

Macraes Phase 4 Fast-track

Lizard Values Assessment

for: OceanaGold New Zealand Limited



Document Approval and Revision History

Document title	Macraes Phase 4 Fast-track
	Lizard Values Assessment
Prepared for	OceanaGold New Zealand Limited
Version	Final
Date	21 August 2026
Filename	E4_MP4Fast_Lizardvaluesassessment_Rev 0

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Rev. no.	Date	Author(s)
Final	21 August 2026	Dylan van Winkel

Reference: Bioresearches (2026). Macraes Phase 4 Fast-track: Lizard Values Assessment. Report for OceanaGold New Zealand Limited. 121 p.

Cover Illustration: McCann's skink (*Oligosoma maccanni*), Macraes, Otago.

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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
GAOS	Grand and Otago Skink
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
LMMP	Lizard 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

Abbreviation	Full term
VES	Visual encounter search(es)
WAA	Wildlife Act Authority
WDP	Waitaki District Plan 2010
WRS	Waste Rock Stack

Executive summary

This report presents an assessment of lizard values associated with the proposed Macraes Phase 4 Project (MP4) at the OceanaGold (New Zealand) Limited (OGNZL) Macraes Operation, Otago. The assessment was undertaken to identify lizard species present within the Project area, describe lizard habitats and communities, estimate relative lizard abundance where practicable, and assess ecological value and significance in accordance with the EIANZ Ecological Impact Assessment 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). Both the unconsented and consented areas require Wildlife Act Authority (WAA) consideration for lizards, and both have therefore been included in the current Lizard Values Assessment.

Targeted lizard investigations were undertaken between April 2022 and March 2026 and included systematic visual encounter surveys, aerial drone surveys, tracking tunnel surveys, artificial cover object monitoring, CritterPic® monitoring, and landscape-scale baseline pitfall trapping surveys.

A total survey effort of more than 515 person-hours of systematic searching, 2,016 pitfall trap days, 14 hours of aerial drone searching, and extensive supplementary monitoring was undertaken across the Project area and surrounding landscapes.

Three indigenous lizard species were confirmed within the MP4 Project area: McCann's skink (*Oligosoma maccanni*), southern grass skink (*Oligosoma chionocholes*), and kōrero gecko (*Woodworthia* "Otago/Southland large"). McCann's skink was the most widespread and abundant species recorded, followed by southern grass skink. Kōrero geckos were locally abundant within rocky habitats, particularly schist outcrops, rock piles, and talus slopes.

Five indigenous lizard species are currently confirmed from OGNZL landholdings overall, and the wider Macraes Ecological District supports nationally significant reptile diversity, including Otago skink and grand skink populations. However, no populations of Otago skink, grand skink, Otago green skink, or herbfield skink were confirmed within areas proposed for direct disturbance under MP4. A remnant Otago skink population was identified within the wider Murphys Creek catchment outside the Project impact footprint.

The Project area supports extensive areas of suitable lizard habitat, including tussock grassland, shrubland, riparian gullies, and rocky outcrops. The highest lizard abundance and habitat quality were generally associated with rocky and tussock-dominated habitats, particularly within BRWRS (not affected by MP4), Murphys Creek (not affected by MP4), Camp Creek, Coal Creek, and parts of the Coronation and Golden Bar areas.

Baseline pitfall trapping and subsequent statistical modelling indicate that lizard populations within the project impact area are large, estimated at approximately 155,500 individuals, and potentially higher still.

Overall, the MP4 Project area supports lizard communities and habitats of moderate to high ecological value at both the local and regional scale. Ecological significance criteria under the NPS-IB, ORPS 2021, and Waitaki District Plan were met in multiple areas due to the presence of indigenous lizard habitat, naturally occurring indigenous biodiversity, and populations of 'At Risk – Declining' lizard species.

This report addresses ecological values only and does not assess the magnitude of ecological effects arising from the MP4 Project. Assessment of effects and recommendations for avoidance, mitigation, management, offsetting, and compensation are addressed separately within the accompanying Ecological Impact Assessment and Lizard Management Plan prepared for the MP4 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 this assessment is to document and describe the lizard community and lizard habitat values present within the MP4 Project area, 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 lizard communities and lizard habitat within the MP4 Project area, including existing consented areas;
- 2) Descriptions of lizard presence and relative abundance within the MP4 Project area;
- 3) Identifying and quantifying areas of suitable lizard habitat in the MP4 Project area;
- 4) An assessment of lizard values contained within the MP4 Project area; and
- 5) An assessment of the ecological significance criteria with respect to lizards.

This document (E4) 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 lizard values and does not include an assessment of the Project’s effects on those values. The effects of the Project on lizard communities and species are addressed separately in the Ecological Impact Assessment (EclA) prepared by Bioresearches (2026f)) (document 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 lizards (*Oligosoma* skinks and *Woodworthia* geckos) 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.

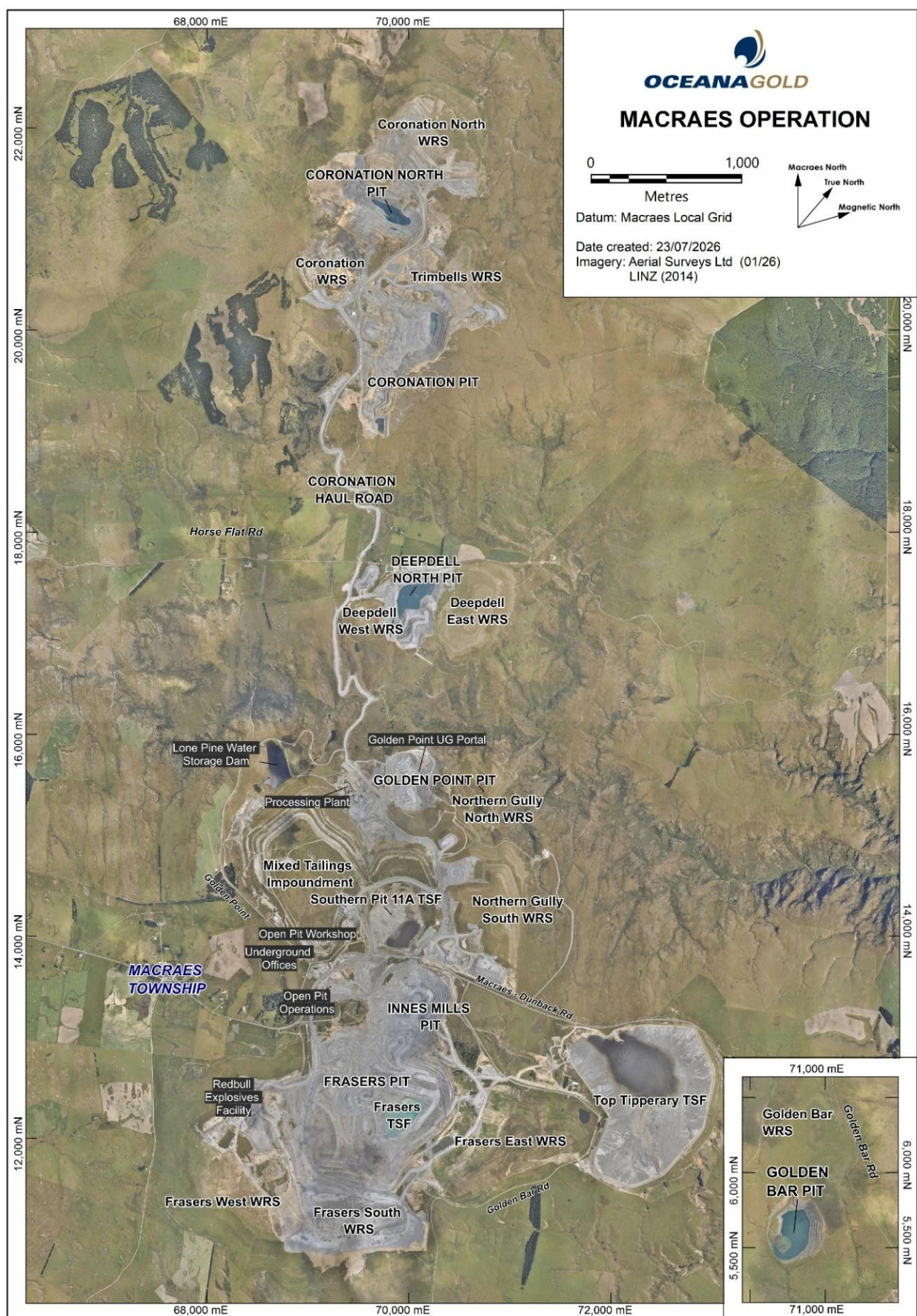


Figure 2.1. Existing site layout at the Macraes Operation (as of July 2026). Figure supplied by OceanaGold.

2.2 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.

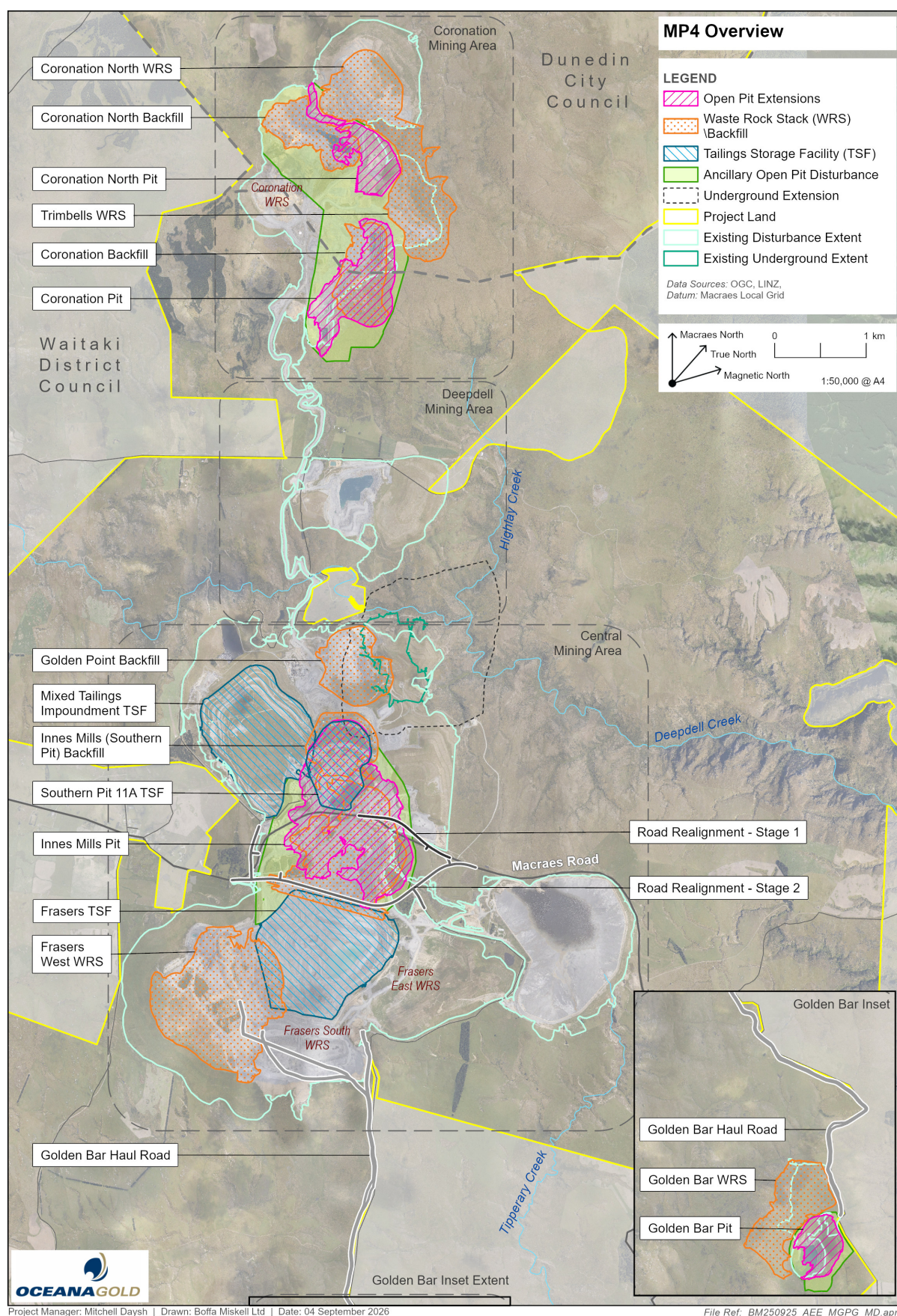


Figure 2.2. MP4 Overview Plan (as of July 2026). Figure supplied by OceanaGold.

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). Both the unconsented and consented areas require Wildlife Act Authority (WAA) consideration for lizards, and both have therefore been included in the current Lizard Values Assessment.

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

2.2.1 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.

2.2.2 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. The ecological footprint of the BRWRS area has been assessed to understand the values that will be maintained by not following through with its construction.
- 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; lizard management activities under the Wildlife Act will be required for both areas.
- 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 but for which WAA consideration is required for lizards.

In addition, resource consents will be required for land and lizard management activities to be implemented as part of the MP4 Project. These areas include:

- Approximately 1,500 ha of the wider Murphys Creek catchment, where MP4 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, of which 265 ha will form part of the MP4 Project compensation package for lizards.

For already consented areas (Table 2.2), the ecological effects on lizards have already been considered and addressed elsewhere, and the consents authorising construction, operation, and maintenance of these areas may be implemented at any time prior to their expiry. However, OGNZL does not currently hold WAAs authorising management of lizards within these disturbance areas (Table 2.2).

Accordingly, these consented areas have been included within the survey scope of this Lizard Values Assessment, to ensure a comprehensive understanding of lizard distribution, abundance, and habitat values across the wider MP4 landscape. However, they have been excluded from the ecological value assessments used to inform the Ecological Impact Assessment for the MP4 Fast-track application. Instead, the lizard survey data collected from these areas has been used to inform preparation of a Lizard Management and Monitoring Plan (LMMP; Bioresearches 2026j) and the associated WAA applications required to authorise lizard management for these already consented projects.

Table 2.1. MP4 Project Areas, showing the extent of the Area footprint, the extent of suitable lizard 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 lizard habitat			Indirectly affected lizard 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
Fraser's 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 lizards 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.

Table 2.2. MP4 Project Areas and associated project components, including existing resource consent and Wildlife Act Authority status.

Coronation Mining Area	Resource Consent status	Wildlife Act Authority status
• Coronation Pit Extension (Stage 5) (CO5)	Consented	Required*
• Coronation North Pit Extension (Stage 6) (CN6)	Consent required	Required
• Coronation Pit Extension (Stages 6-8) (CO6-8)	Consent required	Required
• Trimbells Waste Rock Stack Height Raise and Extension (TRWRS)	Consent required	Required
• Coronation North Waste Rock Stack Height Raise (CNWRS)	Consent required	Required
• Coronation Waste Rock Stack (COWRS)	Consented	Required
• Coronation Pit Backfill (COBF)	Consent required	Not required
• Coronation North Pit Backfill (CNBF)	Consent required	Not required
Golden Point Underground Extension		
• Proposed underground mine expansion.	Consent required	Not required
Central Mining Area		
• Innes Mills Pit Extension (Stages 11-13) (IM11-13)	Consent required	Required
• Frasers Tailings Storage Facility Stage 3 (FTSF3)	Consent required	Required
• Macraes Road Realignment Stage 1 (MRR1) and Macraes Road Realignment Stage 2 (MRR2)	Consent required	Required
• Frasers West Waste Rock Stack Height Raise (FWWRS)	Consent required	Required
• Innes Mills Backfill (IMBF)	Consent required	Not required
• Southern Pit Backfill (SPBF)	Consent required	Not required
• Golden Point Backfill (GPBF)	Consent required	Not required
• Mixed Tailings Impoundment (MTI)	Consent required	Required
• SP10 and SP11 Tailings Storage Facilities (SP10 and SP11)	Consent required	Required
Frasers West French Drain (FWFD)		
• French drain recovery system around the toe of the Frasers West Waste Rock Stack (FWWRS)	Consent required	Required
Golden Bar infrastructure corridor (Golden Bar haul road, GB HR)		
• Recommissioning the private haul road on OGNZL land that runs adjacent to Golden Bar Road and connects Golden Bar Pit to the wider Macraes Operation haul road network.	Consent required	Required
• Installing a pipeline and pump stations within the Golden Bar infrastructure corridor.	Consent required	Required

Establishing an ore stockpiling and loading area in GBWRS.	Consent required	Required
Golden Bar Mining Area		
Golden Bar Pit Extension (Stages 2-3) (GB2-3)	Consent required	Required
Golden Bar Waste Rock Stack Extension (GBWRS)	Consent required	Required
Back Road Waste Rock Stack (BRWRS)		
OGNZL to surrender all Regional Council resource consents that provide for the construction of the BRWRS as part of the MP4 Project.	Consented	Not required
Camp Creek		
Constructing the already consented Camp Creek water storage dams and other water management infrastructure.	Consented	Required
Coal Creek		
Constructing the already consented Coal Creek water storage dams and other water management infrastructure.	Consented	Required
Murphys Ecological Enhancement Area (MEEA)		
Establishment of the MEEA, including constructing an all-weather access track from the public roading network, including culverts or fords at river crossings; construction of a mammal exclusion fence and other fences; fence maintenance tracks and culverts at the points where the mammal exclusion fence crosses major drainage gullies; and construction of a site office, equipment sheds and park-up area.	Consent required	Required

* OGNZL currently holds a WAA that permits the killing of wildlife associated with mining development at Coronation. While this existing WAA could technically be applied to the CO5 component of MP4, OGNZL will instead take the more responsible approach of obtaining a new authorisation through the MP4 FTAA process specifically to salvage and relocate lizards.

