value	Very High

Table 5.2. Ecological value for 'Threatened', 'At Risk', 'Data Deficient', and other notable invertebrates present in the MP4 Project area, as per the EIANZ EcIA Guidelines.

Species	Presence and abundance in the Project area	National threat listing (NZTCS)	Assigned ecological value
<i>Orocrambus sophistes</i>	Single individual found in Golden Bar (GB WRS) in May 2022. Intensive survey efforts to re-detect this species at Golden Bar and elsewhere on OGL Macraes landholdings have been unsuccessful. Evidence suggests opportunistic observation of an individual passing through the Golden Bar Mining Area. Poorly known species and an obligate tussock inhabitant. Not Regionally endemic.	Threatened – Nationally Vulnerable	Very high
<i>Agrotis admirationis</i>	One individual collected at Coronation and one record from Redbank Covenant. This species has a patchy distribution throughout both the North and South Islands. Its host plant is unknown and is likely polyphagous. Patrick et al. (2011) mention it feeds on herbs in open areas.	At Risk – Declining	High
<i>Asaphodes recta</i>	Two individuals caught day-flying over wetted areas in MEEA (other individuals observed); and one individual collected at light at Coronation. This species has been found in Canterbury, Otago, and Southland tussockland and appears to be quite local and associated with wetted boglands. Larval host plants include <i>Ranunculus</i> , <i>Senecio</i> , and <i>Bellis</i> (Patrick 2000).	At Risk – Declining	High
<i>Dasyuris partheniata</i>	Single record of a larva found on speargrass (<i>Aciphylla subflabellata</i>) in the Coronation area in August 2014. The observation was made by M. Thorsen, with identification subsequently confirmed by B. Patrick and reported via iNaturalist.	At Risk – Declining	High
<i>Nyctemera annulata</i>	Single individuals captured in moth traps at Coronation, Macraes Road Realignment, Cranky Jims, Golden Bar, MEEA, and Redbank Covenant. Relatively common in the wider surrounding landscape. Host plants include <i>Cineraria</i> , groundsel, ragwort, and other plants in the <i>Senecio</i> family. There are 19 native <i>Senecio</i> species.	At Risk – Declining	High

<i>Orthodera novaezealandiae</i>	An egg case was found at GPUG and live individuals were seen at two locations elsewhere on OGL Macraes landholdings outside of the MP4 Project footprint. The species is likely to be more widespread in shrubland and more vegetated habitats, including in areas within the MP4 Fast Project footprint. Not Regionally endemic.	At Risk – Declining	High
<i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia")	Individuals collected from Golden Bar, BRWRS, Cranky Jim's, and Redbank Covenant. Undescribed species with a patchy distribution across both main islands. Found in association with native <i>Carmichaelia</i> spp. Has been given a 'Range Restricted' qualifier under the NZTCS recognising its dependence on areas of good quality <i>Carmichaelia</i> shrubland.	At Risk – Declining	High
<i>Patagoniodes farinaria</i>	Single individuals captured in moth traps at Macraes Road Realignment, Golden Bar, BRWRS, Coronation Cranky Jims, MEEA, and Redbank Covenant. Relatively common in the wider surrounding landscape. Host plants include shore groundsel or ragwort which are common in the landscape.	At Risk – Declining	High
<i>Samana acutata</i>	Single individuals recorded in RHIMSPIM, BRWRS, and elsewhere on OGL Macraes landholdings outside of the MP4 Project footprint (Island Block Covenant and Redbank Covenant). Widespread species but not locally common based on single individuals recorded. Host plant is <i>Carmichaelia</i> spp. Not Regionally endemic.	At Risk – Declining	High
<i>Theoxena scissaria</i>	Single individual caught in moth trap in BRWRS. Larvae unknown; related species (in genus <i>Samana</i>) feed on <i>Carmichaelia</i> . Considered local and rare. It is almost certainly associated with dry shrublands. Female unknown and possibly flightless, limited dispersal and increasing need for conservation.	At Risk – Declining	High

<i>Bityla sericea</i>	Single individuals recorded in Golden Bar and BRWRS, and at other sites on OGL Macraes landholdings (e.g., Murphys Creek, Redbank Covenant). This species is widespread across Otago though not found in large numbers. Its hostplant is unknown but thought to be <i>Muehlenbeckia</i> spp (Patrick & Dugdale 2000). Not Regionally endemic.	At Risk – Uncommon	Moderate
<i>Wiseana fuliginea</i>	eDNA was detected in a headwater tributary of Māori Hen Creek in the Trimbells WRS area of Coronation Mining Area. DNA was present in two of the five replicates.	Data Deficient	Moderate•
<i>Wiseana mimica</i>	Single individual collected in Murphys Creek catchment, outside of the MP4 Project impact area. Precautionarily included in the Values Assessment. Adults may occur more widely in the surrounding landscape. Poorly known species. Characteristic of open country east of Fiordland and the Southern Alps. Present at 1,100 m asl on the Lammermoor Range Central Otago and at 1,200 m asl on the Kyeburn (Mt Buster) diggings Central Otago, and a dead specimen was found at 1,700 m on Mt Pisa by B.H. Patrick.	Data Deficient	Moderate•
<i>Zelandobius uniramus</i>	eDNA detected at several sites in the landscape surrounding the MP4 Project area (Highlay, Camp Creek, Cranky Jims, Murphys, and Coal Creek). It is possible that this species occurs within the MP4 Project impact area.	Data Deficient	Moderate•
<i>Hemiandrus maia</i>	Abundant in areas of tussock and shrubland, and around rocky features. Also present, but in lower abundance, in exotic grassland areas. Dozens of individuals were captured in live pitfalls traps for lizards in the Murphys Creek area. Not Regionally endemic, despite its common name.	Not Threatened	Low
<i>Mecodema</i> sp. “Oamaru”	Single observation from the Innes Mills area of the Central Mining Area. The specimen was captured during the CCP2 lizard salvage operation and was relocated to Island Block Covenant in accordance with the salvage conditions.	Not listed	Moderate•

<i>Orocrambus</i> cf. <i>cyclopicus</i>	Two individuals tentatively identified as <i>Orocrambus</i> cf. <i>cyclopicus</i> that could possibly be endemic to inland tussock grasslands (R. Hoare, pers. comm, 2025). The status of this new entity remains unclear, with its presence known from two Central Otago sites—Bendigo and Macraes (R. Hoare, pers. comm. 2025). Its apparent absence from Canterbury and Nelson support the assumption that it may be endemic to inland Otago drylands. Work is currently underway by Dr R. Hoare to dissect material from the Mackenzie Basin to further elucidate the range of this new species.	Not listed	Moderate•
--	--	------------	------------------

- Moderate value, based on the presence of species assumed to be locally uncommon at the Ecological District scale.

5.2 Significance criteria under the policy framework

Assessing the invertebrate values against the National Policy Statement for Indigenous Biodiversity (NPS-IB), Otago Regional Policy Statement 2021 (ORPS 2021), and Waitaki District Plan (WDP) significance criteria resulted in all Project Areas qualifying as significant.

The presence of 'At Risk – Declining' invertebrate species was enough to trigger significance under the 'Rarity' or 'Rarity and Distinctiveness' criteria for all Project Areas.

Table 5.3. Assessment of invertebrate values in each of the Project areas against the National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB) significance criteria.

NPSIB criteria	Significance assessment	Coronation	GPUG	Central	FWFD	GB HR	GB
Representativeness	The habitats for invertebrates are typical or characteristic of the indigenous diversity of the ecological district, though some habitats are degraded examples of their type (e.g., tussockland, shrubland). Indigenous vegetation and habitats are representative of the full range and extent of ecological diversity across all environmental gradients in an ecological district. The fauna habitat supports a typical suite of indigenous invertebrates that would occur in the present-day environment.	✓	✓	x	X	x	✓
Diversity and pattern	The area supports an expected range of diversity and pattern of indigenous invertebrates and/ or invertebrate habitats, like the diversity at the level of the Macraes ED.	✓	✓	x	X	x	✓
Rarity and distinctiveness	The area supports species, or habitats used by species, that are 'At Risk'. Invertebrate species in the area occur at their distribution limits, are endemic to the Otago region, or are of biogeographic interest.	✓	✓	✓	X	X	✓
Ecological context	The terrestrial ecological features in the area, as they pertain to indigenous invertebrates, provide some connectivity between the site and adjoining sites, and provide resources (e.g., food, refuge, breeding sites) for invertebrates.	✓	✓	✓	X	✓	✓
Qualifies as significant		Yes	Yes	Yes	No	Yes	Yes

Table 5.4. Assessment of invertebrate values in each of the Project Areas against the Otago Regional Policy Statement 2021 (ORPS 2021) significance criteria.

ORPS criteria	Significance assessment	Coronation	GPUG	Central	FWFD	GB HR	GB
Representativeness	The habitats for invertebrates are typical or characteristic of the natural diversity of the ecological district, though some habitats are degraded examples of their type (e.g., tussockland, shrubland).	✓	✓	x	X	x	✓
Rarity	The area supports species, and habitats that support species, that are 'At Risk' and/ or potentially 'Threatened'.	✓	✓	✓	X	X	✓
Diversity	The area supports a diversity of indigenous invertebrates and/ or invertebrate habitats, like the diversity found within the immediately surrounding landscape and at the level of the Macraes ED.	✓	✓	✓	X	X	✓
Distinctiveness	Invertebrate species in the area occur at their distribution limits, are endemic to the Otago region, or are of biogeographic interest.	✓	✓	✓	X	X	✓
Ecological context	The terrestrial ecological features in the area, as they pertain to indigenous invertebrates, provide some connectivity between the site and adjoining sites, and provide resources (e.g., food, refuge, breeding sites) for invertebrates.	✓	✓	✓	X	✓	✓
Qualifies as significant		Yes	Yes	Yes	No	Yes	Yes

Table 5.5. Assessment of invertebrate values in each of the Project Areas against the Waitaki District Plan significance criteria.

Waitaki District Plan criteria	Significance assessment	Coronation	GPUG	Central	FWFD	GB HR	GB
Representativeness	The area supports habitats and ecological processes (e.g., invertebrate community contributions to the environment) that are typical of the ecological district relative to the pre-European baseline and contributes to maintaining an appropriate proportional representation of these features.	✓	✓	x	X	x	✓
Rarity and distinctiveness	The area supports 'At Risk – Declining' invertebrate species and invertebrate habitats (e.g., rock tors) that are important in the lifecycle of protected or threatened indigenous invertebrates.	✓	✓	✓	X	X	✓
Diversity and pattern	The area supports a relatively diverse invertebrate fauna, a diversity of habitats for indigenous invertebrates, and ecological processes (e.g., plant pollination, as predators and prey for other fauna, etc.). These features are typical of the immediate surrounding landscape and at the level of the Ecological District.	✓	✓	x	X	x	✓
Ecological Context, Size and Shape	Invertebrate habitats within the area share ecological connections with adjoining habitats allowing dispersal of invertebrates through the landscape and provides regular resources (e.g., food, refuge, breeding sites) for invertebrates.	✓	✓	✓	X	✓	✓
Qualifies as significant		Yes	Yes	Yes	No	Yes	Yes

6 Summary of invertebrate values

The Project area supports widespread and locally abundant invertebrate populations characteristic of the Macraes ED. Extensive areas of suitable invertebrate habitat occur throughout the Project area, particularly within tussock grasslands, shrublands, rocky outcrops, wetlands, and gully systems. The Project area is assessed as having High ecological value for terrestrial invertebrates.

Fourteen 'Threatened', 'At Risk', or 'Data Deficient' invertebrate species have been recorded within the Project impact area or the immediately surrounding landscape on OGNZL landholdings. While single or few individuals of these 'Threatened', 'At Risk', or 'Data Deficient' species were found, this does not detract from their value based on the EIANZ EcIA values assignment method. As such, the ecological values associated with invertebrate communities and habitats within areas proposed for direct mining disturbance, ranged from Low to High. The lowest invertebrate values were associated with the FWFD and Golden Bar Haul Road areas, while the highest values were identified within the Coronation and Golden Bar areas, where extensive high-quality habitat exists for invertebrates.

In contrast, areas not directly subject to mining disturbance, such as the GPUG area and BRWRS (consents for construction to be surrendered), supported markedly higher invertebrate values, including areas assessed as Very High value due to the extent and quality of habitat present and the diversity of TAR species.