3 Methods

The methods used to identify and value lizard species and lizard communities of the MP4 Project area can be categorised in four broad stages:

1. Literature review and desktop assessment;
2. Lizard field surveys;
3. Habitat mapping and habitat suitability assessments;
4. Assignment of ecological value and significance, under the EIANZ EcIA guidelines and policy frameworks, respectively.

3.1 Survey areas

Lizard surveys were undertaken across OGNZL Macraes landholdings, including areas within the proposed MP4 Project impact footprint, surrounding buffer zones, and the Murphys Creek catchment between 2 April 2022 and 30 March 2026.

Additional surveys were conducted at the Mt. Highlay forestry plantation, north of Coronation, in March 2026 to assess the presence and relative abundance of lizards at this potential mitigation site.

Given that common lizard species are widespread across OGNZL Macraes landholdings, individual project components have been grouped and assessed collectively as Mining Areas, using the terminology outlined in Table 2.1 and Table 2.2.

3.2 Literature review and desktop assessment

To investigate the diversity and distribution of lizards within Project area and surrounding landscape, a desktop assessment involving a review of all available herpetological records held in governmental organisation, citizen science, and private databases was undertaken. Databases reviewed included the Department of Conservation (DOC) Bioweb Herpetofauna database (accessed December 2025), iNaturalistNZ (<https://inaturalist.nz/>)¹, information extracted from unpublished technical reports commissioned by OceanaGold (between 1986 and 2026), and lizard records held in Bioresearches internal lizard record database.

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]).

3.3 Lizard surveys

3.3.1 Systematic searches

Systematic searches, also known as visual encounter searches (VES) (Whitaker 1994; Lettink & Hare 2016), were undertaken by herpetologists² (D. van Winkel, T. Harker) and other experienced ecologists during numerous site visits between April 2022 and March 2026. Systematic searches were used to collect information on lizard presence and relative abundance using catch-per-unit-effort indices (e.g., lizards/ person search hour). Systematic searches are extensively used for surveying New Zealand lizards (Lettink & Monks, 2016; Lettink & Hare, 2016) and this technique offered a relatively effective and time efficient method for determining species presence and relative abundance across large spatial areas.

Searching involved systematically moving through survey areas and visually searching and/ or hand searching habitats for lizards. Search times, search routes, and observations were recorded on GPS units (GARMIN GPSMAP® 64sx). Lizard sign (i.e., scat, sloughed skin) was also recorded where found.

Specifically, the following methods were used.

3.3.1.1 Rock-scanning and rock crevice searches

Tors and rock piles were sought out in the landscape, and a standardised rock-scanning method was used to search for lizards (Patterson 1992). First, the observer stood stationary 10 m away from the rock surface and used binoculars to scan the rock feature from left to right, top to bottom. If no lizard was seen, the observer then moved five metres forward and scanned once more with binoculars. If still no lizard was seen, the observer then moved right up to the rock and thoroughly searched each surface and rock crevice, often aided by a torch. In addition to rock tors, areas supporting complex native shrubland were also searched using this technique, primarily to detect sun-basking lizards (including arboreal jewelled geckos) amidst the dense foliage.

3.3.1.2 Habitat searches

Habitat searches entailed physically searching features in the landscape (e.g., rocks, woody debris, rock slabs) by lifting or moving them aside to reveal inactive refuging lizards. All habitat features were carefully lifted to not harm occupants, and all features were replaced in the same position in which they were found. If lizards were captured from beneath refuges, they were carefully released back under the same refuge from which they were caught after the refuge was repositioned.

3.3.1.3 Opportunistic visual encounters

Opportunistic visual searches were undertaken while walking through the landscape and all encounters of disturbed, fleeing, and sun-basking lizards were noted.

Searches were carried out during the daytime, typically between 0900 hrs and 1800 hrs. Nocturnal searching was not undertaken as all lizard species known or expected to occur in the MP4 Project area could reliably be detected during diurnal searches.

² Herpetologist = specialist on reptiles and amphibians.

In some instances, systematic search data were standardised to catch per unit effort (CPUE) metrics, by correcting for person search effort. This metric was not consistently recorded for all searches or all search areas but where recorded, CPUE has been reported.

Areas of the MP4 Project supporting operational mine workings (e.g., open pits, haul roads, etc.), which did not provide suitable habitat for lizards, were not searched for lizards during the survey.

3.3.2 Aerial drone surveys

Drones are increasingly used for wildlife surveys, including reptiles (Schofield *et al.* 2017, 2019; Aota *et al.* 2021; Monks *et al.* 2022; Dubos *et al.* 2023; Davidge *et al.* 2024). In New Zealand, they have been shown to safely and efficiently approach and photograph lizards across habitats such as shrubland, tussock grassland, and alpine scree, with little or no observable response until within a few metres (Monks *et al.* 2022; Davidge *et al.* 2024).

A drone was used to search for lizards in areas of difficult terrain, with the specific focus on targeting large, threatened, saxicolous (rock-dwelling) species such as Otago and grand skinks in complex habitat areas such as the Camp Creek and Murphys Creek catchments.

Surveys were undertaken in February 2026 by herpetologist Carey Knox, using a DJI Mavic 4 Pro drone, with a 100 MP Hasselblad 4/3 CMOS camera (zoom range: 1–6x optical and 6–24x digital). The zoom range allows high resolution photographs or video to be collected from a distance, with minimal disturbance to lizards.

The drone was flown at approximately 10–15 metres away from (and slightly above) rock surfaces. The camera scanned rock surfaces with the zoom partially extended on a downwards angle of 30–50° across rock surfaces. Attention was given to rock ledges with deep crevices or around rock plates where skinks can bask close to a suitable retreat site. Surveys were typically 20–80 minutes in duration and undertaken with the sun directly behind the camera, as skinks will often bask on the aspect directly facing the sun.

Flight paths were not recorded; however, the drone was operated within predetermined survey boundaries within Camp Creek and the Murphys Creek catchments to ensure adequate coverage of target areas.

3.3.3 Tracking tunnel and CritterPic® surveys

Tracking tunnels, CritterPic® devices, artificial cover objects (ACOs), and Gee's Minnow funnel traps were deployed at Camp Creek in late March 2026, in response to an observation of an Otago green skink on 10/03/2026 (see section 4.7.8.1 *Camp Creek* for more details).

Eleven tracking tunnels (*Black Trakka* design) baited with sweet lures (canned pear, banana, and/ or *The Natural Confectionery Co Juicy Bursts Strawberry & Raspberry* jubes) were installed surrounding

the sighting location and left active for 17 days. Tracking tunnels were inspected every day or every other day over this period.

Six CritterPic® devices, baited with canned pear, were installed in vegetation and alongside rock outcrops surrounding the sighting location. CritterPic® provides real-time monitoring of small cryptic species and pest species through instant image feeds via inbuilt cameras. The devices were left active in the field for seven days before the SD cards were removed and reviewed.

Twelve single-layered ACOs (400 mm x 475 mm corrugated *Onduline* sheets) were installed and inspected daily over 17 days between 13th to 30th March 2026. The *Onduline* material has heat-retention properties and thus provides instant artificial refuge and thermoregulatory benefits for lizards that shelter beneath them. Onduline ACOs are considered a standard practice tool for detecting and monitoring native lizards in New Zealand (Lettink & Hare 2016).

Six Gee's Minnow traps—live capture terrestrial funnel traps—were also installed at the site on 13 March 2026 to increase the probability of detecting Otago green skinks. The traps were baited with canned pears or *The Natural Confectionery Co Juicy Bursts Strawberry & Raspberry* jubes and left in the field but only for a single day due to high captures of mice, after which the traps were collected in.

3.3.4 Baseline lizard surveys

A landscape-scale baseline lizard survey was undertaken across the OGNZL landholdings (including within several of the MP4 Mining Areas) between the 15th and 23rd April 2026 to collect quantitative data on lizard population abundances. This information was subsequently used to estimate lizard population sizes to inform the lizard effects assessment.

It is emphasised that the baseline lizard surveys were specifically designed to target terrestrial skink species, as these could be effectively surveyed using standard methodologies and reliable survey tools (e.g., pitfall traps), enabling robust relative abundance estimates to be generated.

Species such as kōrero geckos, which primarily occupy rock crevices and other inaccessible refuges, could not be effectively surveyed using currently available standard survey techniques. As a result, reliable abundance estimates for this species could not be produced. Kōrero geckos are considered to comprise a relatively small proportion (< 5%) of the overall lizard assemblage within the landscape and therefore, were not considered to materially influence overall population abundance or density estimates.

Accordingly, while opportunistic captures and observations of kōrero geckos were recorded during the surveys, these records were excluded from the abundance modelling analyses.

The baseline survey was carried out in the following areas:

- Coronation (CO6 specifically),
- Golden Bar (GB2-3 and GBWRS),
- BRWRS, and

- Murphys Creek catchment and surrounding landscape.

A stratified random sampling regime was used to select locations for pitfall trap arrays that were installed at representative sites across the landscape. Sampling sites were selected by overlaying 20 m x 20 m grid squares on aerial maps and randomly selecting 30–40 grid squares in each representative survey area (Figure 3.1). A 20 m x 20 m grid was chosen as this encompassed the expected home range of target lizard species (i.e., estimated average home range size of 20 m² for McCann’s and southern grass skinks; Patterson 1985); therefore, ensuring each sampling site was spatially independent.

A total of 224 sampling sites were selected. At each sampling site, a pitfall trap (covered by an *Onduline* ACO) was installed. The pitfall traps were activated (cleared of vegetation and bait/ lure added) and inspected over nine consecutive days between 15/04/2023 and 23/04/2024. Daily lizard capture (and recapture) data were collected over this period.

Prior to implementing this programme, OGNZL commissioned an experienced biometrician (Dr. D. MacKenzie, Proteus Research and Consulting Ltd.) to review and validate the survey design to ensure it was appropriate, delivered the desired outputs, and had statistical rigour. This provided confidence in the methods prior to implementation.

The data collected was modelled using two different modelling approaches (N-mixture and capture-mark-recapture models) to generate estimate skink detection probabilities and relative abundance by qualified biostatisticians (MacKenzie & Bratt 2024). These data were subsequently converted to skink density estimates, with confidence limits, and were used to estimate the overall population size of skinks occupying each of MP4 Mining Areas.

3.3.4.1 N-mixture modelling (Repeated counts)

N-mixture models (Royle 2004) are a type of statistical model used primarily in ecology to estimate the abundance of a species in each area while accounting for imperfect detection. These provide estimates of how many individuals of a species are present, even though not all individuals may be detected during a survey.

The model uses repeated count data (i.e., number of skinks captured each night) from each trap location to estimate the expected number of skinks in the vicinity of each trap (i.e., ‘per trap’ metric) (MacKenzie & Bratt 2024). This estimate does not necessarily equate to an estimate of the unique number of individuals in the vicinity of a trap during the entire trapping session, but rather a measure of relative (cf. actual) abundance.

It also estimates a detection probability, which is the probability of detecting an individual during a survey. Detection probability is informed by the variability in the nightly counts at each trap, relative to the maximum count over all nights at the trap (noting that the total number of individuals may be greater than the maximum counted) (MacKenzie & Bratt 2024).

3.3.4.2 Capture-mark-recapture (CMR)

Capture-mark-recapture (CMR) is a popular and powerful method in ecology used to estimate population size, survival rates, and other demographic parameters of animal populations. It involves

capturing, marking, and releasing animals, then recapturing them later to gather data on the proportion of marked individuals in the population.

Mark-recapture methods utilise the information in the frequency of capture of individuals to estimate the probability of capture, and hence the number of individuals that were in the population but never captured during the trapping session. A closed-population model (Huggins-type) was used (i.e., assuming no births, deaths, immigration, or emigration during the study period) and this was a valid approach considering the nine-day consecutive trapping period and the late April sampling period, when lizard activity would have been reduced and recruitment completed for the season.

The estimate of abundance from the CMR represented an estimate of the unique number of individuals in the vicinity of all traps during the sampling session (cf. N-mixture models are at the scale of a single trap) (MacKenzie & Bratt 2024).

3.3.4.3 Skink density estimates from modelled data

Relative skink abundance values from the N-mixture modelling and CMR analyses (reported in MacKenzie & Bratt 2024) were converted to density estimates (skinks/ ha) to allow total population sizes within each Mining Area and across the entire MP4 Project footprint to be calculated. Since the two approaches describe slightly different abundance metrics (i.e., N-mixture models provide a “per trap” abundance metric whereas CMR provides an estimate of the unique number of individuals in the vicinity of all traps during the sampling session), different calculations were required to estimate population densities for each of the approaches.

A key consideration common to both approaches was the exposure of skinks within each population to the pitfall trapping technique, specifically the size of the area around each trap that is effectively being sampled for skinks (MacKenzie & Bratt 2024). To inform the effective trapping area, average home range sizes for McCann’s and southern grass skinks ($\bar{x} = 20.6 \text{ m}^2$ as reported by Patterson 1984, 1985) were applied to the areas surrounding each trap, which allowed density estimates for each representative area of the landscape and for each modelling approach to be calculated. To clearly demonstrate how the N-mixture model outputs were converted to estimate skink population sizes, an infographic has been provided as Appendix A.

It is important to note that these estimates of lizard abundance and density apply only to the two skink species (McCann’s skink and southern grass skink) that were detectable using pitfall traps. They do not include kōrero geckos, which are typically associated with rocky outcrops and are not reliably captured using pitfall traps.

3.4 Lizard population size estimation

Several methods were used to estimate lizard population sizes within the Mining Areas and MP4 Project area overall. Methods generally involved extrapolation of reported or measured lizard densities, or quantified densities from lizard salvages undertaken at other Macraes Mine sites over recent years.

Specifically, four broad methods were used, including:

- 1) N-mixture modelling estimated relative abundances and densities,
- 2) Capture-mark-recapture estimated relative abundances and densities,
- 3) Lizard density estimates reported in the literature from similar ecosystems or habitat types,
- 4) Observed lizard densities based on recovery salvage operations at Macraes Operation
 - a. Continuity Consents Project Innes Mills Stage 8 (CCP IM8),
 - b. Coronation North Stage 5 (CN5), and
 - c. Continuity Consents Project Stage 2 (CCP2).

Density estimates (skinks/ ha) were then extrapolated over areas of suitable lizard habitat within each of the MP4 Project Areas.

As lizard abundance is unlikely to be evenly distributed across habitats or across all MP4 Project Areas, population estimates derived from density extrapolations should be treated cautiously and regarded as approximate. Accordingly, these population estimates were used only as a guide and considered alongside other information when determining ecological values for lizards.