Ecological significance criteria under the NPS-IB, ORPS, and Waitaki District Plan were met in multiple areas due to the presence of indigenous invertebrate habitat, naturally occurring indigenous biodiversity, and populations of TAR invertebrate species.

7 References

- Barratt, B.I.P., van Toor, R.F., Ferguson, C.M., Stewart, K.M. (1990).** Grass grub and porina in Otago and Southland. A guide to management and control. MAF Technology, Invermay/ N.Z. Tablet, Dunedin. 104 p.
- Bauckham, R. (2025).** Sampling for the presence of Crambidae: *Orocrambus sophistes* (Meyrick, 1905) at Golden Bar Pit and WRS, Macraes, Otago. Technical report prepared for Whirika Consulting Ltd. 16 p.
- Dugdale, J.S. (1994).** Hepialidae (Insecta: Lepidoptera). Fauna of New Zealand 30. Manaaki Whenua Press, Canterbury, New Zealand. 164 pp.
- Hoare, R.J.B. (2019).** Noctuinae (Insecta: Lepidoptera: *Noctuidae*) part 2: *Nivetica*, *Ichneutica*. Fauna of New Zealand, 80: 1–455.
- Hoare, R.J.B., Edwards, E.D., Knox, C., Frost, W.T., Michel, P. (2026).** Conservation status of Lepidoptera (moths and butterflies) in Aotearoa New Zealand, 2025. New Zealand Threat Classification Series 51. Wellington: Department of Conservation,
- Hudson, G.V. (1928).** *The Butterflies and Moths of New Zealand*. Wellington: Ferguson & Osborn Ltd. p. 115.
- Patrick, B.H. (1997).** Insects of the Macraes Ecological District. Otago Conservancy Miscellaneous Series No. 30. Department of Conservation. Dunedin.
- Patrick, B.H. (2000).** *Conservation status of two rare New Zealand geometrid moths*. Wellington: Department of Conservation. Science for Conservation 145.
- Patrick, B.H., Dugdale, J.S. (2000).** *Conservation status of the New Zealand Lepidoptera* (No. 136). Department of Conservation.
- Patrick, H., Bowie, M., Fox, B., & Patrick, B. (2011).** The moths of Quail Island (Ōtamahua): A faunal comparison of an island under restoration with other sites on Banks Peninsula. *New Zealand Natural Sciences* (2011) 36: 57–72.
- Richards, N., Ehau-Taumaunu, H., Ferguson, C. (2017).** DNA from 33 year old dried moth specimens help confirm larva as the elusive *Wiseana fuliginea*. *Pasture Pests*, 70: 235–240.
- Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. (2018).** Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.
- Thorsen, M. (2019).** Deepdell North III Project: Impact of Project on Vegetation, Avifauna, Herpetofauna and Invertebrates. Prepared for Oceana Gold (NZ) Ltd. by Ahika Consulting. 154 p.
- Viridis (2026).** Assessment of Aquatic Environmental Effects. Report prepared for OceanaGold (New Zealand) Limited. 66 p.
- Walker, A.K., Crosby, T.K. (1988).** The preparation and curation of insects. DSIR Information Series

163. Science Information Publishing Centre, DSIR, Wellington, New Zealand. 91pp.

Whitaker, A.H. (1986). Macraes Flat Joint Venture area – Terrestrial fauna of the Deepdell catchment, North Otago. Unpub. Report to Homestake New Zealand Exploration Ltd. Auckland. 136pp.

White, E.G. (2002). *New Zealand Tussock Grassland Moths*. Manaaki Whenua Press, Landcare Research.

Whirika. (2026). Assessment of vegetation and wetland values. Report prepared for Oceana Gold (New Zealand) Limited.

Applicability and Limitations

Restrictions of intended purpose

This report has been prepared solely for the benefit of OceanaGold New Zealand Limited as our client with respect to the brief.

Babbage/ Bioresearches acknowledges that this report will be relied on by a Panel appointed under the Fast Track Approvals Act 2024 and these disclaimers do not prevent that reliance.

Legal interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Maps and images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts. Do not scale any of the maps, plans or figures in this report. Any information shown here on maps, plans and figures should be independently verified on site before taking any action. Sources for map and plan compositions include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Babbage Consultants Limited.

Reliability of investigation

Babbage/ Bioresearches has performed the services for this project in accordance with the standard agreement for consulting services and current professional standards for environmental site assessment.

Appendix A

Deepdell North III invertebrate list (Thorsen 2019)

List uplifted from Thorsen (2019) and includes species recorded from nearby on the Taieri Ridge slopes. NZTCS listed taxa highlighted.

Current name	Common name	NZTCS listing	Group 2	Family (Tribe)	Notes
<i>Costelytra? Odontria?</i> small, shiny scarab	Scarab beetle		Coleoptera (beetles)	Scarabaeidae - Melolonthinae	This small beetle (c.9mm long) keyed out uncertainly to genus <i>Costelytra</i> and could not be successfully keyed to a species of either genus. Taken at night in the Horse Flat Dump site.
<i>Mecodema sculpturatum</i>	carabid beetle		Coleoptera (beetles)	Carabidae - Trechinae	This ground beetle is a southern South Island species, known predominantly from Southland and Otago, but found as far north as Otira Gorge. Two dead specimens, one only recently dead, were found in the Horse Flat Dump site.
<i>Mimopeus</i> sp.	Darkling beetle		Coleoptera (beetles)	Tenebrionidae	Moderately large beetle, possibly a small <i>M. opaculus</i> , from the Horse Flat Dump site.
<i>Neocicindela</i> sp.	tiger beetle		Coleoptera (beetles)	Carabidae - Cicindelinae	Tiger beetle larvae holes were visible in some clay banks at the Horse Flat Dump site, usually along road cuttings. A single adult beetle was seen at one site but eluded capture. The beetle was quite light-coloured, suggesting that it may have been a teneral (i.e., a recently emerged adult), which in turn suggests that it was early in the season for the adults to be present. The beetle appeared to have quite a wide marginal line (the whitish band around the edges of the elytra) which may indicate either <i>Neocicindela latecincta</i> or <i>N. parryi</i> , both of which are known from the Otago area.
<i>Odontria</i> sp.1 "medium brown, mottled, velvety"	Scarab beetle		Coleoptera (beetles)	Scarabaeidae - Melolonthinae	Four males and a female in the light traps, Horse Flat Dump site.
<i>Odontria</i> sp.2 "darker, grey, mottled"	Scarab beetle		Coleoptera (beetles)	Scarabaeidae - Melolonthinae	Two apparent males and a female from the Horse Flat Dump site, one male and the female taken in a light trap.
<i>Odontria</i> sp.3 "dark brown, darker & more extensive mottling"	Scarab beetle		Coleoptera (beetles)	Scarabaeidae - Melolonthinae	Likely male from the Deepdell South site, taken at night
<i>Odontria</i> sp.4 "red-brown" (some similarities to the description of <i>O. smithii</i>)	Scarab beetle		Coleoptera (beetles)	Scarabaeidae - Melolonthinae	In light trap, Horse Flat Dump site.
<i>Oregus aereus</i>	carabid beetle		Coleoptera (beetles)	Carabidae - Trechinae	Widespread in Central Otago; previously known from the Deepdell Stream area.
<i>Forficula auricularia</i>	earwig		Dermaptera (earwigs)	Forficulidae	The only earwig collected (from Deepdell South) keyed to this widespread introduced species

Current name	Common name	NZTCS listing	Group 2	Family (Tribe)	Notes
<i>Anabarhynchus</i> sp.; provisionally keyed to <i>A. triangularis</i>	stilleto fly		Diptera (flies)	Therevidae	A single male, taken from a speargrass at the Deepdell South site. <i>A. triangularis</i> was described from two males and two females, taken from the Cromwell Gorge and Kawerau Gorge areas. Previous experience with this group indicates that inland Otago has a number of undescribed species.
Species undertermined	robber fly		Diptera (flies)	Asilidae	A large male robber fly was seen in the Horse Flat Dump site but not collected due to the lack of an up-to-date taxonomy.
<i>Kikihia</i> sp., possibly <i>K. angusta</i>	cicada		Hemiptera (true bugs)	Cicadidae	On Horse Flat Dump site. <i>K. angusta</i> is a widespread species in the South Island, but this identification is very tentative.
Pentatomidae sp.	shieldbug		Hemiptera (true bugs)	Pentatomidae	A shield bug nymph was collected in the Horse Flat Dump site. There are several reasonably widespread native species known from this group.
<i>Rhodopsalta</i> sp., presumed to be either <i>Rhodopsalta cruentata</i> or <i>R. microdora</i>	cicada		Hemiptera (true bugs)	Cicadidae	On Horse Flat Dump site; widespread species in the South Island
<i>Huberia brounii</i>	ant		Hymenoptera (wasps and ants)	Formicidae	Widespread endemic species.
' <i>Aletia</i> ' <i>moderata</i>			Lepidoptera (butterflies & moths)	Noctuidae	A common species from about Rotorua south in open habitats, larvae on <i>Raoulia</i> .
' <i>Chloroclystis</i> ' <i>filata</i>			Lepidoptera (butterflies & moths)	Geometridae	Naturalised from Australia. Abundant throughout New Zealand, larvae on flowers of gorse and other plants.
' <i>Hydriomena</i> ' <i>deltoidata</i>			Lepidoptera (butterflies & moths)	Geometridae	Common almost throughout New Zealand, but scarcer in the far North. Larvae on plantains.
' <i>Hydriomena</i> ' <i>rixata</i>			Lepidoptera (butterflies & moths)	Geometridae	Common throughout New Zealand. Larvae on plantains and willowherbs.
<i>Apoctena</i> cf. <i>conditana</i>			Lepidoptera (butterflies & moths)	Tortricidae	<i>Apoctena conditana</i> is a widespread tortricid that is supposedly polyphagous, but I believe that more than one species may be confused under this name (hence the 'cf.'). In Auckland I have only reared it from <i>Lycopodium deuterodensum</i> , but according to John Dugdale's notes, based on rearings by Brian Patrick in the southern South Island it is polyphagous on various trees, shrubs and herbs. The genitalia of the Macraes specimen show minor differences from those illustrated by John Dugdale (NZ J Zool 1990), which were from a specimen from Opouri (SD) and the whole issue of the taxonomy needs further investigation. We don't have many similar looking specimens under <i>conditana</i> in NZAC, and it looks utterly different from Auckland specimens attributed to this species
<i>Argyrophenga antipodum</i>	Tussock ringlet butterfly	Not Threatened	Lepidoptera (butterflies & moths)	Nymphalidae	Tussock ringlet butterflies were common at both sites. A single specimen collected was identified as <i>A. antipodum</i> ; the study site is probably also within the known range of <i>A. janitae</i> .

Current name	Common name	NZTCS listing	Group 2	Family (Tribe)	Notes
<i>Asaphodes chlamydota</i>			Lepidoptera (butterflies & moths)	Geometridae	A fairly common and widespread species throughout New Zealand, larvae on <i>Clematis</i> spp.
<i>Asaphodes clarata</i>			Lepidoptera (butterflies & moths)	Geometridae	A locally common species from the central North Island south.
<i>Austrocidaria similata</i>			Lepidoptera (butterflies & moths)	Geometridae	A common and widespread species throughout New Zealand, larvae on <i>Coprosma</i> spp.
<i>Bityla defigurata</i>			Lepidoptera (butterflies & moths)	Noctuidae	Fairly common throughout New Zealand, larvae on <i>Muehlenbeckia</i> .
<i>Epiphryne undosata</i>			Lepidoptera (butterflies & moths)	Geometridae	Locally common throughout New Zealand, larvae on <i>Hoheria</i> .
<i>Eudonia (?)oculata</i>			Lepidoptera (butterflies & moths)	Crambidae	A little-known South Island species, larvae presumed to be on moss or in herbaceous swards. Apparently very local and only recent material in NZAC is from Tiwai Point, Southland. Populations on the Chatham Islands may not be conspecific.
<i>Eudonia rakaiensis</i>			Lepidoptera (butterflies & moths)	Crambidae	A usually rather uncommon but widespread species throughout the country. Larva unknown, probably in moss or herbaceous swards.
<i>Eudonia submarginalis</i>			Lepidoptera (butterflies & moths)	Crambidae	Abundant throughout New Zealand, larvae in herbaceous swards.
<i>Gadira acerella</i>			Lepidoptera (butterflies & moths)	Crambidae	Fairly common throughout the country. Larvae presumed to be on lichens.
<i>Graphania lignana</i>			Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species throughout New Zealand, larvae on grasses.
<i>Graphania morosa</i>			Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species from the central North Island south, larvae on grasses.
<i>Graphania mutans</i>			Lepidoptera (butterflies & moths)	Noctuidae	A very common and widespread species throughout New Zealand, larvae polyphagous, mainly on herbaceous plants.
<i>Graphania omoplaca</i>			Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species from the central North Island south, larvae on grasses, plantain and probably other herbs.
<i>Graphania plena</i>			Lepidoptera (butterflies & moths)	Noctuidae	A very common and widespread species throughout New Zealand, larvae polyphagous, mainly on herbaceous plants.
<i>Graphania rubescens</i>			Lepidoptera (butterflies & moths)	Noctuidae	A fairly common and widespread species from the southern North Island south, larvae on herbaceous plants including <i>Gunnera</i> .
<i>Harmologa oblongana</i>			Lepidoptera (butterflies & moths)	Tortricidae	Common and widespread species, larvae polyphagous in shrublands.
<i>Harmologa scolastis</i>			Lepidoptera (butterflies & moths)	Tortricidae	Widespread and fairly common species, larvae on <i>Muehlenbeckia</i> .