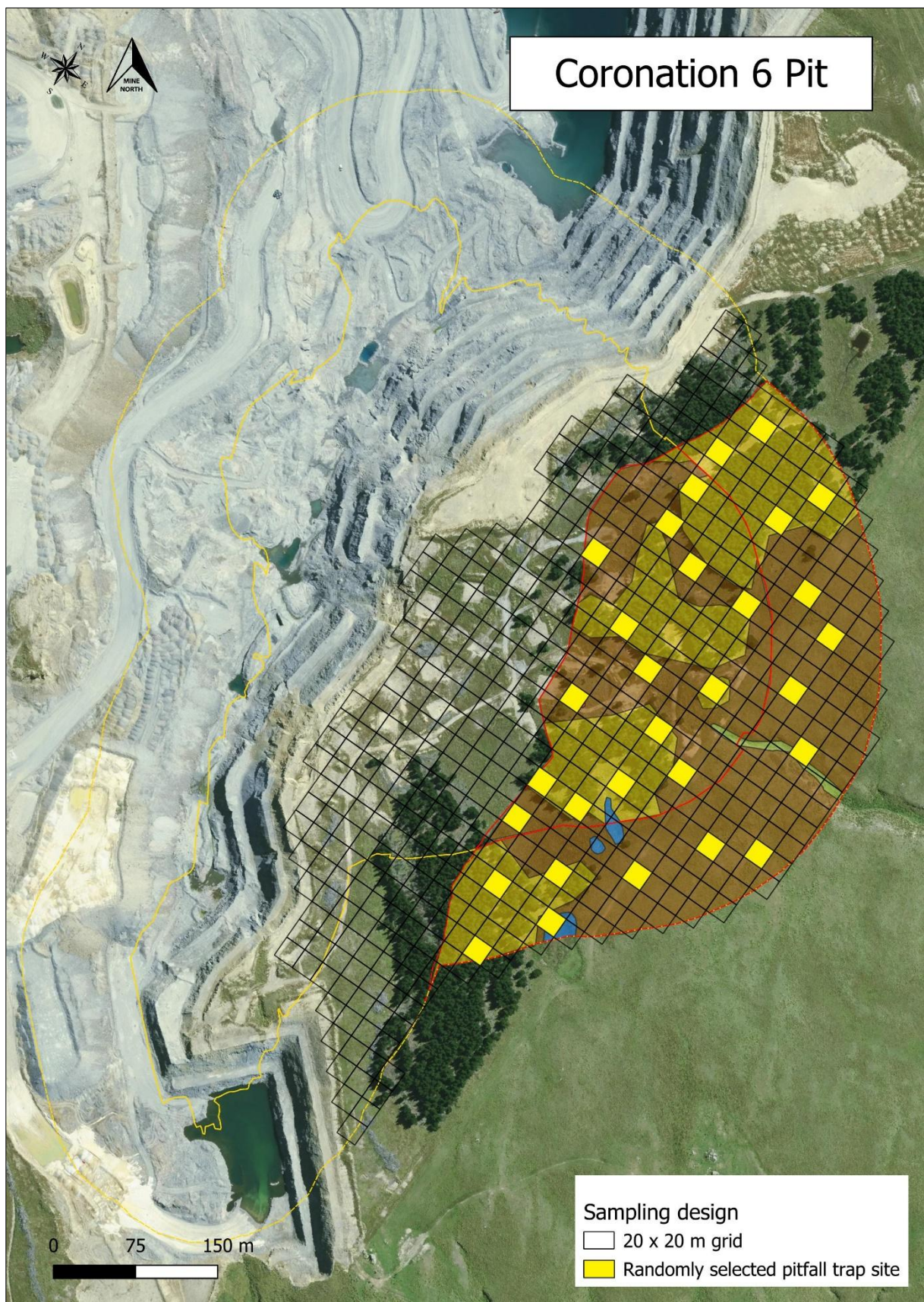


Figure 3.1. An example of random stratified sampling design for monitoring lizard populations at Coronation 6 Pit (CO6 Pit). Coronation 5 area is immediately west. NB the pine trees have now been felled and harvested.

3.5 Habitat mapping and suitability assessment

Ecosystem types, reflecting different vegetation and habitats, were identified and mapped as part of the wider ecological investigations for the MP4 Project. A total of twenty-two ecosystem types were identified (see Whirika 2026) and of these, 18 were considered to provide habitat for native lizards (Table 3.1).

To simplify the ecosystems, the 18 suitable lizard ecosystems were categorised into 12 broad habitat types and then pooled further into three broad habitat categories (tussock/ exotic grassland/ rock outcrops; shrubland; and other) (Table 3.1) which were used as part of the lizard populations estimate calculations (see Section 3.13 *Lizard population size estimates*). The areal extents (in hectares) of each lizard habitat were calculated.

The quality of each habitat type for native lizards was determined through a qualitative process that considered observations of lizards in specific habitats, habitat age and complexity, habitat availability relative to the surrounding landscape, and habitat irreplaceability. Habitats were ranked in order from highest to lowest quality for native lizards.

In addition, quantitative assessments of rock outcrop habitat and lizard occupancy were carried out. This was achieved by tallying the total number of discrete rock outcrops within each Mining Area based on ground-truthing and/ or high-definition aerial imagery. Lizard occupancy rates for rock outcrops were recorded in the field as far as practicable.

Table 3.1. Ecosystem types, as well as categorised broad and pooled lizard habitat types identified within the MP4 Project impact footprint, including within the 20 m surrounding buffer. Excludes BRWRS as this area is to be avoided, and excludes GPUG, where above ground impacts are not anticipated. Also excludes the broader 80 m buffer where only indirect effects may be realised.

	Ecosystem type	Broad lizard habitat category	Areal extent (ha)	Concentrated lizard habitat category	Areal extent (ha)
1	Rock	Rock outcrop	0.26	Tussock/ exotic grassland/ rock outcrop	231.9
2	Tussock – Dense	Tussock	90.0		
3	Tussock – Moderately Dense				
4	Exotic Grassland	Exotic grass	135.86		
5	Pine Forest (felled)	Felled pine	5.80	Shrubland	2.96
6	Shrubland	Shrubland	2.96		
7	Gorse	Woody exotic	1.27		
8	Woody Exotic				
9	Riparian	Riparian	1.28	Other	3.8
10	Riparian - Freshwater Herbaceous				
11	Riparian - Sedgeland				
12	Riparian - Shrubland				
13	Ephemeral wetland	Ephemeral wetland	1.29	Unsuitable habitat	86.51
14	Pine	Pine	1.19		
15	Wetland - Freshwater Herbaceous	Wetland	1.78		
16	Wetland - Sedgeland				
17	Wetland - Seepage				
18	Wetland - Shrubland				
19	Pond	Pond	0.35		
20	Built/ Disturbed	Existing mine/ disturbed ^A	83.19		
21	Mine – Disturbed				
22	Road				
	Total		325.2		325.2
	Total suitable lizard habitat		238.7		238.7

^A Existing mining/ disturbed areas are active mine workings or disturbance that do not offer any suitable habitat for lizards.

3.6 Lizard handling and Wildlife Act Authority

Lizard surveys, including capture and handling of lizards, were carried out by experienced and industry recognised herpetologists: Dylan van Winkel (16+ years' professional experience) and Timothy Harker (10+ years' professional experience), with support from practicing ecologists, supervised in the field by lead herpetologists. Lizard surveys, including lizard capture and handling, were undertaken under Wildlife Act Authority 37604-FAU granted to Bioresearches (Babbage Consultants) under named personnel Dylan van Winkel and Chris Wedding or other suitably qualified personnel under supervision of named personnel.

Specialist lizard drone surveys were carried out by herpetologist, Carey Knox (10+ years' professional experience), and a WAA was not required because no lizards were captured or handled during the drone surveys.

3.7 Ecological value and ecological significance assessments

Ecological values for lizard communities/ habitats and lizard 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 lizards 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 lizard communities/ habitats and individual species within each Project Area using a scale ranging from ‘Negligible’ to ‘Very High’.

- For lizard 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). Both the national New Zealand Threat Classification System (NZTCS; Hitchmough *et al.* 2026) and the Otago Regional Threat Classification System (RTCS; Jarvie *et al.* 2025) listings were considered. Where classifications differed, the highest threat category—whether national or regional—was chosen.

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 Lizard survey results

4.1 Literature review and desktop assessment

Lizards are a vital component of New Zealand's ecosystems, forming a unique and diverse assemblage with 148 species, making the country a global hotspot for lizard diversity. They play integral ecological roles as consumers of invertebrates and fruit, as prey for native birds, and as contributors to plant reproduction (Whitaker 1987a; Whitaker *et al.* 2002; Wotton *et al.* 2016).

The Otago Region stands out as a national hotspot for reptile diversity, currently supporting 31 lizard taxa, due in part to the nature of the schist rock, which tends to form horizontal crevices and large flat pancake-like stacks of rock slabs that provide habitat and refuge for lizards. Of the 31 taxa, 13 are geckos and 18 are skinks, with 97% classified as regionally 'Threatened' or 'At Risk' (Jarvie *et al.* 2025). Otago is a national stronghold for 24 of these taxa (over 20% of their national populations), and eight are regional endemics.

Seven lizard species are known to inhabit the 1.14 M hectare Macraes ED (Table 4.1). The area is particularly notable for supporting the largest populations of the rare grand (*Oligosoma grande*) and Otago (*Oligosoma ottagense*) skinks. The most common species are McCann's skink (*Oligosoma maccanni*), southern grass skink (*Oligosoma* aff. *polychroma* Clade 5), and kōrero gecko (*Woodworthia* "Otago large"), while herbfield skink (*Oligosoma murihiku*), Otago green skink (*Oligosoma* aff. *chloronoton* "eastern Otago"), and the previously mentioned Otago and grand skinks are much less common. Except for McCann's skink, all species are experiencing population declines regionally (Jarvie *et al.* 2025) and nationally (Hitchmough *et al.* 2026).

Currently, five lizard species are confirmed on OceanaGold landholdings—McCann's skink, southern grass skink, kōrero gecko, herbfield, and Otago skink—representing 71% of the species known from the Macraes ED. Grand skink is also likely present in remote rocky habitats. While survey efforts have targeted some areas, large portions of OGNZL's landholdings remain un-surveyed and may support additional species or populations. An eighth species, jewelled gecko (*Naultinus gemmeus*), has been recorded within 20 km of the OGNZL landholdings³; however, the presence of this species on the landholdings or in the Macraes ED is considered unlikely (Jewell & McQueen 2007).

Of the eight lizard taxa from the wider landscape, two are listed as 'Nationally Endangered', five as 'At Risk – Declining', and one as 'Not Threatened' under the New Zealand Threat Classification System (Townsend *et al.* 2008; Rolfe *et al.* 2022; Hitchmough *et al.* 2026) (Table 4.1).

Of note, is that the land on which the Department of Conservation Grand and Otago Skink (GAOS) Recovery Programme is located, fell within the 20 km radius zone and as a result some of the lizard records (e.g., Otago green skink, *Oligosoma* aff. *chloronoton* "eastern Otago") are from within the mammalian predator exclusion fences established to assist in the recovery of threatened lizards.

³ The 20 km radius extends outside of the Macraes ED to the north and captures records of *N. gemmeus* hence the eight lizard taxa, compared to seven recorded within the Macraes ED.

All native reptiles (including all lizards) are legally protected under the Wildlife Act 1953 (and subsequent amendments) and significant habitats⁴ of indigenous fauna (including lizards) are protected under Section 6(c) of the Resource Management Act 1991. Resource Management Act protections are covered by significance criteria in relevant regional and district plans. These protection measures do not extend to introduced and naturalised herpetofauna (reptile and amphibian) species (e.g., plague skink, *Lampropholis delicata*; introduced Australian frogs).

Lizard investigations have long formed part of ecological work undertaken at Macraes Mine. A considerable body of lizard-focused research and monitoring has been conducted across the mine area over the past four decades. This work has included numerous surveys and, in some cases, salvage and relocation programmes associated with resource consent applications for mine expansion.

Lizard salvage-relocation operations undertaken between 2012 and 2026 include the Macraes Phase III Project (2012; Knox & Bell 2013), Deepdell North III Project (2020/2021; Thorsen 2019; Tocher 2021), Continuity Consents Innes Mills 8 Project (2024; van Winkel 2025), Coronation North 5 Project (2025; van Winkel 2026), and Continuity Consents Phase 2 Project (2026; Bioresearches 2026q).

These relocation programmes have generated valuable information on the diversity and density of lizards across extensive areas of the landholdings. Salvage operations typically involve intensive searches and habitat disturbance within development areas, which provides a detailed understanding of the lizard communities present. Across these programmes, four lizard taxa have been recorded: kōrero gecko, McCann's skink, southern grass skink, and herbfield skink. Notably, large skink species (e.g., grand skink, Otago skink, and Otago green skink) have not been recorded in areas subject to the more recent mine expansions⁵.

4.1.1 BRWRS lizard survey

A detailed survey of BRWRS and unnamed tributaries of Deepdell Creek was undertaken by Tocher (2022) between March and April 2022. The survey was commissioned as part of the previous MP4 RMA Project; however, the results remain relevant as the BRWRS site and its habitats have not been disturbed since the survey. Accordingly, the information collected is considered applicable to the Project.

Surveys involved systematic searches for active lizards, searches of retreat sites (e.g., under rocks and in rock crevices in rock outcrops) for both live individuals and their sign (faecal material or sloughed skins of geckos), vantage point surveys and rock outcrop scanning for actively basking lizards and searching areas of shrubland for arboreal geckos such as jewelled gecko. In addition, Gee's Minnow (funnel) trapping targeted 63 locations over five days, primarily in lush grassland and Gaultheria (*G. antipoda* and *G. macrostigma*)-dominated habitats favoured by herbfield and Otago green skinks.

⁴ The term 'significant' is not defined by the RMA but for the purpose of this assessment, "significant habitats" has been interpreted as habitat that provides all the necessary needs for persistence of lizard populations in an environment (i.e., food, shelter, areas for reproduction). It is weighted more heavily towards habitats for 'Threatened' or 'At Risk' species.

⁵ Mummified remains of grand skinks and Otago skinks were recovered from large rock outcrops during the Deepdell North III and CN5 lizard salvage operations, respectively. In both instances, the mummified remains were assessed as being very old, indicating the historical presence of these species in the mining areas.

Surveys were conducted in generally warm (15–20 °C), sunny conditions conducive to lizard activity. Three species were confirmed as widespread and abundant across the surveyed areas. McCann's skink was the most numerous and broadly distributed species, frequently observed during systematic searches and captured in funnel traps at roughly twice the rate of southern grass skink.

Kōrero geckos were found to be numerous in rocky habitats, often occurring in high densities beneath single slabs and within crevices. It was noted that kōrero gecko surveys typically underestimate true gecko abundance due to the difficulties in detecting all geckos in deep crevices.

Southern grass skinks were common but more effectively detected through funnel trapping due to dense grass cover limiting visual detection during systematic searches.

No herbfield, Otago green, or grand skinks, nor jewelled geckos, were detected despite targeted searches and trapping in suitable habitats.

Historical records and regional observations suggest these species may have occurred in the wider catchment, but no contemporary evidence was found within the surveyed BRWRS gullies.

A habitat assessment showed strong contrasts between northeast-facing (drier, more pasture-dominated) and southwest-facing (tussock- and shrubland-dominated) slopes, with extensive high-quality rock outcrops, especially in the two eastern-most gullies, providing abundant creviced (horizontally fissured) and sun exposed rock faces favoured by kōrero geckos.

Overall, the findings indicate that the BRWRS gullies support high lizard abundance and high-quality habitat for McCann's skink, southern grass skink, and kōrero gecko, with rocky outcrops representing key habitat features.

Table 4.1. Herpetofauna of the Macraes Ecological District, corresponding National (Hitchmough *et al.* 2026) and Regional threat statuses (Jarvie *et al.* 2025), status (✓ = recorded; x = not recorded) within 20 km of MP4 Project area and in the Macraes ED, as well as date of most recent record on OGNZL Macraes landholdings.

	Common name	Scientific name	National threat status	Regional threat status	Recorded in Macraes ED	Reported within 20 km	Date of most recent landholdings record
Native	Otago skink	<i>Oligosoma otagense</i>	Threatened – Nationally Increasing	Regionally Threatened - Regionally Endangered	✓	✓	2026
	Grand skink	<i>Oligosoma grande</i>	Threatened – Nationally Increasing	Regionally Threatened - Regionally Endangered	✓	✓	2023 ^A
	Korero gecko	<i>Woodworthia</i> “Otago/ Southland large”	At Risk – Declining	Regionally At Risk – Regionally Declining	✓	✓	2026
	Jewelled gecko	<i>Naultinus gemmeus</i>	At Risk – Declining	Regionally At Risk – Regionally Declining	?	✓	N/A ^B
	Southern grass skink	<i>Oligosoma chionocholescens</i>	At Risk – Declining	Regionally At Risk – Regionally Declining	✓	✓	2026
	Herbfield skink	<i>Oligosoma murihiku</i>	At Risk – Declining	Regionally At Risk – Regionally Declining	✓	✓	2013 ^C
	Otago green skink	<i>Oligosoma</i> aff. <i>chloronoton</i> “eastern Otago”	At Risk – Declining	Regionally At Risk – Regionally Declining	✓	✓	2026 ^D
	McCann’s skink	<i>Oligosoma maccanni</i>	Not Threatened	Regionally Not Threatened	✓	✓	2026
Exotic	Whistling tree frog	<i>Rawlinsonia ewingii</i>	Introduced & Naturalised	Not assessed	✓	✓	2026

^A In December 2023, two grand skinks (a juvenile and an adult) were observed on rock tors in the proposed Redbank Ecological Covenant on OceanaGold landholdings, approximately 6.5 km west of GB WRS and 4.5 km southwest of IM9 Pit (L. Sherwood, Ahikā Consulting; pers. obs., 01/12/2023).

^B Single record from 2019 from Waianakarua Scenic Reserve, located north of Shag River and approximately 17.5 km northeast of MP4 Project area.

^C Bovill’s (2018) record was subsequently considered dubious by Thorsen (2019) due to the habitat being anomalous for this species and potential misidentification.

^D In January 2023, a tracking tunnel print believed to be from an Otago green skink was recorded in the base of a valley in Deepdell Station Ecology Covenant, approximately 5.6 km due west of Coronation (M. Tocher, unpub. data). This record was verified in 2024 by the observation of a live Otago green skink close to the location of the tracking tunnel that recorded the print (M. Tocher, pers. comm. 31/01/2024). Then, in 2026, an Otago green skink was observed basking on a rock in the Camp Creek area (M. Scarrott, pers. comm. 10/03/2026).

4.2 Overall lizard survey effort

Targeted lizard surveys were carried out across the MP4 Project area between April 2022 and March 2026.

In general, surveys were conducted on days with temperatures ranging from 15–20°C, and typically during sunny or partly cloudy conditions, though some systematic searches that included rock flipping and crevice searches were undertaken on overcast days and rarely on days with some precipitation.

The following search effort targeting lizards was invested:

- 515.2 person hours of systematic searches
- 14 aerial drone search hours
- 187 tracking tunnel days
- 204 ACO inspections
- 6 Gee's Minnow trap days
- 65 CritterPic® survey days
- 2,016 pitfall trap days

Details of the survey effort is shown in Table 4.2. The results of each survey method and further information on the lizard communities and habitat values within each of the MP4 Project Areas are outlined in the relevant sections below.

Maps showing the locations of the lizard survey areas, including search routes, and lizard locations are presented in Appendix C.

Table 4.2. Summary of lizard survey areas, methods, and survey effort invested between April 2022 and March 2026.

Date	Survey area	Survey method	Search hours/ search effort
02/04/2022 – 04/04/2022	Coronation, Golden Bar	Systematic searches	20
18/04/2022 – 20/04/2022	Murphys Creek landscape, Murphys Creek.	Systematic searches	22
15/04/2024 – 23/04/2024	Coronation, Golden Bar, BRWRS, Murphys Creek, Murphys Creek landscape.	Pitfall trapping and 9-day mark recapture (baseline monitoring)	2,016 trap days
19/02/2026	Murphys Creek landscape	Aerial drone survey	4
24/02/2026	Camp Creek	Aerial drone survey	4.7
24/02/2026	Murphys Creek	Systematic searches	5.25
25/02/2026	Murphys Creek	Systematic searches	5
26/02/2026	Trimbells (Coronation)	Systematic searches	3.5
27/02/2026	Camp Creek	Systematic searches	4.2
05/03/2026	Murphys Creek landscape	Aerial drone survey	5.3
10/03/2026	Camp Creek	Systematic searches	14
11/03/2026	Murphys Creek	Systematic searches	9
12/03/2026	Coal Creek	Systematic searches	15
13/03/2026 – 30/03/2026	Camp Creek	Tracking tunnel survey	187 tracking tunnel days
13/03/2026 – 30/03/2026	Camp Creek	ACO survey	204 ACO inspections
13/03/2026 – 14/03/2026	Camp Creek	Gee's Minnow trap surveys	6 trap days
13/03/2026	Golden Bar Haul Road	Systematic searches	3
13/03/2026	GPUG	Systematic searches	22.5
14/03/2026	GPUG	Systematic searches	5
15/03/2026	BRWRS	Systematic searches	2
17/03/2026	Innes Mills	Systematic searches	3
17/03/2026	Murphys Creek	Systematic searches	6
19/03/2026	Mt Highlay Station	Systematic searches	6
20/03/2026	Mt Highlay Station	Systematic searches	2.5
20/03/2026	Murphys Creek	Systematic searches	3.25
23/03/2026 – 30/03/2026	Camp Creek	CritterPic surveys	42 CritterPic days
24/03/2026 – 30/03/2026	BRWRS	CritterPic surveys	18 CritterPic days
25/03/2026 – 30/03/2026	Murphys Creek landscape	CritterPic survey	5 CritterPic days

4.3 Systematic searches

Several hundred lizards, comprising three species (McCann's skink, southern grass skink, and kōrero gecko), were observed during systematic searches of the MP4 impact areas. In addition, 10+ individual, introduced and naturalised whistling tree (*Litoria ewingii*) frogs were detected.

Search routes and lizard records are presented in Appendix C. Note that not all observations were recorded or mapped due to the high number of detections; therefore, mapped locations indicate general distribution patterns rather than lizard density or abundance.

4.3.1 MP4 Project Area

Native lizards were recorded in all the MP4 Mining Areas; however, lizard diversity and abundance varied markedly across the project areas. The Coronation and Golden Bar Mining Areas, as well as BRWRS had the highest abundance of lizards. Areas supporting tussock, dense exotic grassland, and rocky features (e.g., rock piles, rock outcrops) had the highest abundance of lizards, whereas lizards were much less common in riparian margins, ephemeral wetlands, and in grazed pasture areas. McCann's skinks were the most encountered lizard in all habitat types—though they were more common in rocky and disturbed habitats. Southern grass skinks were more readily seen in tussock and grassland habitats, and in damper areas such seeps and the heads of gullies.

Kōrero geckos were found almost exclusively in association with rocky features such as outcrops and talus slopes, particularly along the margins of WRSs and roads. Individuals and their sign (scats or droppings) were detected by searching cracks and crevices within rock outcrops and by lifting rock slabs. No kōrero geckos were observed in tussock clumps or open grassland. Instead, they were associated with shrubland and with tussock areas where rocks or small rock piles were interspersed, especially where prostrate vegetation (e.g. *Muehlenbeckia* or *Coprosma* spp.) grew over or against the rocks, providing suitable habitat.

No large or threatened lizard species (Otago green skink, grand skink, or Otago skink) were recorded in areas that will be directly impacted by the MP4 Project. Herbfield skinks and jewelled geckos were also not detected, despite targeted searches for these species.

A targeted survey effort was undertaken to locate lizards within the GPUG area, including sites directly above the existing consented underground mine and within the proposed GPUG extension area. Three species (McCann's skink, southern grass skink, and kōrero gecko) were recorded in high abundance across both areas.

Surveys above the existing underground mine were conducted to assess whether lizard diversity and abundance differed in areas potentially subject to indirect mining effects, such as vibration from underground blasting, ground subsidence, and dewatering impacts. Lizard detection rates (number of lizards observed per person hour) were similar between areas above the existing GPUG footprint and those within the proposed expansion area, at 2.4 and 2.7 lizards per person hour, respectively. No discernible differences in species diversity or abundance were detected between these areas.

4.3.2 Murphys Creek

Systematic searches within the Murphys Creek catchment detected the presence of a small remnant population of Otago skinks. At least 10 individual Otago skinks were sighted on rock outcrops over a period of 5.25 hours (1.9 skinks/ person search hour) on 24/02/2026. This population is located well outside the MP4 Project impact areas and was detected during surveys of potential mitigation sites.

4.3.3 Camp Creek and Coal Creek

Lizard surveys conducted in the Camp and Coal Creek dam footprints were primarily for the purpose of informing the WAA process, as these sites are already consented.

Searches carried out across the Camp Creek dam footprint detected the presence of three lizard species—McCann’s skink, southern grass skink, and kōrero gecko. Rock outcrops were targeted to search for the large saxicolous (rock-dwelling) grand and Otago skinks, but none were observed. Approximately 18.5 hrs of systematic searching was undertaken with a lizard detection rate of 3.5 lizards/ person hour. A single suspected Otago green skink was opportunistically observed in the dense vegetation below a large rock outcrop in the northern part of the site. This observation was followed up with intensive survey efforts over the remainder of March 2026 (see Table 4.2 and Section 3.5 Tracking tunnel and CritterPic® results), though no further individuals were found.

At the Coal Creek dam footprint, approximately 15 systematic search hours were invested, resulting in the detection of three lizard species—McCann’s skink, southern grass skink, and kōrero gecko. Like Camp Creek, search efforts were targeted at rocky outcrops to find grand and Otago skinks, but none were observed.

Both Camp Creek and Coal Creek support extensive areas of high quality habitat for lizards and the three common lizard species all occur in high abundance.

4.3.4 Mt Highlay Station

Searches carried out across the Mt Highlay Station pine plantation detected the presence of three lizard species—McCann’s skink, southern grass skink, and kōrero gecko. Approximately 8.5 hrs of systematic searching was undertaken with a lizard detection rate of 5.6 lizards/ person hour. In 2023, approximately 265 ha of the site was planted in Douglas fir, *Pinus radiata*, and hybrid pine (*P. radiata* × *P. attenuata*) (Forbes 2025) as an afforestation project. Although the site has a history of repeated burning and spraying, there is ample exotic dominated vegetation to provide habitat for lizards and there are numerous large schist rock outcrops, which are providing important refugia for kōrero geckos.

Under the current land management regime, the plantation is expected to develop into a closed-canopy forest over a 20–25 year period. As the canopy matures, increased shading will substantially alter the understory vegetation and associated faunal communities. The skink species present are strongly heliothermic, relying on sun exposure for thermoregulation, and are therefore, unlikely to persist under dense canopy conditions. Similarly, shading of the rock outcrops over time will degrade the habitat quality for kōrero geckos, which often emerge from rock crevices to bask in the sun. Consequently, continued plantation growth would likely result in the progressive loss of existing lizard populations across the 265 ha site. The populations located here are well outside the MP4 Project impact areas and were detected during surveys of potential mitigation sites.

4.4 Drone survey results

On the 19 February 2026, six drone surveys were undertaken in the Murphy's Creek area around the locations where two Otago skinks were recorded on a survey in 2014 (Knox & Herbert 2014). Eight McCann's skink and one korero gecko were recorded (Table 4.3; Figure 4.1). Otago skinks were not seen but weather conditions were considered marginal for their emergence.

On the 24 February 2026, seven drone surveys were undertaken at Camp Creek, which resulted in the detection of three McCann's skinks (Table 4.3).

On 5 March 2026, a total of eight drone surveys were conducted at Murphy's Creek, six of which were undertaken within the area proposed to be enclosed by a mammal exclusion fence. Two Otago skinks were detected on rock outcrops near to the 2014 location on the south-west facing side of the main creek (Figure 4.2). In addition, 15 McCann's skinks were also sighted.

Table 4.3. Aerial drone survey results from Camp Creek and Murphys Creek between 19/02/2026 and 05/03/2026.

			Species			
Date	Flight no.	Flight time (mins)	McCann's skink	Kōrero gecko	Otago skink	Obs. rate (lizards/hr)
Murphys Creek						
19/02/2026	1	40	-	-	-	-
19/02/2026	2	80	5	1	-	4.5
19/02/2026	3	40	1	-	-	1.5
19/02/2026	4	40	1	-	-	1.5
19/02/2026	5	40	1	-	-	1.5
05/03/2026	1	60	2	-	2	4
05/03/2026	2	20	1	-	-	3
05/03/2026	3	40	2	-	-	3
05/03/2026	4	40	3	-	-	4.5
05/03/2026	5	40	1	-	-	1.5
05/03/2026	6	20	-	-	-	-
05/03/2026	7	80	3	-	-	2.3
05/03/2026	8	20	3	-	-	9
		560	23	1	2	2.8
Camp Creek						
24/02/2026	1	40	-	-	-	-
24/02/2026	2	60	1	-	-	1
24/02/2026	3	40	-	-	-	-
24/02/2026	4	40	1	-	-	1.5
24/02/2026	5	20	-	-	-	-
24/02/2026	6	80	1	-	-	0.75
		280	3	0	0	0.64

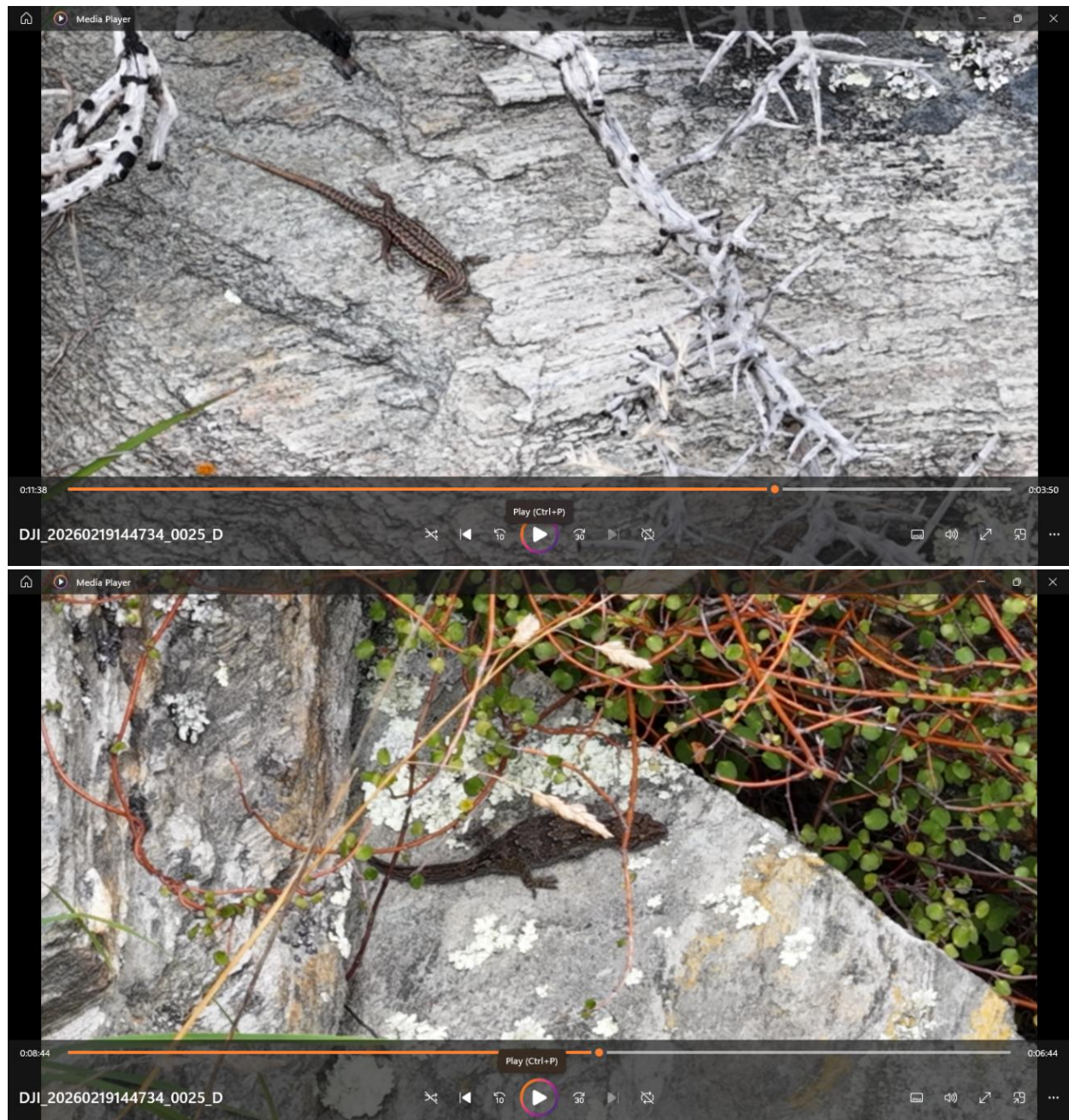


Figure 4.1. Examples of lizards filmed using an aerial drone. Upper image: McCann's skink; Lower image: kōrero gecko. Image credit: Carey Knox.



Figure 4.2. Adult Otago skink detected and filmed at Murphys Creek using an aerial drone. Image credit: Carey Knox.