Current name	Common name	NZTCS listing	Group 2	Family (Tribe)	Notes
<i>Harmologa</i> sp. A.			Lepidoptera (butterflies & moths)	Tortricidae	Local but widespread South Island species associated with small-leaved <i>Melicytus</i> .
<i>Helastia corcularia</i>			Lepidoptera (butterflies & moths)	Geometridae	Common throughout the South Island.
<i>Helastia triphragma</i>			Lepidoptera (butterflies & moths)	Geometridae	Local and usually uncommon species of the southern South Island.
<i>Hierodoris s-fractum</i>		Not Threatened	Lepidoptera (butterflies & moths)	Xyloryctidae	Very local, endemic to the southern South Island (Hoare 2005). Larvae in leaf-litter in shrubland.
<i>Lycaena feredayi</i>	glade copper butterfly	Not Threatened	Lepidoptera (butterflies & moths)	Lycaenidae	A female was taken in the Horse Flat Dump site.
<i>Lycaena salustius</i>	Common copper butterfly	Not Threatened	Lepidoptera (butterflies & moths)	Lycaenidae	This species was present in large numbers throughout the sites investigated
<i>Mnesictena flavidalis</i>			Lepidoptera (butterflies & moths)	Crambidae	Larvae on various herbaceous plants including <i>Hydrocotyle</i> . Common throughout New Zealand.
<i>Monopis ethelella</i>			Lepidoptera (butterflies & moths)	Tineidae	Very common and widespread birds' nest species.
<i>Musotima nitidalis</i>			Lepidoptera (butterflies & moths)	Crambidae	Larvae on various ferns. Common throughout New Zealand, also in Australia.
<i>Opogona comptella</i>			Lepidoptera (butterflies & moths)	Tineidae	Fairly common and widespread species in drier parts of the country; larvae in dead wood.
<i>Orocrambus flexuosellus</i>			Lepidoptera (butterflies & moths)	Crambidae	larvae on native and exotic grasses. Extremely common throughout New Zealand.
<i>Orocrambus</i> sp. B of NZAC			Lepidoptera (butterflies & moths)	Crambidae	Larvae presumed to be on tussock grasses. A local species of Central Otago and Otago Lakes that has been confused with <i>O. crenaeus</i> in collections and was therefore overlooked by Gaskin (1975) in his revision of <i>Orocrambus</i> . It needs to be critically compared with the very similar and poorly known <i>O. dicrenellus</i> , but genitalia seem to be distinct.
<i>Orocrambus vittellus</i>			Lepidoptera (butterflies & moths)	Crambidae	larvae on grasses. Common throughout New Zealand.
<i>Pasiphila</i> (?)cotinaea			Lepidoptera (butterflies & moths)	Geometridae	Very local species occurring from the central North Island south. A worn specimen, identification is doubtful as this genus is unrevised and can be very tricky.
<i>Persectania aversa</i>			Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species throughout New Zealand except the northern North Island, larvae on grasses.
<i>Physetica phricias</i>		Not Threatened	Lepidoptera (butterflies & moths)	Noctuidae	A locally common South Island species, larvae on matagouri (<i>Discaria</i>).

Current name	Common name	NZTCS listing	Group 2	Family (Tribe)	Notes
<i>Tingena</i> sp. cf. <i>siderodeta</i>			Lepidoptera (butterflies & moths)	Oecophoridae	<i>Tingena</i> spp. are associated with leaf-litter. an unrevised and very challenging genus; it is not possible to identify the specimen confidently to species without substantial further research.
<i>Tmetolophota atristriga</i>			Lepidoptera (butterflies & moths)	Noctuidae	A common to abundant and widespread species throughout New Zealand, larvae on grasses.
<i>Tmetolophota propria</i>			Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species in the South Island (and central plateau of the North Island), larvae on grasses.
<i>Tmetolophota semivittata</i>			Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species throughout New Zealand, larvae on sedges (<i>Carex</i> spp.), rushes (<i>Juncus</i> spp.) and probably also grasses.
<i>Tmetolophota steropastis</i> (2)			Lepidoptera (butterflies & moths)	Noctuidae	A common and widespread species throughout New Zealand, larvae mainly on flax (<i>Phormium</i>) toetoe (<i>Austroderia</i> spp.) and pampas grass (<i>Cortaderia</i>), occasionally on other monocots.
<i>Wiseana</i> (?) <i>copularis</i>		Not Threatened	Lepidoptera (butterflies & moths)	Hepialidae	Endemic. A very common and widespread grassland and pasture species.
<i>Wiseana</i> (?) <i>umbraculata</i>		Not Threatened	Lepidoptera (butterflies & moths)	Hepialidae	Endemic. A common and widespread grassland / wetland species.
<i>Xanthorhoe semifissata</i>			Lepidoptera (butterflies & moths)	Geometridae	Fairly common from the central North Island south.
<i>Zizina oxleyi</i>	little blue butterfly	Not Threatened	Lepidoptera (butterflies & moths)	Lycaenidae	Presumed to be much declined in range and abundance since European arrival in New Zealand, but still locally common where found, and classified as 'Not Threatened' (Hoare et al. 2026). Larvae on <i>Carmichaelia</i> and introduced clover.
<i>Pseudaneitea</i> sp.	leaf-veined slug		Mollusca (snails, slugs, etc.)	Athoracophoridae	<i>Pseudaneitea</i> sp. A single leaf-veined slug was collected at night in the Horse Flat Dump site.
Anisoptera sp.	dragonfly		Odonata (damselflies & dragonflies)		Several specimens of at least one species of medium-sized dragonfly (not a <i>Uropetala</i>) were seen but not captured. These were especially prevalent at the Deepdell South Backfill site. Any of three species – <i>Aeshna brevistyla</i> and the two species of <i>Procordulia</i> – could potentially account for these sightings. All three are widespread in New Zealand.
<i>Austrolestes colenisonis</i>	Blue Damselfly	Not Threatened	Odonata (damselflies & dragonflies)	Lestidae	Damselflies were common throughout both sites investigated.
<i>Xanthocnemis zealandica</i>	common redcoat damselfly	Not Threatened	Odonata (damselflies & dragonflies)	Coenagrionidae	Damselflies were common throughout both sites investigated.

Appendix B

**Taxonomic inventory of invertebrates recorded during surveys in
April and May 2022 in the MP4 Project area, Macraes.**

Collection method acronym key: SN = Sweep netting; MLT = Moth light trapping; HS = Hand searching; Obs. = Observation. NZTCS listed taxa highlighted.

Order	Family	Species	Status	NZTCS listing	Location	Collection method	Notes
Araneae	Araneidae	<i>Eriophora pustulosa</i>	Native	Not Threatened	Golden Bar WRS	SN	
	indet.	indet.			Golden Bar Pit Coronation 6 Pit	MLT, SN, HS	Large number of specimens of variable taxa.
Chordeumatida	Metopidiotrichidae	<i>Schedotrigona</i> sp.	Endemic	Not listed	Adjacent GB RR	Obs.	
Coleoptera	Agyrtidae	<i>Zeanecrophilus prolongatus</i>	Endemic	Not listed	Adjacent GB RR Golden Bar Pit	MLT	2 x specimens
	Anthribidae	<i>Phymatus cucullatus</i>	Endemic	Not listed	Adjacent GB RR	SN	
		<i>Sharpus brouni</i>	Endemic	Not listed	Adjacent GB RR	SN	
	Carabidae	<i>Ctenognathus</i> sp.	Endemic	Not listed	Coronation 6 Pit	HS	Under rock
		indet. 1			Adjacent GB RR	HS	Under rock
		indet. 2			Adjacent GB RR	HS	Under rock
		indet. 3			Adjacent GB RR	HS	Under rock
		<i>Megadromus bullatus</i>	Endemic	Not listed	Golden Bar WRS Adjacent GB RR	HS	Under discarded oil drum
		<i>Megadromus</i> sp.	Endemic?	Not listed	Coronation 6 Pit	HS	Under rock
		<i>Oregus aereus</i>	Endemic	Not listed	Golden Bar WRS	HS	Under rock
	Cerambycidae	<i>Prionoplus reticularis</i>	Endemic	Not listed	Adjacent GB RR	HS	
	Coccinellidae	<i>Coccinella undecimpunctata</i>	Introduced	Not listed	Adjacent GB RR Coronation 6 Pit	Obs., HS, SN	One observed on rock tor
	Curculionidae	<i>Rhinocyllus conicus</i>	Introduced	Not listed	Golden Bar WRS	SN	
		<i>Sitona lepidus</i>	Introduced	Not listed	Coronation 6 Pit	SN	
	Scarabaeidae	<i>Odontia</i> sp.	?	?	Golden Bar WRS	HS	Under rock
	Tenebrionidae	<i>Artystona</i> sp.	Endemic	Not listed	Adjacent GB RR	HS	Under rock
		<i>Mimpoeus opaculus</i>	Endemic	Not listed	Golden Bar WRS	HS, Obs.	Under rock slabs on tors
Diptera	Anisopodidae	<i>Sylvicola</i> sp. (possibly <i>S. notatus</i>)	Endemic	Not listed	Golden Bar Pit	SN	
	Asilidae	<i>Saropogon fugiens</i>	Endemic	Not listed	Coronation 6 Pit	SN	
	Chironomidae	indet.			Coronation 6 Pit	SN	
	Dolichopodidae	indet.			Golden Bar WRS	SN	At least two species
		indet.			Golden Bar Pit	SN	
	Ephydriidae	<i>Diasemocera metallica</i>	Endemic	Not listed	Golden Bar WRS	SN	

Order	Family	Species	Status	NZTCS listing	Location	Collection method	Notes
					Coronation 6 Pit		
	Heleomyzidae	<i>Allophylopsis</i> sp. (possibly <i>A. scutellata</i>)	Endemic	Not listed	Golden Bar Pit	SN	
	Limoniidae	indet.			Golden Bar WRS	MLT	
		indet.			Golden Bar Pit	MLT	x 2 specimens
		indet.			Adjacent GB RR	MLT	
		<i>Limonia (Dicranomyia) hudsoni(?)</i>	Native	Not listed	Coronation 6 Pit	MLT	
	Lonchoptridae	<i>Lonchoptrera bifurcata</i>	Introduced	Not listed	Golden Bar WRS Adjacent GB RR	SN, MLT	
	Muscidae	indet.			Adjacent GB RR	SN	
		indet.			Coronation 6 Pit	SN	
		indet.			Golden Bar WRS	SN	
	Mycetophilidae	indet.			Golden Bar Pit	SN	
		indet.			Adjacent GB RR	SN	
		<i>Mycetophila fagi</i>	Endemic	Not listed	Golden Bar Pit Golden Bar WRS	SN, MLT	x 6 specimens
	Sarcophagidae	<i>Oxysarcodexia varia</i>	Introduced	Not listed	Golden Bar WRS	SN	
	Sciomyzidae	<i>Neolimnia sigma</i>	Endemic	Not listed	Golden Bar Pit	SN	
	Syrphidae	<i>Melanostoma fasciatum</i>	Endemic	Not listed	Golden Bar Pit Golden Bar WRS	SN	
	Tephritidae	indet.			Coronation 6 Pit	SN	
		<i>Trupanea longipennis</i>	Native	Not listed	Coronation 6 Pit	SN	
	Tipulidae	indet.			Golden Bar WRS	SN	
	Superfamily Tipuloidea	indet.			Coronation 6 Pit	SN	
	Zoosubsection Acalyptratae	indet.			Golden Bar Pit	SN	
		indet.			Golden Bar WRS	MLT	
Hemiptera	Acanthosomatidae	<i>Rhopalimorpha lineolaris</i>	Endemic	Not listed	Adjacent GB RR	SN	Adult
	Aphididae	<i>Tuberolachnus salignus</i>	Introduced	Not listed	Golden Bar WRS	SN	
	Aphrophoridae	<i>Philaenus spumarius</i>	Introduced	Not listed	Golden Bar WRS Adjacent GB RR	SN	