4.5 Tracking tunnel and CritterPic® results

Surveys targeting lizards in the Camp Creek catchment using tracking tunnels, ACOs, Gee's Minnow funnel traps, and CritterPic® devices only confirmed the presence of one lizard species, McCann's skink, despite the relatively high survey effort over a relatively small area (0.2 ha). Summary of the survey effort and results are shown in Table 4.4.

Table 4.4. Summary of survey effort and results from Camp Creek between 13/03/2026 and 30/03/2026.

Device	Survey effort	Results
Tracking tunnel	187 tracking tunnel days	Skink (likely McCann's skink) footprints
Artificial Cover Object (ACO)	204 ACO inspections	Several McCann's skinks
Gee's minnow funnel trap	6 trap days	Several mice•
CritterPic®	65 CritterPic® days	Possums only

• note: the traps were removed after the first trapping day due to the high numbers of mice caught inside the traps and the potential risk of lizard predation by mice inside the traps.

4.6 Baseline lizard survey results

The landscape scale baseline lizard survey detected three species of lizard (McCann's skink, southern grass skink, and kōrero gecko).

A total of 202 individual lizards and 19 recaptures were recorded over the nine-day survey period. McCann's skinks were the most detected species, with 153 individuals captured, followed by southern

grass skinks, with 47 individuals captured. Kōrero geckos detected at only two sites, with one individual recorded in Murphys Creek and one individual recorded in Murphys landscape.

This low detection rate was unsurprising, given that the pitfall trapping methodology was not specifically designed to target kōrero geckos. In addition, most traps were established away from rock outcrops, which is the preferred habitat of kōrero geckos. It is re-emphasised that the baseline lizard surveys were specifically designed to target terrestrial skink species rather than kōrero geckos (see section 2.3.4 Baseline lizard surveys for more detail).

4.6.1 N-mixture modelling results

- There was strong evidence for the expected abundance of lizards (λ) to differ between sites, with BRWRS and Murphys landscape having the most abundant populations of lizards.
- Some evidence was found for variation in relative abundance between habitats, but this result was not overly strong.
- Tussock habitats in the MEEA and Murphys landscape showed the highest expected abundances of lizards, emphasising the importance of this habitat type for lizards.
- Detection probabilities were typically low and varied between surveys (i.e., daily trap inspections) ranging from 0.02–0.24, and thus abundance estimates may be underestimated.

4.6.2 Capture-Mark-Recapture modelling results

- There was strong evidence for lizard capture probability varying between surveys. This may have been a result of disturbance effects of repeated checks of pitfall traps and/ or weather related factors.
- Detection probabilities were very low and varied between surveys (i.e., daily trap inspections) ranging from 0.00–0.06. This suggests that a very small proportion of skinks in the vicinity of the pitfall traps were getting caught each survey occasion and thus abundance estimates are likely to be underestimated.

There was a high-level of correlation between the N-mixture λ estimates and mark-recapture abundance estimates suggesting that both statistical approaches yield similar inferences about relative abundance among populations.

4.6.3 Estimated lizard density

Lizard densities were estimated based on:

- 1) Abundance estimates from N-mixture and CMR abundance estimates, and
- 2) Literature-based and observed lizard density estimates from similar ecosystems or habitat types.

4.6.3.1 Modelled lizard density estimates

Based on the relative abundance estimates from the N-mixture and CMR models, skink density estimates were generated for each of the surveyed areas. These estimates are shown in Table 4.5.

Table 4.5. Skink density estimates for each of the surveyed areas, based on N-mixture and Capture-Mark-Recapture modelling. Kōrero gecko densities and population size not shown due to unavailable data.

Survey area	N-mixture: Density (skinks/ ha) estimate range	CMR: Density (skinks/ ha) estimate range
Coronation Mining Area	24 – 262	110 – 742
Golden Bar Pit	368 – 1,073	1,194 – 3,231
Golden Bar WRS	135 – 451	661 – 1,979
BRWRS	631 – 1,694	2,712 – 6,500
MEEA	291 – 757	1,241 – 3,278
Murphys landscape	490 – 1,126	2,133 – 5,252

In interpreting the population estimates, the following factors need to be considered.

- The N-mixture models revealed variation in the estimated relative abundance of skinks across different habitat types (e.g., exotic grass, shrubland, tussock, other), with relative abundance typically highest in tussock grassland habitat. In calculating skink population size in the survey areas, habitat variation was not considered for simplicity but rather the average skink relative abundance across all habitats was used. Therefore, the population estimates may be overinflated in some areas where tussock represents only a small component of the overall habitat, or where tussock is absent altogether.
- Environmental covariates (e.g., windspeed, relative humidity, habitat type) and survey day (time) explained some of the temporal variation in skink detection, but there was additional temporal variation in both models that remained unexplained.
- Estimates of abundance from the CMR results are likely to be an underestimate of the total number of skinks in each survey area due to the low trap density. CMR methods rely on lizards being available to be caught in more than one trap and because of the low density of traps in the survey areas (i.e., less than one trap per skink home range⁶), 'gaps' in the trapping coverage are likely, meaning estimates will be underestimated.
- Lizard detection/ capture probabilities calculated from the CMR and N-mixture models were exceptionally low (0–0.24), and capture probability decreased markedly over the nine-day trapping period. This suggests that a very small fraction of skinks in the vicinity of a pitfall trap were caught each survey occasion.
- Extrapolating averaged skink densities from CMR and N-mixture methods across the survey areas to estimate lizard population sizes is a relatively rudimentary technique and is subject to several assumptions. The most important being that it assumes a uniform distribution of lizards across all affected habitat types and survey areas, and that lizard detection probability is relatively high. It

⁶ The low trap density was intentional and a function of the study design, which primarily focused on N-mixture models. N-mixture models require independence between sampling units (e.g., pitfall traps).

is clear from the results that these assumptions do not hold true; thus, population size could be over- or underestimated.

- The population estimate methods did not include kōrero geckos (a species confirmed to be present in at least two survey areas), nor did they include other species of skink that have not been recorded in the impact area but could potentially be present in low numbers (e.g., herbfield, grand, Otago, and Otago green skink). Based on direct observations (relative abundance) of kōrero geckos and availability of gecko habitat in some of the survey areas (D. van Winkel, pers. obs.), it is estimated that the total lizard population (skinks and geckos) could be approximately 2–5% higher than those reported. With respect to other skinks, if present, the numbers are expected to be very low and the reported lizard population estimates are unlikely to noticeably change given the confidence intervals surrounding the population size.

4.6.3.2 Literature-based and measured lizard density estimates

Lizard density estimates reported in the literature, together with densities observed from recovery salvage operations at Macraes Mine in comparable ecosystems and habitat types, were reviewed to assess the validity of the modelled lizard density estimates. The literature-based and measured density estimates are presented in Table 4.7.

4.6.3.3 Overall informed lizard density estimates

Using the two approaches outlined above, informed density estimates were developed for each lizard species within each broad habitat type (Table 4.6).

These values represent estimates rather than absolute measures and may therefore be subject to under- or overestimation. However, they are based on the best available data and are considered to reasonably reflect expected lizard densities across habitat types and species within the MP4 Project Area. These densities were subsequently used to estimate population sizes (see Section 3.13: *Lizard population size estimates*).

Table 4.6. Informed lizard density estimates (no. of lizards/ hectare).

Habitat type	McCann's skink	Southern grass skink	Kōrero gecko	All species
Tussock	256	375	25	656
Shrubland	810	224	25	1,059
Other	41	27	5	73
Overall (all habitats)	1,107	626	50	

Table 4.7. Density estimates (no. of lizards/ hectare) for Otago lizard species present or likely to be present in the MP4 Project Area. Density estimates available in the literature and those recorded from historical lizard management projects at the Macraes mine are presented. Information on sampled sites and habitats is also provided for context.

	Densities (lizards/ ha) available in the literature									Densities (lizards/ ha) recorded from activities on OGNZL Macraes landholdings				
Reference	Patterson (1984)	Patterson (1985)	Dixon (2004)	Clark (2006)	Jones <i>et al.</i> (2013)	Bell <i>et al.</i> (2013)	Knox <i>et al.</i> (2013)	Knox <i>et al.</i> (2013)	Wilson <i>et al.</i> 2017	Macraes Baseline survey (N-mixture models) ^A	Deepdell North III salvage Tocher (2021)	IM8 lizard salvage (van Winkel 2024)	CN5 lizard salvage (van Winkel 2026)	CCP2 lizard salvage (van Winkel unpub. data)
Habitat & site information	Tussock; Rock & Pillar Range	Tussock; Rock & Pillar Range	Tall tussock; Macraes	Ridges & gullies; Alistair's Gully control site, ~29 ha	Tall tussock, Macraes	Deepdell QEII covenant, 110 ha	Tussock, rank grass, rock tors; FNWRS salvage, 5.24 ha	Tussock, rank grass, rock tors; FSWRS salvage, 4.91 ha	Tussock, Macraes Flat (non-pest control vs predator-proof fence)	Tussock, rank grass, rock tors	Tussock, rank grass, rock tors; MPIII Deepdell North III salvage, 109 ha	Rank grassland, Macraes 0.11 ha	Tussock, rock outcrops, Macraes 11 ha ^B	Tussock, rank grass, Macraes 2.38 ha
Species														
Southern grass skink	-	769 ^C	572–2,250 ^C	2–35 ^D	683–777	1–8	3	13	1,900–4,000 ^E	24–637	2.9	778 ^D	368	1,077
McCann's skink	423				~300	-	11	0		91–1,328	- ^F		1,047	812
Herbfield skink	-				-	-	-	-		0	0		0	0
Kōrero gecko	-	-	-	-	-	3–9	0.2	7		8–22	11.6	0	~25-60	0

^A Only N-mixture modelling results presented due to inaccuracies related to low detection probabilities in CMR modelling data.

^B Estimates have been inflated to account for incomplete salvage (Hamlin 2025).

^C Figure includes tussock, McCann's, and cryptic (herbfield) skink combined.

^D Figures include tussock and McCann's skink combined.

^E The upper estimate (4,000/ ha) reflects lizard densities within the predator-proof fence.

^F McCann's skinks were not salvaged; hence no density estimate is available.

4.7 Lizard communities within the MP4 Project Area

A summary of the lizard species occurrence in the MP4 Project Areas is presented in Table 4.8.

4.7.1 Coronation Mining Area

The Coronation Area supports a variety of habitat types considered suitable for lizards such as extensive areas of tussock grassland, rock tors and rock piles, ephemeral wetland, and more modified habitats like improved pasture and felled pine forest (Table 4.4).

Systematic searches within the Coronation Area recorded three species of lizards: McCann's skink, southern grass skink, and kōrero gecko. Of these, McCann's and southern grass skinks were most abundant with the former occupying more rocky habitats (e.g., rock piles, haul road windrows, and rock tors) but also grass-dominated and tussock vegetation, while southern grass skinks were abundant in the grass, tussock, ephemeral wetland, and felled pine vegetation. Lizards were observed moving over the ground, basking, and found beneath logs and rocks.

Kōrero geckos were largely restricted to rocky habitats (e.g., rock outcrops and small rock tors), although it is likely that surrounding grassland habitats are used for dispersal between suitable rocky areas. Rock tor habitat is limited within the Coronation area and, where present (e.g., on the ridges and gully slopes to the east of the Trimbells WRS), outcrops are generally small and isolated. All rock tors surveyed within Coronation were occupied by both kōrero gecko and McCann's skink.

Within the Coronation Mining Area, there are eight (created rock piles (two located inside the CO8 Pit body and six inside the Coronation pit disturbance area), each measuring approximately 25 m L × 5 m W × 3 m H (Figure 4.4). These rock piles represent the remainder of a set of ten⁷ that were installed as part of the mitigation package for the Coronation Project in October 2014 (Herbert *et al.* 2023). A brief search for lizards on these rock piles revealed the presence of McCann's skinks. However, three species (McCann's skink, southern grass skink, and kōrero gecko) have previously been recorded amongst the rock piles and lizard monitoring in the years following their construction has demonstrated an increasing abundance of lizards over time (Herbert *et al.* 2023).

An area of undisturbed established vegetation occurs around the Coronation Pit spillway footprint (Figure 4.5). Here riparian-type vegetation comprised of tussock, harakeke/ flax, and interspersed broom, exotic grass, and occasional wilding pines, and provides good habitat for lizards, particularly southern grass skink and McCann's skink. There are no rocky features present in this area and thus, kōrero geckos are unlikely to be present.

⁷ Originally, 10 rock piles were constructed in 2014; however, some were later removed during mining activities, and subsequently reconstructed.



Figure 4.3. Extensive areas of narrow-leaved tussock grassland in Trimbells Gully with the Coronation Mining Area. The exotic grass-dominated slope of the Trimbells Waste Rock Stack is visible on the left hand side of the image.



Figure 4.4. Upper: rock outcrop at Coronation and lower: Coronation rock piles constructed as part of the mitigation package for the Coronation Project in 2014.



Figure 4.5. Undisturbed vegetation within the Coronation Pit spillway footprint.

Table 4.8. Summary of the lizard species occurrence in the MP4 Project Areas. “*” denotes expected (cf. confirmed) presence based on habitat quality and expert opinion.

Species	Coronation	GPUG	Central	FWFD	GB Haul Road	Golden Bar	BRWRS	Camp Creek	Coal Creek	Murphys Creek
McCann’s skink	●	●	●	*	●	●	●	●	●	●
Southern grass skink	●	●	●	*	●	●	●	●	●	●
Kōrero gecko	●	●	-	-	-	●	●	●	●	●
Otago skink	-	-	-	-	-	-	-	-	-	●
Grand skink	-	-	-	-	-	-	-	-	-	-
Otago green skink	-	-	-	-	-	-	-	● ^A	-	-
Herbfield skink	-	-	-	-	-	-	-	-	-	-
Jewelled gecko	-	-	-	-	-	-	-	-	-	-

^A Single opportunistic observation from March 2026.

4.7.2 Golden Point Underground

The Golden Point Underground area supports a mosaic of natural and exotic vegetation communities and an abundance of suitable lizard habitat (Figure 4.6). An assessment of the indigenous biodiversity values of GPUG undertaken by Ahika Consulting in January 2020 reported the presence of two lizard species (McCann's skink and kōrero gecko) and suitable habitat for these species was found as rock tors in the undisturbed areas. It was also considered unlikely that the area contained habitat for the other lizard species known to occur at Macraes (Thorsen 2020).

Systematic lizard surveys undertaken in March 2026 within areas immediately above the existing GPUG footprint (i.e., areas already subject to underground mining) and within the proposed GPUG expansion area re-confirmed the presence of McCann's skink and kōrero gecko (Figure 4.7). Southern grass skinks were also recorded in both the existing underground mining areas and the proposed expansion area.

McCann's skinks and southern grass skinks were widely distributed across the site and occurred in relatively high abundance. Kōrero geckos were primarily associated with rock outcrops and rocky hillslopes, where they were also found to be locally abundant.

Lizard detection rates (number of lizards observed per person hour) were similar between areas above the existing GPUG footprint and those within the proposed expansion area, at 2.4 and 2.7 lizards per person hour, respectively. Overall, no obvious differences in lizard diversity or relative abundance were observed between areas above the existing underground mining footprint and those within the proposed underground expansion zone.



Figure 4.6. Images of the vegetation and habitat types in the GPUG area. Upper: vegetated valley, looking north over the intersection of Highlay Creek and Deepdell Creeks; Middle: view looking south over the intersection of Highlay Creek and Deepdell Creeks; Lower: dense and complex vegetation in the proposed GPUG expansion area.



Figure 4.7. Kōrero gecko found in the proposed GPUG expansion area in March 2026.

4.7.3 Central Mining Area

The Central Mining Area generally supports lower quality habitat for lizards compared to the other Mining Areas. The habitat is predominantly improved pasture and rank exotic grassland interspersed with tussock, golden speargrass/ Taramea (*Aciphylla aurea*), gorse (*Ulex europaeus*), and exotic pine trees (Figure 4.8). Several smaller gullies supporting more complex vegetation such as tussock, ferns, and matagouri shrubs.

Both McCann's and southern grass skinks are known to occur within the Central Mining Area. McCann's were commonly observed basking on spoil mounds alongside the haul road margins, and both species were recorded in grassland habitats (Dale 2011; D. van Winkel, pers. obs., March 2026). Kōrero geckos have not been recorded in the Central Mining Area footprint, probably because there is a lack of rocky outcrops. No 'Threatened' lizard species have been reported from this area either and it is considered unlikely that they occur due to the extent of disturbed habitat (Dale 2011; D. van Winkel, pers. obs., March 2026).

Systematic searches as part of MP4 Project detected both McCann's and southern grass skinks, and numbers were found to be relatively high in areas of dense rank grass and tussock, including in the smaller shallow gully systems. While no kōrero geckos were observed with any of the affected areas of the footprint, they were detected in rock tors and rocky habitats in the immediate surrounding landscape (within the surrounding 80 m buffer), outside the footprint.

Information from the recent CCP2 lizard salvage operation, which was undertaken in areas immediately adjacent to the Golden Bar Road Realignment Project Component and in identical habitat types, recorded an abundance of McCann's and southern grass skinks, with reported densities of 805 McCann's/ ha and 1,084 southern grass skinks/ ha (Bioresearches 2026q). No kōrero geckos, nor any of the other Otago lizard species were detected during this salvage operation.



Figure 4.8. Images of the vegetation and habitat types present within the Central Mining Area.

4.7.4 Frasers West French Drain

A French drain recovery system is proposed to be installed along the toe of the Frasers West WRS (Figure 4.9). The drain will allow the capture of shallow sub-surface seepage from the toe of a WRS thus limiting migration of such water to nearby watercourses or the local groundwater system.

The vegetation in the drain footprint is currently comprised of exotic grass that is regularly grazed by stock. The area was visited briefly but no dedicated lizard surveys were undertaken due to the relatively poor quality of the habitat for lizards. That said, it is likely that low numbers of McCann's and southern grass skinks are present in the French drain footprint because these species are frequently found in degraded grassland habitats, including grazed pasture, across OGNZL landholdings. No rocky habitat occurs in the footprint and thus, kōrero geckos are not considered to be present.



Figure 4.9. Location of the proposed French drain to be constructed along the toe of the Frasers West WRS.

4.7.5 Golden Bar Haul Road

The habitat quality for lizards within the GB HR alignment is limited, with small areas of rough pasture, scattered rock accumulations, and small areas of denser grass and tussock in the heads of gullies providing some habitat values for common lizard species (Figure 4.10; Figure 4.11).

McCann's skinks are present and abundant throughout the alignment, occurring mostly under rocks and in exotic grasses along the edges of the existing road. Small numbers of southern grass skinks were found along the edge of the GB Haul Road footprint, in the heads of gullies where denser grass occurs. Kōrero geckos were not found in the haul road alignment and are not expected to be present directly inside the footprint due to a lack of suitable habitat. However, they were recorded in rocky outcrops within the 100 m buffer zone.

The larger threatened lizard species (Otago green skink, Otago skink, and grand skink) are highly unlikely to be present either within the haul road alignment or the 80 m buffer zone due to lack of suitable habitat.



Figure 4.10. Images of the vegetation and habitat types present in the Golden Bar Haul Road footprint.



Figure 4.11. Example of a typical large rock outcrop occurring in the surrounding 20 m buffer area.

4.7.6 Golden Bar Mining Area

Golden Bar supports a variety of vegetation communities such as narrow-leaved tussock grassland, shrubland, and shallow, incised gullies containing seasonally wet or damp watercourses bordered by water-dependent riparian vegetation (e.g., rushes, sedges, and exotic grasses) (Figure 4.14; Figure 4.13).

Three species of lizard (McCann's skink, southern grass skink, and kōrero gecko) were found during systematic searches. McCann's skink was the most encountered species and was found in all habitats that were searched, including under rocks in areas of grazed pasture on the plateau of the existing GB WRS. Southern grass skinks were common in the tussock and dense grassland areas, and they were particularly abundant in damper, seepage areas around the toe of the existing GB WRS. Kōrero geckos were restricted to rocky habitats, including smaller isolated rock outcrops and in the rocky faces and eroding piles of rocks around the edges of the existing GB Pit.

Despite the presence of large rock outcrops, no large, threatened lizard species were found during the surveys. The most extensive area of rock outcropping occurs on the steep slope of the existing GB WRS, at the northern most boundary of the MP4 GB WRS footprint. The outcrop is south facing and shaded for much of the day, which is not preferred by large heliothermic (sun-loving), saxicolous (rock dwelling) lizards such as Otago and grand skinks and is likely the reason why they are not present.

A large quantity of high value rock outcrop habitat occurs to the immediate west of the GB WRS footprint, inside the 80 m buffer zone. These outcrops were searched once during suitably warm and sunny conditions in April 2022, and three species (McCann's and southern grass skinks, and kōrero geckos) were found in abundance. No large skink species were detected but given the limitations on search effort, the potential presence of Otago green, Otago, and/ or grand skink cannot be dismissed. Indeed, considering the high quality and largely natural characteristics of these rock crops, there is a relatively high probability that at least one of these threatened species is present.



Figure 4.12. Images of the vegetation and habitat types present in the Golden Bar Area.



Figure 4.13. Additional images of the vegetation and habitat types present in the Golden Bar Area.

4.7.7 Back Road Waste Rock Stack

BRWRS is located on slopes draining into Deepdell Creek downstream of the current Macraes mining operation (Figure 4.14). The area covers approximately 184 hectares and is dominated by tussock grasslands, interspersed patches of grey shrubland and grazed exotic grassland. The stream gullies and riparian margins support diverse native vegetation communities and rock outcrops are abundant along the gullies.

These vegetation communities provide high quality habitat for lizards and the results of previous surveys (Dale 2011; Tocher 2022) and systematic searches as part of the MP4 Project have demonstrated that at least three species of lizards (McCann's skink, southern grass skink, and kōrero geckos) are widespread and abundant at this site. McCann's skinks were abundant throughout the rock outcrops along the gully edges, whilst southern grass skinks were found in both rocky habitat and grassland. All rock outcrop searches either had groups of kōrero geckos or evidence of their presence was found as lizard scats (droppings) observed in the crevices of rock outcrops.

To date, no other species of lizard has been confirmed from the BRWRS. Large scats possibly belonging to Otago green skinks were found in loose stones in an adjacent gully northeast of the BRWRS boundary (NZTM E1402234 N4974949) in 1996 (Whitaker 1996) suggesting the possible presence of this species, but no direct evidence of their presence was found. Subsequent searches targeting Otago green skinks, including surveys in the same gully system, have failed to confirm the presence of this species (Dale 2011; Tocher 2022; van Winkel, unpub. data). Thus, over the course of thirty years (1996–2026), lizard surveys targeting the larger threatened lizard species (Otago green, grand, and Otago skinks) in BRWRS and the immediate surrounds have failed to detect them (Whitaker 1996⁸; Dale 2011; Tocher 2022; van Winkel unpub. data). However, given the rarity of the larger skinks, the especially cryptic (secretive) behaviour of Otago green skinks, the expanse of habitat availability and quality dismissing the presence of any of these large species is not possible. Indeed, there remains a possibility that small, isolated pockets of habitat may support relict (small, contracted) populations of larger skink species such as Otago green skink, but without active intervention it is likely that these species will continue to decline.



Figure 4.14. Images of the vegetation and habitat types in the BRWRS area.

4.7.8 Camp Creek and Coal Creek

The Camp Creek and Coal Creek sites represent deep gully systems that harbour a diverse range of vegetation and habitat types. Large complex rock outcrops are abundant at both sites (Figure 4.15; Figure 4.16). The sites are both grazed by stock, and the valley floors and ridge tops show clear signs of stock disturbance (e.g., pugged ground, grazed and trampled vegetation). Some of the steeper gully slopes are less impacted by stock and denser vegetation (grey shrubland, tussock, and taramea/speargrass) is present.

Both Camp and Coal Creek sites have existing land use consents to develop dams/ reservoirs for mining activities. These sites have received lizard survey effort in the past, either as part of the resource consent applications (Dale 2011) or as part of landscape (OGNZL landholdings) wide surveys targeting large lizard species (e.g., Otago green skink) (Knox *et al.* 2015).

These two areas were recently surveyed solely to inform WAA applications as part of the MP4 Project.

4.7.8.1 Camp Creek

The Camp Creek site was surveyed for lizards as part of the Macraes Phase III Project in late 2010 (Dale 2011). The surveys were to inform an ecological impact assessment to create a reservoir (Camp Creek storage dam) to facilitate ongoing mining activities.

Surveys involved active searches for lizards across the 14.4 ha site. Two species were recorded (McCann's skink and southern grass skink); both of which were commonly observed basking on rocks and within vegetation. No kōrero geckos were observed; however, a large lizard dropping assumed to be from kōrero gecko was seen on a rock outcrop (Dale 2011). No Otago green skinks were found despite searches for this species. However it was stated that there was a possibility of this species occurring due to the occurrence of ideal habitat and the elusive nature of this species making it difficult to confirm presence. The site was described as supporting "a large amount of suitable lizard habitat, with numerous rock outcrops surrounded by indigenous scrubland, tussock grasslands, and pasture" (Dale 2011).

Surveys as part of the MP4 Project investigations in early 2026, involving visual encounter searches and aerial drone surveys, detected the presence of three species of lizards (McCann's skink, southern grass skink, and kōrero gecko). All three species were common and abundant across the site, with kōrero geckos restricted to crevices of rock outcrops and under loose rocks around rock outcrops. Intensive searches of suitable habitat for Otago green skink (e.g., damper gullies and areas of loose rocks) were undertaken. While no Otago green skinks were captured, there was an incidental observation of an Otago green skink at the northeastern extent of the site (M. Scarrott, pers. obs., 10 March 2026). The skink was opportunistically seen fleeing from a basking perch in shrubland, below a rock outcrop, when approached.

In response, targeted search effort using a variety of traps and lizard detection devices (see Section 3.5 *Tracking tunnel and CritterPic® results*) was invested at the site over a period of several weeks to re-detect the individual. This effort failed to confirm presence but because this species is rare, elusive, and in northern Otago this species is typically only found in single individuals (Whitaker 1987b), it

would be premature to dismiss its presence from the complex Camp Creek site based on the survey efforts to date.

Overall, the Camp Creek area supports high quality lizard habitat and good populations of McCann's skinks, southern grass skinks, and kōrero geckos. The lizard population within the proposed dam footprint is likely in the order of hundreds of thousands of individuals, and the potential presence of other species such as Otago green skink should not be dismissed.

4.7.8.2 Coal Creek

Surveys of Coal Creek and the surrounding catchments in November 2014, involving diurnal visual encounter surveys and rock-lifting over 117 person search hours, detected the presence of McCann's skink, southern grass skink, and kōrero gecko (Knox *et al.* 2015). All species were found in relatively high abundances.

In 2016, further surveys of the Coal Creek site were undertaken as part of the resource consent application (Thorsen 2016). This survey found similar results to the 2014 survey, detecting the presence of three species of lizard (McCann's skink – 106 sightings over 12 person hours or 8.8 sightings hr^{-1} ; southern grass skink – 16 sightings over 12 person hours or 1.3 sightings hr^{-1} ; and kōrero gecko – eight individuals recorded over two person hours (4 individuals hr^{-1}), as well as exotic whistling tree frogs (*Litoria ewingii*). This survey did not detect any other lizard species (e.g., Otago green skink, Otago skink, grand skink) and the author concluded that it was unlikely that these species are present at the site. Herbfield skinks were also not recorded but it was considered possible that a small number of individuals may occur within the dense valley bottom vegetation (Thorsen 2016).

Visual encounter surveys in 2026 (15 person search hours), as part of the MP4 Project, found very similar results with the three common lizard species present and none of the larger or 'Threatened' lizard species were found.

The Coal Creek area appears to provide highly suitable habitat for the common lizard species that are widespread throughout the surrounding landscape. The habitat quality is high as there are extensive areas of complex lizard habitat, including large rock outcrops. Accordingly, the lizard population in this area is expected to be large. Although surveys to date have not recorded any 'Threatened' lizard species, their presence cannot be ruled out given the abundance of high-quality habitat.



Figure 4.15. Images of Camp Creek showing the extensive area of high quality lizard habitat, being shrubland, tussock grassland, damp gullies, and an abundance of rock outcrops.



Figure 4.16. Images of Coal Creek showing the extensive area of high quality lizard habitat, including shrubland, tussock grassland, damp gullies, and an abundance of rock outcrops.

4.7.9 Murphys Creek

The Murphys Creek catchment comprises an extensive area of high-value lizard habitat located southwest of the MP4 Project Area (Figure 4.19). Although the MP4 Project will not directly impact Murphys Creek, the catchment has been investigated as a potential mitigation site.

Initial surveys conducted in 2014 as part of OceanaGold's targeted search for Otago green skinks (Knox *et al.* 2015) recorded four lizard species within the catchment. While Otago green skinks were not

detected, McCann's skink, southern grass skink, and kōrero gecko were found to be abundant. In addition, two individual Otago skinks were recorded at separate locations within schist rock outcrops along the main gully system (Knox *et al.* 2015).

More extensive baseline monitoring in 2021 surveyed a broader area of the catchment, including higher ridgelines. These surveys confirmed the continued abundance of common lizard species, with McCann's skink and southern grass skink particularly prevalent in tussock and exotic grassland habitats, and kōrero geckos occupying all surveyed rock outcrops.

Systematic ground surveys and aerial drone assessments undertaken in early 2026 again confirmed the presence of common lizard species and re-identified Otago skinks, although in a different area from that recorded in 2014. The Otago skink population was locally abundant and included a full range of age classes, from juveniles to adults, indicating an active breeding population. However, additional surveys elsewhere in the catchment, including the original 2014 locations, did not detect the species. As Otago skinks are not known from any other sites within OGNZL Macraes landholdings, the Murphys Creek population represents the last known stronghold for the species in this area.

Overall, the Murphys Creek catchment supports robust populations of the three most common lizard species found in the Macraes ED, as well as a relict population of the 'Threatened' Otago skinks. The habitat is extensive and of high ecological value. While the absence of active management (e.g. mammalian predator control or stock-proof fencing) currently limits its conservation potential, the site presents a strong opportunity for mitigation through targeted habitat enhancement and conservation intervention for Otago skinks as part of the MP4 Project.



Figure 4.17. Image of the Murphys Creek catchment, showing extensive areas of relatively undisturbed vegetation and complex habitat for lizards.



Figure 4.18. Additional images of the Murphys Creek catchment. Otago skink pictured in-situ (lower image).



Figure 4.19. Additional images of the Murphys Creek catchment, showing extensive areas of relatively undisturbed vegetation and complex habitat for lizards.

4.8 Lizard species diversity and ecology overview

Of the seven lizard taxa confirmed from the Macraes ED, five are currently recorded on OGNZL Macraes landholdings: McCann's skink, southern grass skink, kōrero gecko, Otago skink, and grand skink (Figure 4.20).

Of these, three species—McCann's skink, southern grass skink, and kōrero gecko—have been confirmed within the MP4 Project impact area. This represents 42.9% of the total lizard diversity known from the Macraes ED and 60% of the lizard diversity recorded on OGNZL Macraes landholdings.

The larger-bodied grand and Otago skinks have not been recorded within the MP4 impact area and are instead restricted to small, relict populations in relatively isolated locations, such as Redbank Covenant and the Murphys Creek catchment, respectively.

The following sections provide additional ecological context for species confirmed within the MP4 Project area, as well as those that may occur in the surrounding landscape.



Figure 4.20. Examples of the herpetofauna (reptiles and amphibians) present within the MP4 Project Area; upper left: korero gecko; upper right: southern grass skink; middle left: McCann's skink; middle right: whistling tree frog; lower central: Otago skink.

4.8.1 McCann's skink (*Oligosoma maccanni*)

McCann's skink is endemic to the South Island and is one of the most widely distributed species of native skink. It is a common and widespread species of lizard in Otago and is typically found in a wide range of habitat types, including rock outcrops, shrubland, tussockland, riparian vegetation, exotic grassland, and more disturbed areas in suburban and urban areas (van Winkel *et al.* 2018; Whitaker *et al.* 2002). This species can tolerate some level of human disturbance and appears to be able to persist in the presence of introduced mammalian predators, probably because it is a fast maturing skink with a relatively high reproductive output.

Within the MP4 Project area, McCann's skink was the most abundant and most encountered species and was recorded at all sites surveyed. It was found in rough pasture, tussock, riparian margins, ephemeral wetlands, rock outcrops, and rock accumulations, disturbed areas (e.g., haul road windrows), and even grazed pasture where it was found under rocks and other woody debris. McCann's skinks were most common in dryer habitats where rocky features (outcrops, tors, or rock piles) were present.

McCann's skink is nationally classified as 'Not Threatened' (Hitchmough *et al.* 2026). Regionally, it is listed as 'Regionally Not Threatened,' with a $\pm$ 10% stable regional population trend. Regional qualifiers: National Stronghold and Type Locality (Jarvie *et al.* 2025).