Order	Family	Species	Status	NZTCS listing	Location	Collection method	Notes
	Berytidae	<i>Bezu wakefieldi</i>	Endemic	Not listed	Golden Bar Pit	SN	
	Miridae	<i>Chinamiris laticinctus</i>	Endemic	Not listed	Adjacent GB RR	SN	
		indet.			Golden Bar WRS	SN	
	Nabidae	<i>Nabis maoricus</i>	Endemic	Not listed	Adjacent GB RR Coronation 6 Pit	SN	Nymph
	indet.	indet.			Golden Bar Pit	SN	
Hymenoptera	Apidae	<i>Bombus terrestris</i>	Introduced	Not listed	Adjacent GB RR Golden Bar WRS	Obs.	Flying over tussock and grassland
	Ichneumonidae	<i>Eutanyacra lictatoria</i>	Introduced	Not listed	Golden Bar WRS	SN	
		indet.			Golden Bar Pit	SN	
		indet.			Adjacent GB RR	SN	
		indet.			Coronation 6 Pit	SN	
Lepidoptera	Crambidae	<i>Orocrambus sophistes</i>	Endemic	Threatened - Nationally Vulnerable	Golden Bar WRS	MLT	Larvae unknown but presumably feeds on native tussock grasses. Very local species of drier inland South Island, confined to the Mackenzie and Central Otago regions. Female is short-winged and flightless, so dispersal is severely limited.
		<i>Deana hybreasalis</i>	Endemic			MLT	Larvae on <i>Clematis</i> spp. Fairly common and widespread.
		<i>Scoparia rotuella</i>	Endemic			MLT	Larvae probably on herbaceous plants in swards. Fairly common and widespread.
	Geometridae	<i>Aponotoreas insignis</i>	Endemic	Not listed	Adjacent GB RR	SN, MLT	Larvae on <i>Chionochloa</i> spp. Widespread in tussock grassland habitats throughout the South Island
		<i>Elvia glaucata</i>	Endemic			MLT	Larvae on <i>Rubus</i> spp. (probably also introduced spp.). Fairly common and widespread.
		<i>Epyaxa rosearia</i>	Endemic	Not listed	Golden Bar WRS Adjacent GB RR	MLT	Larvae on many different herbaceous plants. Very common and widespread.
		<i>Pasiphae inductata</i>	Endemic	Not listed	Golden Bar WRS	MLT	Larvae on flowers of a variety of different trees and shrubs and climbers. Very common and widespread.
		<i>Pasiphila testulata</i>	Native			MLT	Larvae on flowers of a range of plants, including rangiora, apple, Acacia. Common and widespread.

Order	Family	Species	Status	NZTCS listing	Location	Collection method	Notes
		<i>Theoxena scissaria</i>	Endemic	At Risk - Declining	BRWRS	MLT	Larvae unknown; related species (in genus <i>Samana</i>) feed on <i>Carmichaelia</i> . Local, rare. It is almost certainly associated with dry shrublands. Female unknown and possibly flightless, limited dispersal and increasing need for conservation.
	Lycaenidae	<i>Zizina oxleyi</i>	Endemic	Not Threatened	Adjacent GB RR Golden Bar Pit Coronation 6 Pit	Obs., MLT	Larvae feed on <i>Muehlenbeckia</i> .
	Noctuidae	<i>Agrotis ipsilon</i>	Native			MLT	Larvae polyphagous on herbaceous plants. Very common and widespread.
		<i>Bityla defigurata</i>	Endemic	Not listed	Coronation 6 Pit Adjacent GB RR	MLT	Larvae on <i>Muehlenbeckia</i> . Fairly common and widespread.
		<i>Ichneutica insignis</i>	Endemic	Not Threatened	Unknown	MLT	Larvae polyphagous, mainly on herbaceous plants. Common and widespread.
		<i>Ichneutica mutans</i>	Endemic	Not Threatened	Golden Bar Pit Adjacent GB RR	MLT	Larvae polyphagous, mainly on herbaceous plants. Very common and widespread.
		<i>Ichneutica plena</i>	Endemic	Not Threatened	Golden Bar WRS Adjacent GB RR	MLT	x 6 specimens. Larvae polyphagous, mainly on herbaceous plants. Very common and widespread.
		<i>Ichneutica scutata</i>	Endemic	Not Threatened	Golden Bar WRS	MLT	Larvae polyphagous, mainly on herbaceous plants. Very common and widespread.
		<i>Ichneutica skelloni</i>	Endemic	Not Threatened	Adjacent GB RR	MLT	Larvae probably polyphagous on herbaceous plants. Common and widespread from Wellington south but may represent a species complex.
		<i>Meterana ochthistis</i>	Endemic		Golden Bar WRS	MLT	Larvae on a range of plants, including <i>Carpodetus</i> , but possibly favouring epiphytes such as mistletoes and climbers such as <i>Rubus</i> and <i>Parsonsia</i> . Occurs in small numbers but very widespread in many habitats.
		indet.			Golden Bar WRS	SN	Unidentified larva (caterpillar). Several specimens of at least two species.
		<i>Physetica phricias</i>	Endemic	Not Threatened	Adjacent GB RR	MLT	Larvae on <i>Discaria</i> (matagouri) and possibly other plants. Common and widespread in South Island shrublands.
	Nymphalidae	<i>Argyrophenga antipodum</i>	Endemic	Not Threatened	Adjacent GB RR Golden Bar Pit	SN	Flying near wetland. Larvae on native and introduced grasses. Widespread and common.

Order	Family	Species	Status	NZTCS listing	Location	Collection method	Notes
		<i>Vanessa gonerilla gonerilla</i>	Endemic	Not Threatened	Adjacent GB RR Golden Bar Pit	SN, Obs.	Several individuals seen
		<i>Vanessa itea</i>	Native	Not Threatened	Adjacent GB RR Golden Bar Pit	SN, Obs.	Several individuals seen.
	Pterophoridae	<i>Amblyptilia repletalis</i>	Endemic	Not listed	Golden Bar WRS	MLT	Larvae on plantains (<i>Plantago</i> spp.), including introduced species. Common and widespread.
	Tortricidae	<i>Apoctena conditana</i>	Endemic	Not listed	Golden Bar WRS	MLT	Larvae on <i>Lycopodium deuterodensum</i> and probably other herbaceous plants. Widespread and fairly common.
		<i>Capua intractana</i>	Adventive. Australian			MLT	Larvae on leaf-litter. Widespread and very common.
		<i>Clepsia divulsana</i>	Adventive. Australian			MLT	Larvae polyphagous, mainly on herbaceous plants, especially Fabaceae. Very common and widespread.
Odonata	Coenagrionidae	<i>Xanthocnemis zealandica</i>	Native	Not Threatened	Adjacent GB RR Coronation 6 Pit	Obs.	Flying over pond
	Lestidae	<i>Austrolestes colenisonis</i>	Endemic	Not Threatened	Golden Bar Pit Golden Bar WRS Adjacent GB RR Coronation 6 Pit	SN, Obs.	Flying over wetlands
Orthoptera	Anostomatidae	<i>Hemiandrus maia</i>	Endemic	Not Threatened	Coronation BRWRS Golden Bar	Obs.	Seen under rocks and in lizard pitfall traps
	Acrididae	<i>Phaulacridium marginale</i>	Endemic	Not Threatened	Golden Bar WRS Golden Bar Pit Adjacent GB RR Coronation 6 Pit	Obs., SN, HS, MLT	Several individuals seen
	Rhaphidophoridae	<i>Isoplectron armatum</i>	Endemic	Not Threatened	Coronation Golden Bar BRWRS	Obs.	Several individuals seen under rocks and in rock outcrops
	Trigonidiidae	<i>Bobilla nigrovus</i>	Endemic	Not listed	Coronation 6 Pit	SN	
Psocodea	indet.	indet.			Coronation 6 Pit	SN	
Trichoptera	indet.	indet.			Golden Bar Pit	MLT	
Tricladida	Geoplanidae	<i>Artioposthia subquadrangulata</i>	Endemic	Not listed	Adjacent GB RR	Obs.	Under rock
		<i>Newzealandia</i> sp.	Endemic	Not listed	Golden Bar WRS	Obs.	Under rock

Appendix C

Taxonomic inventory of Lepidoptera recorded during moth light trapping on OceanaGold Macraes landholdings (including several covenants) in September 2022.

NZTCS listed taxa highlighted.

Family	Species	Status	NZTCS listing	Location	Count	Notes
[Gelechioidea]	[undetermined]			RHIMSPIM	1	
Carposinidae	<i>Heterocrossa rubophaga</i>	Endemic		RHIMSPIM, Highlay Creek Ecology Covenant	3	
Crambidae	<i>Deana hybreasalis</i>	Endemic		Highlay Creek Ecology Covenant, RHIMSPIM	6	
Elachistidae	<i>Elachista</i> sp.	Endemic		RHIMSPIM	2	
Erebidae	<i>Rhapa scotosialis</i>	Endemic		RHIMSPIM	1	
Geometridae	<i>Asaphodes chlamydata</i>	Endemic		BRWRS, RHIMSPIM	6	
	<i>Austrocidaria callichlora</i>	Endemic		BRWRS	1	
	<i>Austrocidaria cedrinodes</i>	Endemic		BRWRS	1	
	<i>Austrocidaria gobiata</i>	Endemic		Island Block Covenant	1	
	<i>Austrocidaria gobiata</i> / <i>A. anguligera</i>	Endemic		RHIMSPIM	3	
	<i>Declana junctilinea</i>	Endemic		BRWRS, RHIMSPIM, CRANKY Jims Creek Ecology Covenant, Island Block Covenant	8	
	<i>Elvia glaucata</i>	Endemic		RHIMSPIM	1	
	<i>Epiphryne verriculata</i>	Endemic		Cranky Jims Creek Ecology Covenant	1	
	<i>Homodotis falcata</i>	Endemic		Cranky Jims Creek Ecology Covenant	1	Very dark specimen; very unusual record for Central Otago, usually not so far inland
	<i>Ischalis fortinata</i>	Endemic	Not Threatened	BRWRS, RHIMSPIM, Highlay Creek Ecology Covenant	3	
	<i>Samana acutata</i>	Endemic	At Risk - Declining	Island Block Covenant, RHIMSPIM	2	<i>Carmichaelia</i> specialist
	<i>Xanthorhoe occulta</i>	Endemic		BRWRS, Highlay Creek Ecology Covenant	3	
	<i>Xanthorhoe semifissata</i>	Endemic		RHIMSPIM	1	
	<i>Xyridacma alectoraria</i>	Endemic		Cranky Jims Creek Ecology Covenant	2	
	<i>Zermizinga indocilisaria</i>	(?) Endemic		BRWRS, RHIMSPIM, Island Block Covenant	12	
Momphidae	<i>Zapyrastra (?)stellata</i>	Endemic		Island Block Covenant	1	
Noctuidae	<i>Agrotis ipsilon</i>	Native / immigrant		RHIMSPIM	1	
	<i>Bityla defigurata</i>	Endemic		Island Block Covenant	1	
	<i>Ichneutica insignis</i>	Endemic	Not Threatened	BRWRS, RHIMSPIM, Highlay Creek Ecology Covenant	3	
	<i>Ichneutica mutans</i>	Endemic	Not Threatened	RHIMSPIM, Cranky Jims Creek Ecology Covenant	2	