4.8.2 Southern grass skink (*Oligosoma chionocholescens*)

The southern grass skink (*Oligosoma chionocholescens*) is a member of the *Oligosoma polychroma* species complex. Liggins *et al.* (2008) identified five deep genetic lineages within this complex ('Clade 1'–'Clade 5'), which have since been treated as distinct species (van Winkel *et al.* 2018; Hitchmough *et al.* 2026). The southern grass skink corresponds to Clade 5 and represents the southern lineage of the complex, with populations occurring from central and southern Canterbury (including Christchurch and Banks Peninsula) through Otago and Southland, and across Foveaux Strait to Stewart Island/Rakiura. Jewell (2022a) split Clade 5 into two entities, with the southern lineage recognised as southern grass skink (*O. chionocholescens*), while populations north of the Ida Range remained as *O. aff. polychroma* Clade 5. However, due to insufficient genetic evidence for this split, the name *O. chionocholescens* has recently been applied to the whole of Clade 5 of the *O. polychroma* complex (Hitchmough *et al.* 2026), and this is the position taken in the current report.

Southern grass skink is a widespread species that can occur at relatively high population densities in suitable habitats. Within the Macraes ED, it is common and can be locally abundant in high-quality habitat, including sites where mammalian predators are present. It is most often associated with dense grass-dominated vegetation and damper areas such as seeps, depressions, and gullies (Jewell 2022a), although it may also occur in rocky habitats. Preferred habitats include tussock grassland, rank grass, rough pasture, riparian margins, and wet gullies.

In the MP4 Project area, southern grass skinks were commonly encountered and moderately abundant in areas supporting dense grasses, tussock, and sedges. Though this species was also found to occupy rocky areas, wetland herbfields, shrublands, and sites with woody cover.

Key threats include habitat loss (particularly conversion of shrubland, tussockland, and wetlands to agricultural land) and predation by introduced mammals. The species persists at sites free of mammalian predators, at sites where all mammals except mice are excluded, and at locations subject to intensive predator management.

Southern grass skink is relatively short-lived, reaching sexual maturity at approximately 2–3 years of age and having an estimated generation time of 8 years. Its high fecundity means that it is better able to withstand predation than many other skink species and it is also tolerant of habitat modification. While it remains widespread and abundant, it is undergoing significant decline overall.

Southern grass skink is nationally classified as ‘At Risk – Declining’ under the NZTCS (Townsend *et al.* 2008; Rolfe *et al.* 2022; Hitchmough *et al.* 2026), based on criterion DECu3m, which reflects a very large population (> 100,000 ha area of occupancy) with an ongoing or predicted decline of 10–30%. National qualifiers: Climate Impact and Data Poor: Recognition (Hitchmough *et al.* 2026). Regionally, it is listed as ‘Regionally At Risk – Declining’, based on criterion B(2), which reflects a large population (area of occupancy ≤ 10 000 ha) and moderate ongoing or forecast decline of 10–50%. Regional qualifiers: Data Poor Trend and Natural Range (Jarvie *et al.* 2025).

4.8.3 Kōrero gecko (*Woodworthia* “Otago/Southland large”)

The kōrero gecko (*Woodworthia* “Otago/Southland large”) is an undescribed taxon within the *Woodworthia* genus that contains several other unnamed entities previously classified as *Woodworthia maculatus* (Hitchmough 1997; Nielsen *et al.* 2011). The species now excludes the populations referred to as the south-western large gecko (*Woodworthia* “south-western large”) and Raggedy Range gecko (*Woodworthia* “Raggedy”).

Kōrero geckos are found throughout much of Otago, including the Dunstan Mountains, Dansey’s Pass, Kakanui Mountains, Horse Range, Rock and Pillar Range, and Southland (including islands in Foveaux Strait). They are terrestrial and nocturnal and are typically found in close association with rocky habitats where they form large aggregations in crevices. They are also known to inhabit beech and podocarp forests, and grasslands in parts of their range.

Within the MP4 Project area, kōrero geckos were commonly found associated with rocky features such as rock outcrops or tors, rock accumulations, and under loose rocks in tussock and shrubland habitat. Indeed, all rock outcrops greater than 1 m² in area contained at least one kōrero gecko, emphasising the importance of rock features for this species. Where present, they frequently occurred at moderate to high abundances. It is likely that kōrero geckos are also present in the tussock, dense grassland, and shrubland habitats within the MP4 Project area, as dispersing through these habitats is necessary to travel between rock outcrops.

Agents of decline include ongoing impacts of mammalian predators and habitat loss due to development (mining) and agricultural intensification. Kōrero geckos in the Macraes ED are habitat restricted; they rely on rock tors and rocky features in the landscape to persist. In other parts of their range (e.g., Southland), kōrero geckos have been recorded in rimu trees deep within dense podocarp forest (T. Jewell & C. Knox unpublished data). Kōrero geckos occur at sites that are free of mammalian

predators (Department of Conservation Grand and Otago Skink [GAOS] fences at Nenthorn), sites free of all mammals except mice (Orokonui Sanctuary), and sites under intensive pest management (GAOS non-fenced areas). Kōrero gecko populations at these sites are likely to be benefiting from mammalian predator management.

It is a long-lived species, is slow to reach sexual maturity (~8 years at higher latitudes) and has a generation time of approximately 15 years meaning population growth is slow.

The kōrero gecko is nationally listed as 'At Risk – Declining' under the NZTCS (Townsend *et al.* 2008; Rolfe *et al.* 2022; Hitchmough *et al.* 2026), based on criterion DECu4f, which reflects a large population (>100,000 mature individuals) and ongoing or predicted decline rate of 30–50%. National Qualifiers include Climate Impact and Partial Decline (Hitchmough *et al.* 2026). Regionally, it is listed as 'Regionally At Risk – Declining', based on criterion C(1), which reflects a large population (> 100,000 mature individuals) and moderate ongoing or forecast decline of 10–30%. Regional qualifiers: National Stronghold and Partial Decline (Jarvie *et al.* 2025).

4.8.4 Otago skink (*Oligosoma otagense*)

Otago skinks are large-bodied and rare lizards, endemic to the Otago Region. Indeed, the Otago Region is both a regional and national stronghold for this species. They were formally widespread across Otago but are now restricted to < 8% of their former range (Whitaker & Loh 1995; Houghton & Linkhorn 2002). The Otago skink population is comprised of two major populations (eastern and western), that are geographically separated and exhibit a relatively high level of genetic divergence (Chapple *et al.* 2012). Known from around Lindis Pass and Lake Hawea areas (western population), and around Macraes Flat and Middelmarsh (eastern population).

Otago skinks remain present in relatively strong numbers within Department of Conservation GAOS management areas at Redbank and Nenthorn, located south of the OGNZL Macraes landholdings. Historically, Otago skinks were also recorded on OGNZL landholdings, including at Murphys Creek, Emerald Creek, the headwaters of Deepdell Creek, and in areas now occupied by the mixed tailings impoundment south of Golden Point Pit Underground (Whitaker 1986) (Appendix D).

In 2014, two individuals were recorded within large rock outcrop habitats at Murphys Creek (Knox *et al.* 2015), and follow-up surveys by Bioresearches ecologists in February 2026 confirmed that this population persists (this report) (Appendix D).

Notably, in October 2025, the mummified remains of two adult Otago skinks were discovered during the deconstruction of rock tors associated with the Coronation North 5 lizard management programme (van Winkel 2026). This finding indicates that Otago skinks were present in the Coronation area within recent decades.

Otago skinks are diurnal, terrestrial, and saxicolous (rock-dwelling). They are a strongly heliothermic species that sun basks avidly. They occupy deeply creviced schist outcrops and bluffs, most commonly along steep-sided valleys (Towns 1985, Whitaker 1996; van Winkel *et al.* 2018). They are relatively

long-lived (20+ years), reaching sexual maturity in 4–6 years, and have a generation time of approximately 10 years.

Agents of decline include habitat loss, particularly conversion of shrubland and tussockland to production farmland, as well as ongoing impacts of mammalian predators. Otago skinks occur at sites that are free of mammalian predators (GAOS fenced areas) and sites under landscape pest management (GAOS non-fenced areas). Relict populations appear to persist at some sites without mammalian pest management (e.g., Murphys Creek).

Otago skinks are currently nationally listed as ‘Threatened – Nationally Increasing’ based on criterion Nlu1c; unnatural population state, population trend increasing > 10%, and population size 1,000–5,000 mature individuals. National qualifiers: Conservation Dependent, Population Fragmentation, Range Restricted, and Relict (Hitchmough *et al.* 2026). Regionally, they are listed as ‘Regionally Endangered’ based on criterion B(1); 250–1,000 mature individuals with a $\pm 10\%$ stable population trend. Regional qualifiers: Conservation Dependent, Climate Impact, National Stronghold, Partial Decline, Population Fragmentation, RE, Range Restricted, and Type Locality.

4.8.5 Grand skink (*Oligosoma grande*)

Like Otago skinks, grand skinks are endemic to Otago and the Otago Region is both a regional and national stronghold for this species. They are now rare in the Macraes ED, because they are large-bodied skinks that are highly susceptible to impacts by mammalian predators, but also because of loss of habitat. Their range has contracted significantly over the past 150 years and extensive surveys of the entire Central Otago area in 1984–89 have revealed that their distribution is patchy and localised, these skinks occupying only 8% of their potential range (Whitaker & Loh 1995). Grand skinks are comprised of two major geographically separated forms, the western population known from around Lindis Pass and Lake Hawea areas, and the eastern population around Macraes Flat and Middlemarch.

They are diurnal, strongly heliothermic (sun-loving) and saxicolous (rock-dwelling), inhabiting the deeply creviced schist rocks, especially those with native vegetation amidst or on the periphery. They seek refuge in crevices, cracks and holes in rock tors, and will forage and bask on the rocks or in surrounding vegetation (van Winkel *et al.* 2018). They depend on the warmth of the outcrops and generally do not stray far from rocks (Whitaker *et al.* 2002). Dense tussock and vegetation cover is highly important for their dispersal (Whitaker 1996).

In areas surrounding OGNZL Macraes landholdings, grand skinks were known to occur historically in the Deepdell catchment, in rock tors 1.5 km northwest of the BRWRS (Whitaker 1996). In addition, there are a couple of records of grand skinks from 1996, located 3–7 km southwest of the landholdings (DOC Herpetofauna database). There are several relatively recent records (within the last five years) of grand skinks from the DOC grand and Otago skink (“GAOS”) management areas to the south of OceanaGold landholdings.

Inside the OGNZL Macraes landholdings, there are recent (since December 2023) records of grand skinks observed on rock tors in the Redbank Ecological Covenant, approximately 6.5 km west of GB WRS and 4.5 km southwest of IM9 Pit (L. Sherwood and M. Tocher, unpub. data). In February 2021,

the mummified remains of grand skinks were found in rock tors dismantled as part of the Deepdell North Stage III project (Tocher 2021), indicating their presence in recent times.

Grand skinks are relatively long-lived (20+ years), reaching sexual maturity in 4–6 years, and have a generation time of approximately 10 years.

Agents of decline include habitat loss, particularly conversion of shrubland and tussockland to production farmland, as well as ongoing impacts of mammalian predators. Grand skinks occur at sites that are free of mammalian predators (GAOS fenced areas) and sites under landscape pest management (GAOS non-fenced areas). Populations in these areas are likely to be benefiting from management.

Grand skinks are currently listed as nationally ‘Threatened – Nationally Increasing’ based on criterion N1u1c; unnatural population state, population trend increasing > 10%, and population size 1,000–5,000 mature individuals. Nationally qualifiers: Climate Impact, Conservation Dependent, Partial Decline, Range Restricted, and Relict (Hitchmough *et al.* 2026). Regionally, they are listed as ‘Regionally Endangered’ based on criterion B(1); 250–1,000 mature individuals with a $\pm 10\%$ stable population trend. Regional qualifiers: Conservation Dependent, Climate Impact, National Stronghold, Partial Decline, Population Fragmentation, RE, Range Restricted, and Type Locality.

4.8.6 Herbfield skink (*Oligosoma murihiku*)

The herbfield skink is a recently recognised member of the cryptic skink (*O. inconspicuum*) species complex (Jewell 2019; Jewell 2022b; Hitchmough *et al.* 2026) and in 2022, it was elevated to full species (*O. murihiku*) (Jewell 2022b). Herbfield skink is widely distributed across the south-eastern areas of the South Island, from Macraes southwards and eastwards to Tiwai Peninsula in Southland.

It is found in tussock grasslands, herbfields, scrub, sand dunes, cobble beaches and wetlands, and also rocky areas such as screes (Whitaker *et al.* 2002, van Winkel *et al.* 2018). Populations are often isolated and localised (Whitaker *et al.* 2002). The herbfield skink is becoming increasingly rare across large parts of its range due in part to degradation of habitat. Within the Macraes ED, this species is typically found in association with tussock grassland supporting dense woody subshrubs, or wetter areas (e.g., seepages, flushes, wetlands, and the grassland surrounding such areas). It is less reliant on stable retreats such as rocks, and therefore, is particularly sensitive to habitat modification of grassland and low woody shrubs by grazing, drainage, or weed incursion (Jewell 2022b). Accordingly, herbfield skinks are now in decline across their entire range (Jewell 2022b; Hitchmough *et al.* 2026).

Herbfield skinks are rarely encountered in the landscape surrounding OceanaGold landholdings, with verified records of single individuals from Highlay Creek Covenant (on OceanaGold landholdings) and Deepdell Station Covenant (adjacent to OGNZL landholdings) in 2013 (Bell *et al.* 2013). There was also a possible (unverified) observation from an area of rocks along Horse Flat Road (Deepdell North III between Coronation 6 Pit and Round Hill Innes Mills SPIM) in 2018 (Bovill 2018). This record was subsequently considered dubious, and it was reported by Thorsen (2019) that the habitat was anomalous for this species and the possibility existed that this was a misidentification of a subadult skink of another species.

Agents of decline are like those affecting southern grass skink such as habitat loss, particularly conversion of shrubland, tussockland, and wetland to production farmland, as well as ongoing impacts of mammalian predators. Herbfield skinks occur at sites that are free of mammalian predators (GAOS fenced areas) and sites under intensive pest management (GAOS non-fenced areas). Populations in these areas are likely to be benefiting.

It is a relatively short-lived species, reaching sexual maturity in 2–3 years, and has a generation time of approximately 6–7 years.

Herbfield skinks are currently nationally listed as ‘At Risk – Declining’, based on criterion DECu3k, which reflects a large population (1,000–10,000 ha area of occupancy) with an ongoing or predicted decline of 10–30%. National qualifiers: Climate Impact, Data Poor: Trend, Partial Decline, Population Fragmentation, and Range Restricted (Hitchmough *et al.* 2026). Regionally, it is listed as ‘Regionally At Risk – Declining’, based on criterion A(2), which reflects a large population (area of occupancy ≤ 1,000 ha) and an ongoing or forecast decline of 10–30%. Regional qualifiers: Conservation Dependent, Climate Impact, Data Poor Trend, National Stronghold, Natural Range, Partial Decline, Population Fragmentation, and Range Restricted (Jarvie *et al.* 2025).

Overall, the status of herbfield skinks on OGNZL Macraes landholdings remains uncertain and if this species is present populations are likely to be small and isolated. Although not recorded from the MP4 Project Area, its presence cannot be dismissed due to its rare and cryptic (secretive) nature.

4.8.7 Otago green skink (*Oligosoma aff. chloronoton* “Eastern Otago”)

The Otago green skink occurs in Otago and potentially into northern Southland. Otago green skinks inhabit a diverse range of environments from the coast to alpine areas (Whitaker *et al.* 2002), and it is usually found associated with well-vegetated, open habitats such as tussock grassland, sub-alpine grassland, shrublands, wetlands, rocky outcrops, and in damper sites where there are loose rocks and dense herbaceous vegetation (Whitaker *et al.* 2002, Jewell 2008; van Winkel *et al.* 2018).