Family	Species	Status	NZTCS listing	Location	Count	Notes
	<i>Ichneutica plena</i>	Endemic	Not Threatened	BRWRS, RHIMSPIM, CRANKY Jims Creek Ecology Covenant, Island Block Covenant, Highlay Creek Ecology Covenant	27	
	<i>Ichneutica skelloni</i>	Endemic	Not Threatened	BRWRS, RHIMSPIM, Cranky Jims Creek Ecology Covenant	3	
	<i>Ichneutica steropastis</i>	Endemic	Not Threatened	Cranky Jims Creek Ecology Covenant	1	
	<i>Ichneutica ustistriga</i>	Endemic	Not Threatened	BRWRS, RHIMSPIM, Cranky Jims Creek Ecology Covenant, Highlay Creek Ecology Covenant, Island Block Covenant	22	
	<i>Meterana coelena</i>	Endemic		RHIMSPIM, Cranky Jims Creek Ecology Covenant, Highlay Creek Ecology Covenant	4	
	<i>Meterana decorata</i>	Endemic		RHIMSPIM, Island Black Covenant	2	
	<i>Meterana ochthistis</i>	Endemic		RHIMSPIM, Island Black Covenant	5	
	<i>Meterana stipata</i>	Endemic		Highlay Creek Ecology Covenant	1	
	<i>Persectania aversa</i>	Endemic		RHIMSPIM, Island Block Covenant	2	
	<i>Physetica phricias</i>	Endemic	Not Threatened	BRWRS, Cranky Jims Creek Ecology Covenant, Island Block Covenant	3	
Oecophoridae	<i>Atomotricha</i> sp.	Endemic		BRWRS, Island Block Covenant	2	
	<i>Tingena hastata</i>	Endemic		Island Block Covenant	1	
	<i>Tingena</i> sp. (?)	Endemic		Unknown	1	
Plutellidae	<i>Orthenches chlorocoma</i>	Endemic		Cranky Jims Creek Ecology Covenant	1	<i>Carmichaelia</i> specialist
Psychidae	<i>Lepidoscia heliochares</i>	Adventive		RHIMSPIM, Cranky Jims Creek Ecology Covenant, Highlay Creek Ecology Covenant, Island Block Covenant	7	Tentative ID, specimen very damaged
Tortricidae	(?) <i>Pyrgotis plagiatana</i>	Endemic		RHIMSPIM	1	Tentative ID, specimen very damaged
	[indet.] - possibly <i>Harmologa</i> sp.			Adjacent RHIMSPIM	1	
	<i>Apoptena persecta</i>	Endemic		Cranky Jims Creek Ecology Covenant	1	Scarce southern South Island species
	<i>Planotrortrix</i> sp.	Endemic		RHIMSPIM	1	
	<i>Pyrgotis plagiatana</i>	Endemic		Adjacent BRWRS	1	
					154	

Appendix D

Moth species recorded during targeted searches for Orocrambus sophistes in April to May 2025

NZTCS listed taxa highlighted.

Family	Species	Status	NZTCS listing	Survey period	Notes
Crambidae	<i>Eudonia feredayia</i>	Endemic		2-4 April & 22-25 April 2025	
	<i>Eudonia philerga</i>	Endemic		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Orocrambus cf. cyclopicus</i>	Endemic		2-4 April & 22-25 April 2025	
	<i>Orocrambus cyclopicus</i>	Endemic		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Orocrambus enchophora</i>	Endemic		22-25 April & 6-9 May 2025	
	<i>Orocrambus flexuosellus</i>	Endemic		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Orocrambus lewesi</i>	Endemic		22-25 April 2025	
	<i>Orocrambus vittellus</i>	Endemic		2-4 April 2025	
	<i>Orocrambus vulgaris</i>	Endemic		2-4 April & 22-25 April 2025	
	<i>Scoparia halopis</i>	Endemic		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Scoparia ustimacula</i>	Endemic		22-25 April 2025	
	<i>Uresiphita maoralis</i>	Endemic		2-5 April & 6-9 May 2025	
Depressariidae	<i>Agonopterix alstroemeriana</i>	Introduced		2-5 April & 6-9 May 2025	
	<i>Agonopterix umbellana</i>	Introduced		22-25 April & 6-9 May 2025	
Elachistidae	<i>Elachista</i> sp	Endemic		2-4 April & 22-25 April 2025	"White with black scaling" - unable to determine species without dissection.
Gelechiidae	<i>Megacraspedus calamogonus</i>	Endemic		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Symmetrischem a tangolias</i>	Introduced		6-9 May 2025	
Geometridae	<i>Aponotoreas insignis</i>	Endemic		2-4 April 2025	
	<i>Asaphodes abrogata</i>	Endemic		2-5 April & 6-9 May 2025	
	<i>Asaphosea beata</i>	Endemic		6-9 May 2025	
	<i>Chloroclystis filata</i>	Introduced		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Chloroclystis inductata</i>	Endemic		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Elvia glaucata</i>	Endemic		22-25 April & 6-9 May 2025	
	<i>Epicyme rubropunctaria</i>	Native		22-25 April 2025	
	<i>Epyaxa rosearia</i>	Endemic		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Helastia corcularia</i>	Endemic		2-5 April & 6-9 May 2025	
	<i>Pasiphila plinthina</i>	Endemic		6-9 May 2025	
	<i>Poecilasthena pulchraria</i>	Native		2-5 April & 6-9 May 2025	
	<i>Pseudocoremia leucelaea</i>	Endemic		2-4 April 2025	

Family	Species	Status	NZTCS listing	Survey period	Notes
	<i>Pseudocoremia suavis</i>	Endemic		22-25 April & 6-9 May 2025	
	<i>Xanthorhoe semifissata</i>	Endemic		2-5 April & 6-9 May 2025	
Glyphipterigidae	<i>Glyphipterix triselena</i>	Endemic		22-25 April 2025	
Hepialidae	<i>Aoraia rufivena</i>	Endemic	Not Threatened	2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Cladoxycanus minos</i>	Endemic	Not Threatened	6-9 May 2025	
	<i>Wiseana</i> sp	Endemic		22-25 April 2025	Dissection required to identify species.
Lycaenidae	<i>Lycaena</i> sp	Endemic		2-4 April 2025	Undescribed sp within the "common copper complex".
	<i>Zizina oxleyii</i>	Endemic	Not Threatened	2-4 April & 22-25 April 2025	
Noctuidae	<i>Agrotis ipsilon</i>	Native		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Bityla defigurata</i>	Endemic		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Bityla sericea</i>	Endemic	At Risk - Uncommon	2-4 April 2025	
	<i>Diarsia intermixta</i>	Native		2-5 April & 6-9 May 2025	
	<i>Ichneutica atristriga</i>	Endemic	Not Threatened	2-4 April & 22-25 April 2025	
	<i>Ichneutica lignana</i>	Endemic	Not Threatened	2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Ichneutica moderata</i>	Endemic	Not Threatened	2-4 April 2025	
	<i>Ichneutica morosa</i>	Endemic	Not Threatened	2-4 April & 22-25 April 2025	
	<i>Ichneutica mutans</i>	Endemic	Not Threatened	2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Ichneutica nullifera</i>	Endemic	Not Threatened	2-4 April 2025	
	<i>Ichneutica plena</i>	Endemic	Not Threatened	2-4 April & 22-25 April 2025	
	<i>Ichneutica propria</i>	Endemic	Not Threatened	2-4 April 2025	
	<i>Ichneutica scutata</i>	Endemic	Not Threatened	6-9 May 2025	
	<i>Ichneutica skelloni</i>	Endemic	Not Threatened	2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Ichneutica steropastis</i>	Endemic	Not Threatened	2-4 April 2025	
	<i>Ichneutica ustistriga</i>	Endemic	Not Threatened	2-5 April & 6-9 May 2025	
	<i>Meterana ochthistis</i>	Endemic	Not Threatened	6-9 May 2025	
	<i>Meterana tartarea</i>	Endemic		2-4 April & 22-25 April 2025	
	<i>Mythimna seperata</i>	Introduced		6-9 May 2025	
	<i>Physetica phricias</i>	Endemic	Not Threatened	2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Physetica sequens</i>	Endemic	Not Threatened	2-4 April 2025	

Family	Species	Status	NZTCS listing	Survey period	Notes
Nymphalidae	<i>Argyrophenga</i>	Endemic		22-25 April 2025	Unidentifiable to species level as found dead and partially decomposed amongst tussocks.
Plutellidae	<i>Plutella xylostella</i>	Introduced		6-9 May 2025	
Tineidae	<i>Monopis ethelea</i>	Introduced		2-4 April, 22-25 April, & 6-9 May 2025	
Tortricidae	<i>Capua intractana</i>	Introduced		2-4 April, 22-25 April, & 6-9 May 2025	
	<i>Clepsis divulsana</i>	Introduced		2-4 April & 22-25 April 2025	
	<i>Cnephasia jactatana</i>	Endemic		2-4 April 2025	

Appendix E

Moth species recorded during surveys between February and April 2026

NZTSC listed taxa highlighted.

Family	Species	Status	NZTCS	BRWRS	Coronation	Cranky Jims	Golden Bar	MEEA	Redbank	Road Realignment
Batrachedridae	<i>Batrachedra arenosella</i>	Native						•		
Carposinidae	<i>Heterocrossa gonosemana</i>	Endemic				•				
Choreutidae	<i>Asterivora marmarea</i>)	Endemic						•		
Coleophoridae	<i>Coleophora deauratella</i>	Introduced					•			
Crambidae	<i>Antiscopa elaphra</i>	Endemic		•	•			•	•	
	<i>Deana hybreasalis</i>	Endemic		•		•	•			
	<i>Diplopseustis perieresalis</i>	Native		•				•		•
	<i>Eudonia asterisca</i>	Endemic		•						
	<i>Eudonia bisinualis</i>	Endemic				•		•	•	•
	<i>Eudonia cataxesta</i>	Endemic		•	•				•	
	<i>Eudonia cf. philerga</i> "red scales"	Endemic		•	•			•	•	•
	<i>Eudonia characta</i>	Endemic							•	
	<i>Eudonia cymatias</i>	Endemic							•	
	<i>Eudonia diphtheralis</i>	Endemic		•			•			
	<i>Eudonia feredayi</i>	Endemic		•	•		•	•	•	•
	<i>Eudonia leptalea</i>	Endemic		•	•					
	<i>Eudonia microphthalma</i>	Endemic				•			•	
	<i>Eudonia octophora</i>	Endemic			•		•	•		
	<i>Eudonia oculata</i>	Endemic			•		•	•	•	
	<i>Eudonia philerga</i>	Endemic		•	•	•	•	•	•	•
	<i>Eudonia rakaiensis</i>	Endemic		•	•	•	•	•	•	•
	<i>Eudonia sabulosella</i>	Endemic		•	•			•		
	<i>Eudonia steropaea</i>	Endemic					•		•	
	<i>Eudonia submarginalis</i>	Endemic		•	•		•	•	•	
	<i>Gadira acerella</i>	Endemic		•					•	
	<i>Hygraula nitens</i>	Native		•	•			•	•	•
	<i>Leucinodes cordalis</i>	Native				•				
	<i>Mnesictena flavidalis</i>	Endemic		•	•	•	•	•	•	•
	<i>Musotima nitidalis</i>	Native		•						

Family	Species	Status	NZTCS	BRWRS	Coronation	Cranky Jims	Golden Bar	MEEA	Redbank	Road Realignment
	<i>Orocrambus angustipennis</i>	Endemic		•	•		•			
	<i>Orocrambus cyclopicus</i>	Endemic			•	•	•	•		
	<i>Orocrambus enchophorus</i>	Endemic		•	•		•	•	•	
	<i>Orocrambus ephorus</i>	Endemic		•	•	•	•	•	•	•
	<i>Orocrambus flexuosellus</i>	Endemic		•	•	•	•	•	•	•
	<i>Orocrambus lewisi</i>	Endemic		•	•	•	•	•	•	•
	<i>Orocrambus ramosellus</i>	Endemic		•	•	•	•	•	•	•
	<i>Orocrambus</i> sp	Endemic		•						
	<i>Orocrambus</i> sp. nov.	Endemic		•	•	•	•	•	•	•
	<i>Orocrambus vittellus</i>	Endemic		•	•	•	•	•	•	•
	<i>Orocrambus vulgaris</i>	Endemic		•	•	•	•	•	•	•
	<i>Scoparia chalicodes</i>	Endemic		•	•	•	•	•	•	
	<i>Scoparia exilis</i>	Endemic							•	
	<i>Scoparia indistinctalis</i>	Endemic						•		
	<i>Scoparia minusculalis</i>	Endemic				•				
	<i>Scoparia petrina</i>	Endemic					•		•	
	<i>Scoparia rotuella</i>	Endemic				•		•		
Depressariidae	<i>Agonopterix alstroemeriana</i>	Introduced		•				•		•
	<i>Agonopterix umbellana</i>	Introduced		•			•	•		•
	<i>Eutorna symmorpha</i>	Endemic			•			•	•	
	<i>Phaeosaces apocrypta</i>	Endemic		•	•		•	•	•	
Elachistidae	<i>Elachista</i> sp	Endemic						•	•	
	<i>Elachista</i> sp "brown streak"	Endemic			•					
	<i>Elachista</i> sp "grey white"	Endemic		•	•			•		•
	<i>Elachista</i> sp "grey"	Endemic				•	•		•	
	<i>Elachista</i> sp "white"	Endemic					•	•	•	
	<i>Elachista thallophora</i>	Endemic		•					•	
Erebidae	<i>Nyctemera annulata</i>	Endemic	At Risk - Declining		•	•	•			•
	<i>Rhapha scotosialis</i>	Endemic		•	•	•	•	•		
	<i>Schrankia costaestrigalis</i>	Native						•	•	

Family	Species	Status	NZTCS	BRWRS	Coronation	Cranky Jims	Golden Bar	MEEA	Redbank	Road Realignment
Gelechiidae	<i>Anisoplaca ptyoptera</i>	Endemic		•						
	<i>Aristotelia paradesma</i>	Endemic		•						
	<i>Kiwaia brontophora</i>	Endemic		•		•				
	<i>Kiwaia lithodes</i>	Endemic							•	
	<i>Kiwaia pharetria</i>	Endemic		•			•	•		
	<i>Megacraspedus calamogonus</i>	Endemic		•	•		•	•	•	•
	<i>Platyedra subcinerea</i>	Introduced		•		•				
	<i>Thiotricha oleariae</i>	Endemic		•						
Geometridae	<i>Aponotoreas insignis</i>	Endemic		•	•		•		•	
	<i>Arctesthes catapyrrha</i>	Endemic	Not Threatened					•	•	
	<i>Asaphodes abrogata</i>	Endemic		•	•	•	•	•	•	•
	<i>Asaphodes aegrota</i>	Endemic		•				•	•	
	<i>Asaphodes beata</i>	Endemic							•	
	<i>Asaphodes chlamydota</i>	Endemic		•		•				
	<i>Asaphodes clarata</i>	Endemic		•	•		•		•	
	<i>Asaphodes helias</i>	Endemic						•		
	<i>Asaphodes recta</i>	Endemic	At Risk - Declining		•			•		
	<i>Austrocidaria callichlora</i>	Endemic		•						
	<i>Austrocidaria cedrinodes</i>	Endemic		•		•			•	
	<i>Austrocidaria similata</i>	Endemic		•					•	
	<i>Austrocidaria sp</i>	Endemic		•	•	•	•	•	•	
	<i>Chloroclystis filata</i>	Introduced		•		•			•	•
	<i>Chloroclystis inductata</i>	Endemic		•	•	•	•	•	•	•
	<i>Dasyuris anceps</i>	Endemic			•					
	<i>Elvia glaucata</i>	Endemic				•				
	<i>Epicyme rubropunctaria</i>	Native							•	•
	<i>Epiphryne verriculata</i>	Endemic				•				
	<i>Epyaxa rosearia</i>	Endemic		•	•	•	•		•	•
	<i>Gellonia pannularia</i>	Endemic		•		•	•	•		
	<i>Helastia cinerearia</i>	Endemic		•	•			•	•	•

Family	Species	Status	NZTCS	BRWRS	Coronation	Cranky Jims	Golden Bar	MEEA	Redbank	Road Realignment
	<i>Helastia corcularia</i>	Endemic		•	•	•	•	•	•	•
	<i>Helastia plumbea</i>	Endemic		•		•		•	•	
	<i>Helastia triphragma</i>	Endemic		•		•				
	<i>Homodotis falcata</i>	Endemic				•		•		
	<i>Homodotis megaspilata</i>	Endemic		•	•	•		•		
	<i>Horisme suppressaria</i>	Endemic							•	
	<i>Hydriomena deltoidata</i>	Endemic		•	•		•	•		•
	<i>Hydriomena rixata</i>	Endemic						•		
	<i>Ipana egregia</i>	Endemic				•				
	<i>Ipana junctilinea</i>	Endemic		•	•	•	•	•	•	•
	<i>Ischalis fortinata</i>	Endemic	Not Threatened	•		•	•	•	•	
	<i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia")	Endemic	At Risk - Declining	•		•	•		•	
	<i>Pasiphilodes testulata</i>	Native		•						
	<i>Poecilasthena shistaria</i>	Endemic					•			
	<i>Pseudocoremia fenerata</i>	Endemic		•	•					
	<i>Pseudocoremia leucelaea</i>	Endemic		•		•				
	<i>Pseudocoremia melinata</i>	Endemic					•			
	<i>Samana acutata</i>	Endemic	At Risk - Declining	•					•	
	<i>Sarisa muriferata</i>	Endemic		•		•				
	<i>Scopula rubraria</i>	Native		•		•				
	<i>Xanthorhoe occulta</i>	Endemic		•	•	•	•	•	•	
	<i>Xanthorhoe semifissata</i>	Endemic		•	•	•	•	•	•	
	<i>Xyridacma alectoraria</i>	Endemic				•				
	<i>Zermizinga indocilisaria</i>	Endemic		•			•	•		
Glyphipterigidae	<i>Glyphipterix metasticta</i>	Endemic		•	•			•	•	•
	<i>Glyphipterix nephoptera</i>	Endemic		•		•	•			
	<i>Glyphipterix rugata</i>	Endemic			•		•			•
	<i>Glyphipterix triselena</i>	Endemic		•	•	•	•	•		•
	<i>Glyphipterix tungella</i>	Endemic				•				
Gracilariidae	<i>Polysoma eumetalla</i>	Introduced					•			

Family	Species	Status	NZTCS	BRWRS	Coronation	Cranky Jims	Golden Bar	MEEA	Redbank	Road Realignment
	<i>Caloptilia elaeas</i>	Endemic		•	•			•	•	•
Hepialidae	<i>Aoraia rufivena</i>	Endemic	Not Threatened		•		•	•	•	
	<i>Wiseana copularis</i>	Endemic	Not Threatened	•						
	<i>Wiseana mimica</i>	Endemic	Data Deficient					•		
	<i>Wiseana umbraculata</i>	Endemic	Not Threatened		•		•	•	•	
Lycaenidae	<i>Lycaena</i> sp	Endemic		•	•	•	•	•	•	
	<i>Zizina oxleyi</i>	Endemic	Not Threatened		•	•	•	•	•	•
Noctuidae	<i>Agrotis admirationis</i>	Endemic	At Risk - Declining		•					
	<i>Agrotis ipsilon</i>	Native		•	•	•	•	•	•	•
	<i>Bityla defigurata</i>	Endemic		•	•	•	•	•	•	•
	<i>Bityla sericea</i>	Endemic	At Risk - Uncommon	•			•	•	•	
	<i>Diarsia intermixta</i>	Native				•				
	<i>Ichneutica agorastis</i>	Endemic	Not Threatened						•	
	<i>Ichneutica alopa</i>	Endemic	Not Threatened					•		
	<i>Ichneutica atristriga</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Ichneutica averella</i>	Endemic	Not Threatened	•			•	•		•
	<i>Ichneutica barbara</i>	Endemic	Not Threatened	•	•					
	<i>Ichneutica cuneata</i>	Endemic	Not Threatened	•				•	•	
	<i>Ichneutica insignis</i>	Endemic	Not Threatened		•	•	•	•		
	<i>Ichneutica lignana</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Ichneutica lissoxyla</i>	Endemic	Not Threatened		•					
	<i>Ichneutica lithias</i>	Endemic	Not Threatened		•		•	•		
	<i>Ichneutica moderata</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Ichneutica morosa</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Ichneutica mutans</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Ichneutica nullifera</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Ichneutica plena</i>	Endemic	Not Threatened	•	•	•	•	•	•	
	<i>Ichneutica propria</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Ichneutica purdii</i>	Endemic	Not Threatened			•				
	<i>Ichneutica rubescens</i>	Endemic	Not Threatened	•	•		•	•	•	•

Family	Species	Status	NZTCS	BRWRS	Coronation	Cranky Jims	Golden Bar	MEEA	Redbank	Road Realignment
	<i>Ichneutica semivittata</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Ichneutica steropastis</i>	Endemic	Not Threatened	•	•	•	•		•	•
	<i>Ichneutica sulcana</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Ichneutica ustistriga</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Meterana decorata</i>	Endemic				•				
	<i>Meterana ochthistis</i>	Endemic	Not Threatened	•		•				
	<i>Meterana stipata</i>	Endemic			•					
	<i>Meterana tartarea</i>	Endemic		•		•	•		•	
	<i>Peripyra sanguipuncta</i>	Introduced		•	•	•	•	•		•
	<i>Persectania aversa</i>	Endemic		•	•	•	•	•	•	•
	<i>Physetica cucullina</i>	Endemic	Not Threatened	•	•		•	•	•	
	<i>Physetica phricias</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Proteuxoa comma</i>	Endemic	Not Threatened		•				•	
	<i>Proteuxoa tetronycha</i>	Endemic	Not Threatened	•						•
Nymphalidae	<i>Argyrophenga antipodum</i>	Endemic	Not Threatened	•	•	•	•	•	•	•
	<i>Vanessa gonerilla</i>	Endemic	Not Threatened	•			•			
	<i>Vanessa itea</i>	Endemic	Not Threatened			•	•	•	•	
Oecophoridae	<i>Barea exarcha</i>	Introduced				•				
	<i>Chersadaula s.l sp</i>	Endemic			•	•		•		
	<i>Endrosis sarcitrella</i>	Introduced					•	•		
	<i>Gymnobathra sarcoxantha</i>	Endemic		•	•	•	•	•	•	•
	<i>Gymnobathra tholodella</i>	Endemic		•	•	•	•	•	•	
	<i>Tachystola acroxantha</i>	Introduced		•	•				•	
	<i>Tingena sp "yellow"</i>	Endemic				•				
	<i>Trachypepla anastrella</i>	Endemic			•	•	•			
Pieridae	<i>Pieris rapae</i>	Introduced		•	•	•	•	•	•	•
Plutellidae	<i>Orthenches semifasciata</i>	Endemic							•	
	<i>Plutella psammochroa</i>	Native		•			•	•	•	
	<i>Plutella xylostella</i>	Introduced				•	•			
	<i>Proditrix megalynta</i>	Endemic					•			

Family	Species	Status	NZTCS	BRWRS	Coronation	Cranky Jims	Golden Bar	MEEA	Redbank	Road Realignment
Pterophoridae	<i>Amblyptilia repletalis</i>	Endemic						•	•	
	<i>Pterophorus innotatalis</i>	Endemic		•			•			
	<i>Stenoptilia zophodactylus</i>	Native			•					
Pyralidae	<i>Patagoniodes farinaria</i>	Native	At Risk - Declining	•	•			•	•	•
Stathmopodidae	<i>Stathmopoda horticola</i>	Endemic		•		•				
	<i>Stathmopoda plumbiflua</i>	Endemic		•				•		•
Tineidae	<i>Habrophila compseuta</i>	Endemic		•						
	<i>Monopis ethelella</i>	Introduced		•	•	•	•	•	•	•
	<i>Opogona comptella</i>	Introduced		•	•			•	•	
	<i>Sagephora exsanguis</i>	Endemic		•		•				
	<i>Tinea pallescentella</i>	Introduced						•		
Tortricidae	<i>Apoctena conditana</i>	Endemic		•					•	
	<i>Bactra noteraula</i>	Endemic						•		
	<i>Capua intractana</i>	Introduced		•	•	•		•		
	<i>Capua semiferana</i>	Endemic		•	•	•	•	•		•
	<i>Clepsis divulsana</i>	Introduced					•	•		•
	<i>Clepsis leucaniana</i>	Endemic		•			•			
	<i>Ctenopsustis</i> sp	Endemic			•		•		•	•
	<i>Cydia succedana</i>	Introduced		•	•	•	•	•	•	•
	<i>Epichorista siriana</i>	Endemic		•	•	•	•	•	•	•
	<i>Epiphias postvittana</i>	Introduced				•				
	<i>Eurythecta eremana</i>	Endemic		•	•	•	•	•	•	•
	<i>Harmologa amplexana</i>	Endemic				•				
	<i>Harmologa oblongana</i>	Endemic		•						
	<i>Harmologa petrias</i>	Endemic		•	•	•	•	•	•	•
	<i>Harmologa scoliastis</i>	Endemic						•		
	<i>Harmologa</i> sp "grey"	Endemic				•				
	<i>Harmologa</i> sp "small"	Endemic		•						
	<i>Strepsicrates ejectana</i>	Native				•	•		•	
	<i>Tortrix demiana</i>	Endemic						•		•

Family	Species	Status	NZTCS	BRWRS	Coronation	Cranky Jims	Golden Bar	MEEA	Redbank	Road Realignment
Total				129	100	100	102	113	109	67

Appendix F

Invertebrates recorded during hand searching efforts over February and March 2026

NZTCS listed taxa highlighted.

Species	NZTCS	Trimbells	Central (CCP2)	Haul Road	IM	Macraes Office	GPUG	BRWRS	Camp Creek	Coal Creek	Murphys	Total
<i>Anoteropsis</i> sp.											1	1
<i>Argiope protensa</i>	Not Threatened								1			1
<i>Argyrophenga antipodum</i>	Not Threatened						1			1	1	3
<i>Asaphodes abrogata</i>	Not listed						1		1	1		3
<i>Asaphodes clarata</i>	Not listed										1	1
<i>Austrolestes colenisonis</i>	Not Threatened						1				1	2
<i>Cermatulus nasalis</i>	Not listed										1	1
<i>Coccinella leonina</i>	Not listed										1	1
<i>Coccinella undecimpunctata</i>	Not listed						1					1
<i>Colaranea verutum</i>	Not Threatened		1								1	2
<i>Colaranea viriditas</i>	Not Threatened										1	1
<i>Creophilus oculus</i>	Not listed								1			1
<i>Dolomedes minor</i>	Not Threatened	1					1		1	1	1	5
<i>Eristalis tenax</i>	Not listed								1			1
<i>Eudonia philerga</i>	Not listed									1		1
<i>Helastia corcularia</i>	Not listed									1		1
<i>Hemicloea rogenhoferi</i>	Introduced and Naturalised								1		1	2
<i>Hemicordulia smithii</i>	Not listed							1				1
<i>Kikihia angusta</i>	Not listed								1	1	1	3
<i>Leioproctus fulvescens</i>	Not listed									1		1
<i>Lycaena boldenarum</i>	Not Threatened									1	1	2
<i>Lycaena feredayi</i>	Not Threatened								1			1
<i>Lycaena salustius</i>	Not Threatened								1			1
<i>Lycaena</i> sp.	Not Threatened									1	1	2
<i>Mecodema</i> sp.				1								1
<i>Megadromus bullatus</i>	Not listed						1					1

Species	NZTCS	Trimbells	Central (CCP2)	Haul Road	IM	Macraes Office	GPUG	BRWRS	Camp Creek	Coal Creek	Murphys	Total
<i>Mimopeus opaculus</i>	Not listed	1					1		1		1	4
<i>Mimopeus</i> sp.	Not listed			1					1			2
<i>Mnesictena flavidalis</i>	Not listed										1	1
<i>Neactina opposita</i>	Not listed								1			1
<i>Neocicindela latecincta</i>	Not listed								1		1	2
<i>Nyctemera annulata</i>	At Risk – Declining						1					1
<i>Nyssus coloripes</i>	Introduced and Naturalised						1				1	2
<i>Oregus aereus</i>	Not listed										1	1
<i>Orthodera novaezealandiae</i>	At Risk – Declining					1	1					2
<i>Pleioplectron thomsoni</i>	Not Threatened								1			1
<i>Porrhothele antipodiana</i>	Not Threatened						1			1	1	3
<i>Priocnemis monachus</i>	Not listed	1										1
<i>Sigauss</i> sp.									1	1	1	3
<i>Sphictostethus nitidus</i>	Not listed								1			1
<i>Vanessa itea</i>	Not Threatened						1		1			2
<i>Xanthocnemis zealandica</i>	Not Threatened										1	1
<i>Zizina oxleyi</i>	Not Threatened									1		1
Total		3	1	2	0	1	12	1	17	12	21	70

Appendix G

eDNA Insecta results provided by Viridis, via Wilderlab, April 2026

NZTCS listed taxa highlighted.

Order/ type/ species	NZTCS listing	Count
Cecidomyiidae		2
Gall midge		2
<i>Mycodiplosis</i> sp.		1
<i>Rhopalomyia</i> sp.		1
Coleoptera		10
Beetle		8
<i>Antiporus strigosulus</i>		1
<i>Antiporus uncifer</i>	Not Threatened	1
<i>Ataenius picinus</i>		1
<i>Carpelimus zealandicus</i>		1
<i>Corticara</i> sp.		1
Hydraenidae sp.		1
Latridiidae sp.		1
<i>Liodessus plicatus</i>		1
Dung beetle		1
<i>Onthophagus variegatus</i>		1
Weevil		1
<i>Rhinocyllus conicus</i>		1
Diptera		25
Blackfly		2
<i>Austrosimulium australense</i>		1
<i>Austrosimulium</i> sp.		1
Drain fly		1
<i>Psychoda alternata</i>		1
Flesh fly		1
<i>Oxysarcodexia varia</i>		1
Fly		4
<i>Australophyra rostrata</i>		1
<i>Limnophelina</i> sp.		1
Muscidae sp.		1
<i>Spilogona</i> sp.		1
Fungus gnat		2
<i>Bradysia pallipes</i>		1
<i>Cratyna nobilis</i>		1
Hoverfly		1
<i>Helophilus hochstetteri</i>		1
Leaf-miner fly		1
<i>Scaptomyza flava</i>		1
Lesser dung fly		1
Sphaeroceridae sp.		1
Long-legged fly		1
Dolichopodidae sp.		1
Midge		4
<i>Corynoneura scutellata</i>		1
<i>Cricotopus</i> sp.		1
<i>Paratanytarsus grimmii</i>		1

Order/ type/ species	NZTCS listing	Count
<i>Smittia</i> sp.		1
Moth fly		1
Psychodidae sp.		1
Scorpionfly		1
<i>Nannochorista philpotti</i>	Not Threatened	1
Scuttle fly		1
Phoridae sp.		1
Shore fly		2
Ephydridae sp.		1
<i>Hydrellia tritici</i>		1
Spear-winged fly		1
<i>Lonchoptera bifurcata</i>		1
Ephemeroptera		3
Mayfly		3
<i>Deleatidium</i> sp.		1
<i>Neozephlebia scita</i>	Not Threatened	1
<i>Zephlebia spectabilis</i>	Not Threatened	1
Hemiptera		22
Aphid		18
<i>Acyrtosiphon kondoi</i>		1
<i>Acyrtosiphon pisum</i>		1
Aphididae sp.		1
<i>Aphis craccivora</i>		1
<i>Aploneura lentisci</i>		1
<i>Aulacorthum solani</i>		1
<i>Brevicoryne brassicae</i>		1
<i>Capitophorus elaeagni</i>		1
<i>Lipaphis pseudobrassicae</i>		1
<i>Macrosiphum euphorbiae</i>		1
<i>Myzus persicae</i>		1
<i>Nasonovia ribisnigri</i>		1
<i>Nearctaphis bakeri</i>		1
<i>Rhopalosiphoninus latysiphon</i>		1
<i>Rhopalosiphum nymphaeae</i>		1
<i>Rhopalosiphum padi</i>		1
<i>Sitobion</i> sp.		1
<i>Smynthuroides betae</i>		1
Cicada		1
<i>Kikihia angusta</i>		1
Psyllid		1
<i>Arytaina genistae</i>		1
Scale insect		1
<i>Setascutum pallidum</i>		1
Water strider		1
<i>Veliidae</i> sp.		1
Lepidoptera		16
Butterfly		2

Order/ type/ species	NZTCS listing	Count
<i>Lycaena salustius</i>	Not Threatened	1
<i>Zizina oxleyi</i>	Not Threatened	1
Moth		13
<i>Agrotis ipsilon</i>		1
Geometridae sp.		1
<i>Huberia striata</i>		1
<i>Hygraula nitens</i>	Not Threatened	1
<i>Ischalis fortinata</i>	Not Threatened	1
<i>Omiodes decialis</i>		1
<i>Orocrambus vittellus</i>		1
<i>Palpita vitrealis</i>		1
<i>Powellia discariae</i>		1
<i>Proteuxoa tetrorycha</i>	Not Threatened	1
<i>Wiseana copularis</i>	Not Threatened	1
<i>Wiseana fuliginea</i>	Data Deficient	1
<i>Wiseana umbraculata</i>	Not Threatened	1
Moth/Butterfly		1
Lepidoptera sp.		1
Megaloptera		1
Dobsonfly		1
<i>Archichauliodes diversus</i>		1
Neuroptera		1
Lacewing		1
<i>Drepanacra binocula</i>		1
Odonata		2
Damselfly		2
<i>Austrolestes colenisonis</i>	Not Threatened	1
<i>Xanthocnemis zealandica</i>	Not Threatened	1
Orthoptera		2
Cricket		1
<i>Bobilla</i> sp.		1
Ground weta		1
<i>Hemiandrus maia</i>	Not Threatened	1
Plecoptera		4
Stonefly		5
<i>Acroperla trivacuata</i>	Not Threatened	1
<i>Stenoperla prasina</i>	Not Threatened	1
<i>Zelandobius foxi</i>	Not Threatened	1
<i>Zelandobius uniramus</i>	Data Deficient	1
<i>Zelandoperla tillyardi</i>	Not Threatened	1
Psocodea		4
Barklouse		4
Caeciliusidae sp.		1
<i>Ectopsocus briggsi</i>		1
<i>Lobocaecilius monicus</i>		1
<i>Protopsocus pulchripennis</i>		1
Trichoptera		15

Order/ type/ species	NZTCS listing	Count
Caddisfly		15
<i>Aoteapsyche colonica</i>		1
<i>Hudsonema alienum</i>	Not Threatened	1
<i>Hudsonema amabile</i>	Not Threatened	1
<i>Hydrobiosella stenocerca</i>	Not Threatened	1
<i>Hydropsyche catherinae</i>	Not Threatened	1
<i>Hydropsyche raruraru</i>	Not Threatened	1
Hydroptilidae sp.		1
<i>Olinga feredayi</i>	Not Threatened	1
<i>Oxyethira albiceps</i>		1
<i>Polypsectropus puerilis</i>	Not Threatened	1
<i>Psilochorema bidens</i>		1
<i>Psilochorema tautoru</i>	Not Threatened	1
<i>Pycnocentria evecta</i>	Not Threatened	1
<i>Triplectides cephalotes</i>	Not Threatened	1
<i>Triplectides obsoletus</i>	Not Threatened	1
Total		107

Appendix H

EIANZ key tables for assessing level of effect

Table 5 Factors to consider in assigning value to terrestrial species for EcIA

Determining factors	
Nationally Threatened species, found in the ZOI either permanently or seasonally	Very High
Species listed as At Risk – Declining, found in the ZOI, either permanently or seasonally	High
Species listed as any other category of At Risk, found in the ZOI either permanently or seasonally	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pests, species having recreational value	Negligible

Table 6. Scoring for sites or areas combining values for four matters in Table 4.

Value	Description
Very High	Area rates High for 3 or all of the four assessment matters listed in Table 4 . Likely to be nationally important and recognised as such.
High	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder, or Area rates High for 1 of the assessment matters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder. Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

Table 7. Matters that may be considered when assigning ecological value to a freshwater site or area

Matters	Attributes to be assessed
Representativeness	- Extent to which site/catchment is typical or characteristic - Stream order - Permanent, intermittent or ephemeral waterway - Catchment size - Standing water characteristics
Rarity/distinctiveness	- Supporting nationally or locally²¹ Threatened, At Risk or uncommon species - National distribution limits - Endemism - Distinctive ecological features - Type of lake/pond/wetland/spring
Diversity and pattern	- Level of natural diversity - Diversity metrics - Complexity of community - Biogeographical considerations – pattern, complexity, size, shape
Ecological context	- Stream order - Instream habitat - Riparian habitat - Local environmental conditions and influences, site history and development - Intactness, health and resilience of populations and communities - Contribution to ecological networks, linkages, pathways - Role in ecosystem functioning – high level, proxies

Table 8. Criteria for describing magnitude of effect (Adapted from Regini (2000) and Boffa Miskell (2011))

Magnitude	Description
Very high	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature

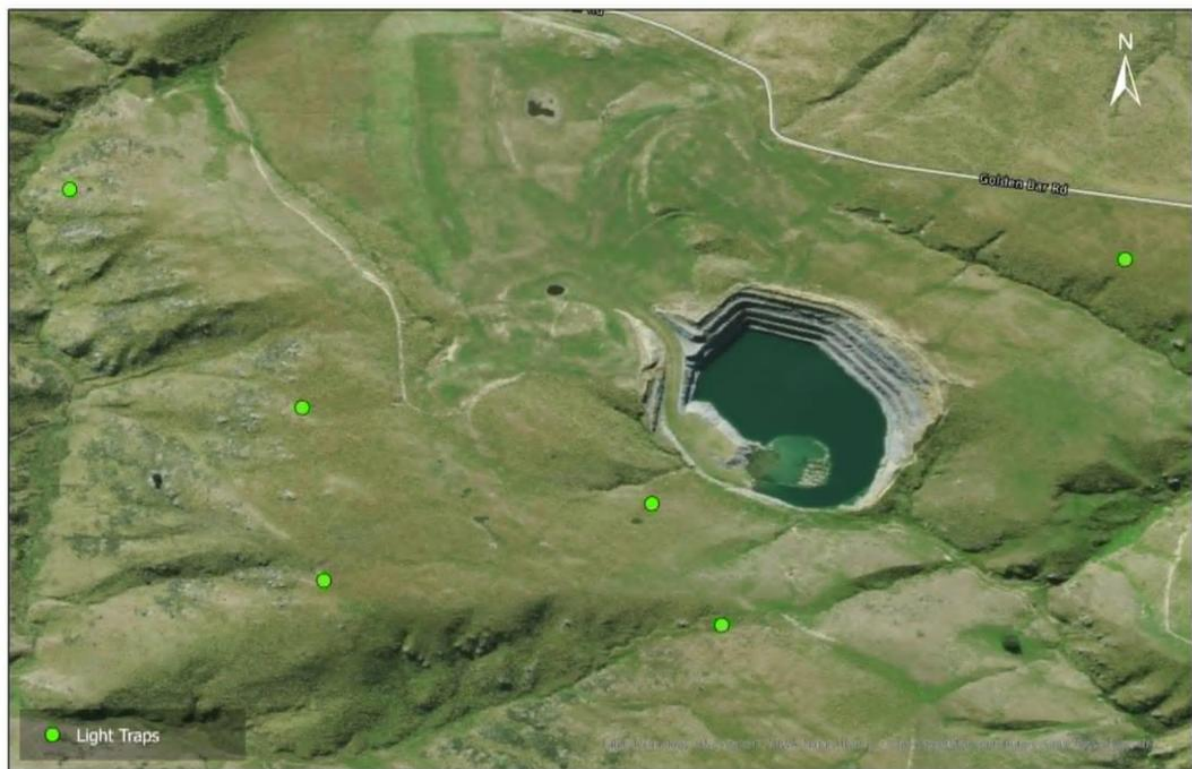
Table 10. Criteria for describing level of effects (Adapted from Regini (2000) and Boffa Miskell (2011))

Ecological Value ► Magnitude ▼	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very Low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Appendix I

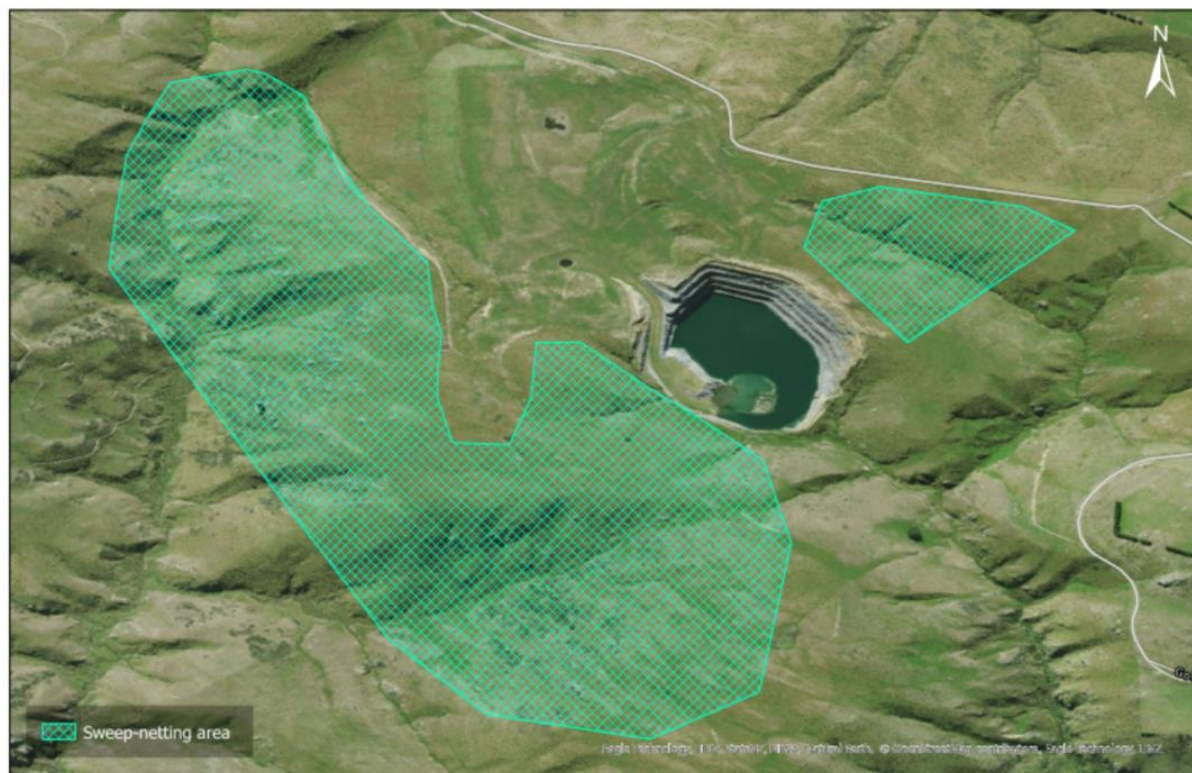
April to May 2025 moth survey maps (Bauckham 2025)

Heath moth trap locations at Golden Bar Pit and Golden Bar Waste Rock Stack. From Bauckham (2025).



OceaniaGold Macraes - Golden Bar Pit
Orocrambus sophistes Survey

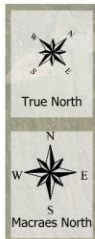
Sweep-netting focus areas within tussock and other vegetation types at Golden Bar Pit and Golden Bar Waste Rock Stack. From Bauckham (2025).



OceaniaGold Macraes - Golden Bar Pit
Orocrambus sophistes Survey

Appendix J

Overview invertebrate survey map: 2022 – 2026 survey efforts



COPYRIGHT BABBAGE CONSULTANTS
LIMITED UNAUTHORISED COPYING
PROHIBITED DO NOT SCALE THIS MAP
PLEASE REFER ALL QUERIES TO BABBAGE
CONSULTANTS LIMITED

CLIENT / PROJECT
OceanaGold (NZ) Ltd

Overview invertebrate survey map

7 August 2026

Legend

- MP4 Project Components
- MP4 Impact Areas
- eDNA sample locations
- General invertebrate sampling
- Feb - Apr 2026 sweepnet area

Moth light trap locations

- Apr - May 2022
- Sep 2022
- Apr - May 2025
- Feb - Apr 2026

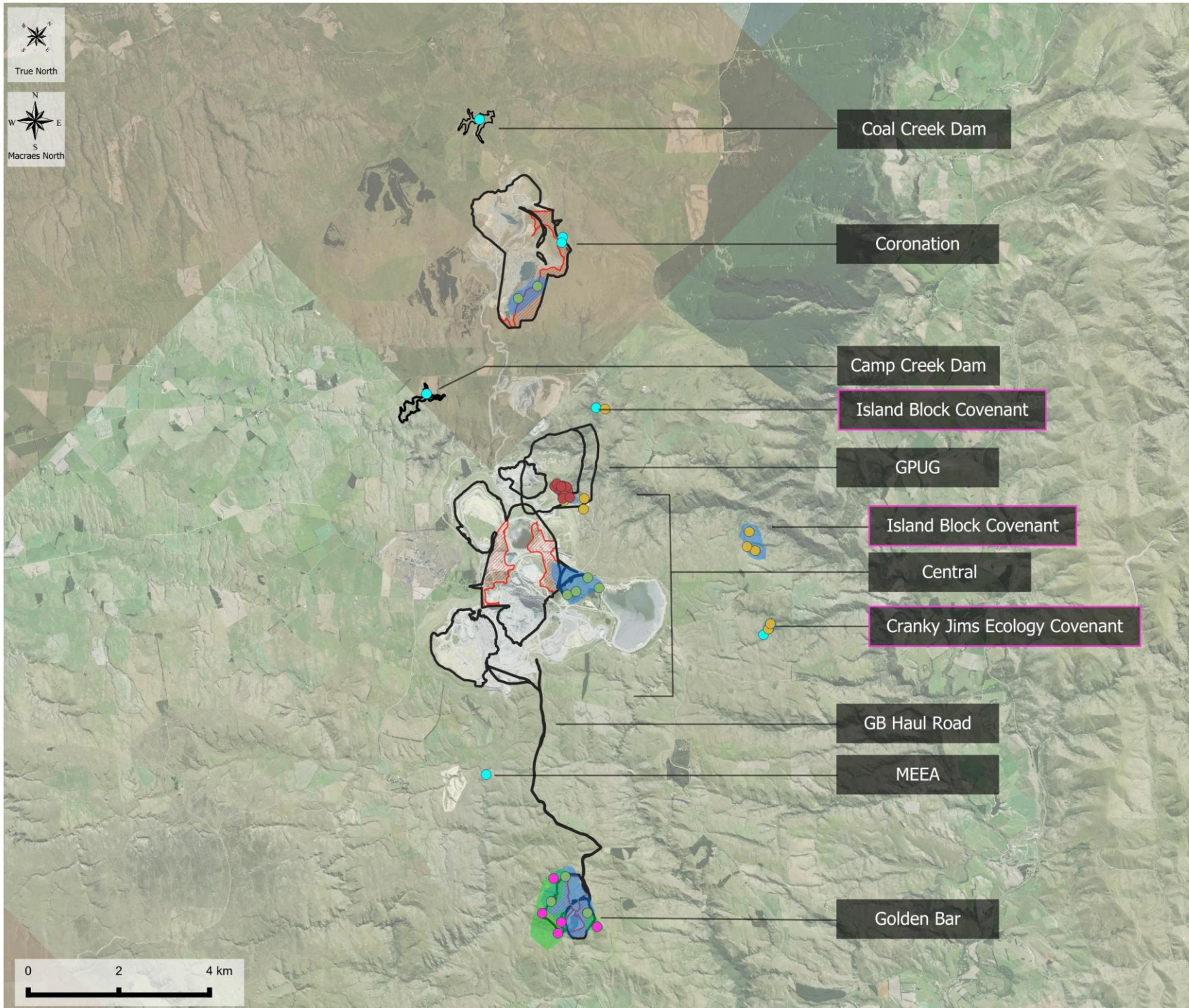
SOURCES
LINZ Basemap aerial

MAP PROJECTION
NZGD2000 / New Zealand Transverse
Mercator 2000

DISCLAIMER:
This map/plan is not an engineering draft.
This map/plan is illustrative only and all
information should be independently
verified on site before taking any action.

SCALE
1:110,000@ A4

MAP NO.
68766



Auckland

Address | Level 4, 68 Beach Road, Auckland 1010

Post | PO Box 2027, Shortland Street, Auckland
1140, New Zealand

Ph | 64 9 379 9980

Fax | +64 9 377 1170

Email | contact-us@babbage.co.nz

Hamilton

Address | Unit 1, 85 Church Road, Pukete,
Hamilton 3200

Post | PO Box 20068, Te Rapa, Hamilton 3241,
New Zealand

Ph | +64 7 850 7010

Fax | +64 9 377 1170

Email | contact-us@babbage.co.nz

Christchurch

Address | 128 Montreal Street, Sydenham,
Christchurch 8023

Post | PO Box 2373, Christchurch 8140, New
Zealand

Ph | +64 3 379 2734

Fax | +64 3 379 1642

Email | solutions@babbage.co.nz

Babbage Consultants Australia Pty Ltd – Australia

Address | Suite 4, Level 2, 1 Yarra Street,
Geelong,

Victoria 3220, Australia

Ph | +61 3 8539 4805

Email | contact-us@babbage.co.nz

www.bioresearches.co.nz

www.babbage.co.nz

www.babbageconsultants.com.au