Otago green skinks are rare within the Macraes ED, and there are currently no verified populations on OGNZL Macraes landholdings. Historical records indicate the species was present in the 1960s, with sightings from shrubland northwest of the current Deepdell North Pit (Whitaker 1986). A possible sighting occurred during a 2013 survey at Deepdell (Knox & Bell 2013a), but subsequent targeted searches over the past decade have failed to verify its presence (Knox *et al.* 2015; van Winkel 2024; 2025; 2026). Encouragingly, footprints and a follow-up observation of possible Otago green skink were recorded in the nearby Deepdell Station Ecology Covenant (approximately 5.6 km west of the Coronation 6 Pit PC) in 2023 (M. Tocher, pers. comm. 31 January 2024), following three years of mammalian predator control. This site is not on OGNZL Macraes landholdings but is rather a QEII Covenant. Furthermore, there was a sighting of a suspected Otago green skink in Camp Creek area in early 2026 though targeted surveys failed to find further evidence of its presence.

It has declined drastically in recent years with the most abundant populations occurring at higher altitude sites and in mammal-controlled sanctuaries. It has largely disappeared from lowland areas of Otago (Purdie 2022). This lizard appears to be particularly susceptible to the impacts of mammalian predators but also habitat loss. Little is known of its reproductive biology.

Otago green skinks are currently nationally listed as 'At Risk – Declining', based on criterion DECu4k, which reflects a large population (1,000–10,000 ha area of occupancy) with an ongoing or predicted decline of 30–50%. National qualifiers: Climate Impact, Conservation Dependent, Data Poor: Size, Data Poor: Trend, and Population Fragmentation (Hitchmough *et al.* 2026). Regionally, it is listed as 'Regionally At Risk – Declining', based on criterion B(2), which reflects a large population (area of occupancy $\leq 10,000$ ha) and an ongoing or forecast decline of 30–50%. Regional qualifiers: Conservation Dependent, Climate Impact, Data Poor Size, Data Poor Trend, National Stronghold, Natural Range, Partial Decline, and Population Fragmentation (Jarvie *et al.* 2025).

Overall, while the absence of verified (confirmed without doubt) records on OGNZL Macraes landholdings for over 50 years raises concerns about possible local extinction, these recent unverified observations provide hope that the species may persist in small remnant populations in the wider landscape.

4.8.8 Jewelled gecko (*Naultinus gemmeus*)

Jewelled geckos are primarily arboreal, inhabiting shrubland and forested environments, although inland Otago populations are also known to occupy tussock grasslands (van Winkel *et al.* 2018). The species has a broad but patchy distribution, ranging from Banks Peninsula in Canterbury southwards to Codfish Island and Green Island in Foveaux Strait, Southland.

Within the dryland ecosystems of Central and eastern Otago, jewelled geckos are relatively uncommon and sparsely distributed. In southern Otago drylands, populations may be approaching local extinction, largely as a result of habitat loss and modification following post-settlement burning and pastoral development (Jewell & McQueen 2007). In northern Otago, the species is known from only a small number of relatively recent historical records (c. 2017–2019), most located approximately 20 km northeast of the MP4 Project Area, north of the Shag River in the Waianakarua Ecological District.

A single historical record of *Naultinus* sp. (presumably *N. gemmeus*) from 1980 exists at the southern margin of the Macraes ED, approximately 40 km southwest of the OGNZL Macraes landholdings. This record is classified as "suspect" in the DOC Herpetofauna database. The basis for this designation is unclear but may reflect the absence of photographic verification and/or the lack of corroborating records of *Naultinus* from the Macraes ED.

Extensive lizard surveys undertaken on OGNZL Macraes landholdings since the late 1980s, including targeted searches for jewelled geckos, have not detected the species. It is therefore possible that jewelled geckos were historically extirpated from the local landscape due to repeated burning, conversion to pastoral land, and predation by introduced mammals.

Nevertheless, key habitat features associated with the persistence of jewelled geckos in Central Otago include refugia from historical fires (e.g. boulder fields and bluffs), structurally complex and woody vegetation, dense and/ or tall vegetation with rock cover, and the availability of warm basking sites alongside shelter from extreme winter conditions (Jewell & McQueen 2007). Some of these attributes are present within parts of OGNZL Macraes landholdings. Given the highly cryptic nature of jewelled

geckos, the possibility of small relict populations persisting in the least disturbed habitats (e.g. Island Block Covenant) cannot be entirely excluded.

Jewelled geckos are currently classified nationally as 'At Risk – Declining' under criterion DECu3I, reflecting a relatively large area of occupancy (10,000–100,000 ha) with an ongoing or predicted population decline of 10–30%. Associated qualifiers include Climate Impact, Partial Decline, and Population Fragmentation (Hitchmough *et al.* 2026). Regionally, the species is listed as 'Regionally At Risk – Declining' under criterion B(2), indicating an area of occupancy $\leq 10,000$ ha and a similar projected decline. Regional qualifiers include Climate Impact, National Stronghold, Partial Decline, and Population Fragmentation (Jarvie *et al.* 2025).

Overall, in the absence of verified records from northern Otago—including the OGNZL Macraes landholdings—and given the limited availability of suitable habitat within the MP4 Project impact area, jewelled geckos are considered unlikely to be present.

4.8.9 Whistling tree frog (*Litoria ewingii*)

Whistling tree frogs are a common and often abundant introduced species widely distributed across the South Island, including throughout Otago (van Winkel *et al.* 2018). They were recorded in a range of habitats across OGNZL Macraes landholdings, including ponds, riparian margins, wetlands, seeps, and rock piles, and are present within the MP4 Project impact areas (e.g. Golden Bar and Coronation).

As an introduced species, whistling tree frogs are not protected under the Wildlife Act 1953. Accordingly, their presence within OGNZL Macraes landholdings and the MP4 Project area is not relevant to the ecological values assessment or the assessment of project effects. This species is therefore not considered further in this report.

4.9 Species of biogeographic interest

Of the lizard species recorded in the MP4 Project area, none occur at their distribution limits—though Macraes is close to the northern distributional boundary for southern grass skink—and none are of specific biogeographic interest.

4.10 Genetically or morphologically distinct forms

Genetically distinct forms of two lizard species (McCann's skink and kōrero gecko) occur within the MP4 Project area. These are described below and while noteworthy, these lineages are not currently recognised as having specific conservation concern nor are they treated or managed differently from other members of their respective clades.

4.10.1 McCann's skink

McCann's skink populations from eastern Otago and eastern Southland are assigned to Clade 4 by O'Neill *et al.* (2008). This clade is genetically distinct from the six other recognised clades within the species complex. Clade 4 occurs primarily south of the Waitaki River, extending from the Ida Range

south to the Hokonui Hills in northern Southland, and west to Alexandra. Accordingly, this lineage is widely distributed across the MP4 Project area and is common throughout the Macraes ED.

4.10.2 Kōrero gecko

Of scientific interest is the potential presence of two distinct races of kōrero gecko within OGNZL Macraes landholdings. Kōrero geckos have been recorded within the MP4 Project area. In 2020, an unusual kōrero gecko was recorded during Stage 1 lizard salvage for the Deepdell North Stage III Project (Tocher 2021). This individual was subsequently identified as a ‘black-spotted gecko’—a distinctive form exhibiting both morphological and genetic differences from typical kōrero geckos, although it is not formally recognised as a separate taxon by Hitchmough *et al.* (2026).

Given that this individual was located just south of the Coronation Mining Area, it has been suggested that a genetic contact zone between these forms may occur within the MP4 Project Area.

4.11 Ecological function

New Zealand lizards, including the three species recorded in the MP4 Project area, play important ecological roles as predators, prey, seed dispersers, and pollinators (Hare *et al.* 2016).

Many New Zealand lizards are omnivorous, feeding primarily on arthropods but also consuming fruits, flowers, nectar, and honeydew (Hare *et al.* 2016). Other food items may include smaller lizards (of the same or different species) and carrion from larger vertebrates. Lizards themselves form an important component of the diet of a range of predators, including several native bird species and some invertebrates (Hare *et al.* 2016).

McCann’s skink, southern grass skink, and *Woodworthia* geckos (e.g., kōrero gecko) are known to supplement their diet with fruits (e.g., berries) when available. Seeds consumed in fruit are often dispersed incidentally by lizards, which can benefit native plants by allowing seeds to escape parent plants and reach suitable establishment sites. Lizards can therefore act as important seed dispersers, even at relatively low densities on the mainland. In shrubland habitats where frugivorous birds are scarce, lizards may play a particularly important role in seed dispersal (Wotton *et al.* 2016).

Geckos, including *Woodworthia* species, are also known to visit flowers and can function as effective pollinators (Whitaker 1987a; Smith 2009). In some cases, they have been recognised as ecologically significant pollinators within New Zealand ecosystems (Smith 2009).

Accordingly, the lizard community, which includes nocturnal geckos and diurnal skinks, within the MP4 Project area contributes to ecosystem functioning through the provision of these ecological roles and services.

4.12 Lizard habitat suitability

4.12.1 Habitat types

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 4.10 and illustrated in Figure 4.21.

4.12.2 Habitat quality

Lizards were recorded in 10 (83%) of the 12 habitat categories, although habitat quality varied among them. Rock outcrops, tussock, exotic grassland, and shrubland provided the highest-quality habitat within the Project Area, supporting the greatest lizard diversity and abundance. No lizards were recorded within pine forest or pond habitats.

McCann's skink was observed in recently disturbed habitats, including windrows along haul road margins and rock accumulations on the periphery of ancillary mining areas. These habitats are considered temporary and occur within highly modified environments; accordingly, their overall habitat quality is regarded as low.

Felled pine areas supported a similar diversity of lizard species to higher-quality habitats but were assessed as lower quality overall due to their transient nature. Recently felled areas can provide abundant refuges (e.g. logs, branches, flaking bark) and increased sun exposure for basking; however, these conditions are short-lived as vegetation regenerates and woody debris decomposes.

Except for the existing mining/ disturbed category and litteram, none of the identified habitat types are unique to the Project Area, with most occurring widely across the surrounding landscape. Comparable disturbed environments (e.g. farm track margins and farmyards) are also present beyond the Project Area. High-value habitats (i.e., rock outcrops, tussock, and shrubland) are well represented both within OGNZL Macraes landholdings and more broadly across the Macraes ED.

4.12.2.1 Rock outcrops

Four hundred and eighty four rock outcrops were identified within the MP4 Project Area (excluding GPUG extension, where rock outcrops were not mapped) based on field assessments and high-definition aerial photography (Table 4.9). Of these, 64 outcrops (0.3 ha in total extent) were identified in areas that will be directly affected by the MP4 Project activities (i.e., within the impact area and surrounding 20 m buffer) and all 64 outcrops were visited during the survey. The remaining 420 outcrops were in the BRWRS area, where no mining activities are currently proposed under the MP4 Project. Only a small proportion (< 25%) of the BRWRS outcrops were visited during the survey.

In addition, 130 rock outcrops (1.45 ha in total extent) were identified in the wider surrounding 80 m buffer, where indirect effects are anticipated as a result of the MP4 Project (Table 4.9). Only a small proportion (< 25%) of these outcrops were visited during the survey, mostly within the buffer of the Golden Bar Mining Area.

Despite the high number of identified rock outcrops, the actual number could be higher since not all areas were ground-truthed and smaller outcrops may not have been discernible even using high-definition aerial imagery.

Lizard occupancy rates were very high with > 95% of all inspected rock outcrops supporting at least one lizard species. Three species of lizards (McCann's skink, southern grass skink, and korero gecko) were observed on rock tors, though McCann's skink and korero gecko were the species most frequently encountered. Kōrero geckos were present wherever rock outcrops had crevices or flat, schist rock slabs available and McCann's skink were frequently observed basking on rock outcrops.

Table 4.9. The number of rock outcrops identified within the MP4 Project Area and surrounds “ - “= not measured. n/a = not applicable.

Project Area	Footprint		20 m buffer		Total impact area		80 m buffer	
	No. of outcrops	Areal extent (ha)	No. of outcrops	Areal extent (ha)	No. of outcrops	Areal extent (ha)	No. of outcrops	Areal extent (ha)
Coronation	39	0.13	9	0.04	48	0.17	32	0.14
GPUG	-	-	n/a	n/a	n/a	n/a	n/a	n/a
Central	0	0	0	0	0	0	2	0.01
FWFD	0	0	n/a	n/a	n/a	n/a	n/a	n/a
Golden Bar HR	0	0	2	0.01	2	0.02	43	0.36
Golden Bar	8	0.03	6	0.04	14	0.12	53	0.94
BRWRS	420	-	n/a	n/a	420	-	n/a	n/a
Total	467	0.16	17	0.10	484	0.26	130	1.45
Total (excl. BRWRS & GPUG)	47	0.16	17	0.10	64	0.26	130	1.45

Table 4.10. Broad lizard habitat types identified in the MP4 Project impact area and the recorded presence (✓) of lizard taxa. Suitable lizard habitat shown as green shading and unsuitable lizard habitat shown with red shading. Ranked habitat value for lizards shown as 1 = highest quality to 12 = lowest quality.

Habitat rank	Broad lizard habitat category	Brief description	Lizard taxa		
			McCann's skink	Southern grass skink	Korero gecko
1	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 Otago lizard species, offering abundant basking sites, crevices for refuge from predators and extreme temperatures, and stable microclimates. Schist outcrops, particularly large complex ones, support high lizard diversity and abundance, and provide key habitat for kōrero geckos.	✓	✓	✓
2	Tussock	Tussock grasslands, especially those dominated by native narrow-leaved snow tussock (<i>Chionochloa rigida</i>), provide structurally complex habitat with good cover and invertebrate prey availability. Lizards use tussock bases for shelter and thermoregulation. Tussock habitat quality can vary depending on grazing pressure and historical modification, but generally tussock habitat supports a diversity and abundance of lizards.	✓	✓	✓
3	Exotic grass	Exotic grasslands seemingly offer low quality habitat for lizards due to reduced structural diversity and fewer and less complex refuges compared to native vegetation. However, common skink species, can persist and even thrive in these areas, particularly where the grass is sufficiently dense and interspersed with ground cover such as rocks or logs.	✓	✓	✓
4	Shrubland	Shrubland typically supports dense and complex growing plant species such as matagouri (<i>Discaria toumatou</i>), <i>Coprosma crassifolia</i> , <i>Muehlenbeckia complexa</i> , and desert broom (<i>Carmichaelia petriei</i>). Shrubland provides important habitat for both arboreal and terrestrial lizards, offering a mix of cover, basking opportunities, and foraging resources. Dense or diverse native shrubland is particularly valuable for geckos (e.g., kōrero).	✓	✓	✓
5	Felled pine	Recently felled pine areas can provide temporary habitat through increased sunlight, exposed ground, and residual woody debris that offers shelter for lizards. Felled pine areas are used by McCann's and southern grass skinks, and recolonisation of rock outcrops by kōrero geckos can be relatively rapid.	✓	✓	✓

6	Riparian	Riparian habitats along streams and waterways offer increased moisture, vegetation diversity, and invertebrate prey, supporting a range of lizard species. Southern grass skinks favour damper habitats and are frequently found within riparian margins.	✓	✓	-
7	Woody exotic	Woody exotic vegetation (e.g. gorse, broom) can provide dense cover and refuge for some lizards. However, large patches of gorse and broom do not support complex understory, and these habitats are generally less suitable for lizards than native shrublands.	✓	✓	-
8	Ephemeral wetland	Ephemeral wetlands are seasonally wet areas that provide temporary habitat for lizards when dry. While not core habitat, their margins can support lizards where suitable cover and basking sites are present.	✓	✓	-
9	Wetland	Permanent wetlands generally offer limited habitat for most lizard species due to high moisture levels and reduced basking opportunities. However, edges and drier margins with vegetation do provide habitat for some species of skink (e.g., southern grass skink).	-	✓	-
10	Existing mine/ disturbed	Existing mine and disturbed habitats are those where active mining (pits) or ancillary mining activities are taking place. These areas offer very little to no suitable habitat for lizards though, the margins of these areas can support populations of McCann's skinks, which inhabit rock accumulations on the edges of haul roads (e.g., windrows) and overburden stockpiles.	✓	-	-
11	Pine	Standing pine plantations generally provide very low-quality habitat for lizards due to heavy shading and limited basking opportunities, simplified understorey, and heavy mammalian predator loads (e.g., rodents and pigs). Lizard species may occur along plantation edges or along tracks within plantations where sunlight is able to penetrate the canopy. Rock outcrops beneath the canopy do not receive suitable sunlight for kōrero geckos to persist permanently. Fallen debris (e.g., logs and branches), flaking bark on pine trunks, and the edges of pine plantations supporting lower growing shrubs may provide marginal habitat for skinks and geckos.	-	-	-
12	Pond	Artificial or natural ponds do not themselves provide habitat for terrestrial lizards; however, habitat may be present around the margins of ponds but this falls within the riparian habitat category rather than the strict definition of pond applied here.	-	-	-

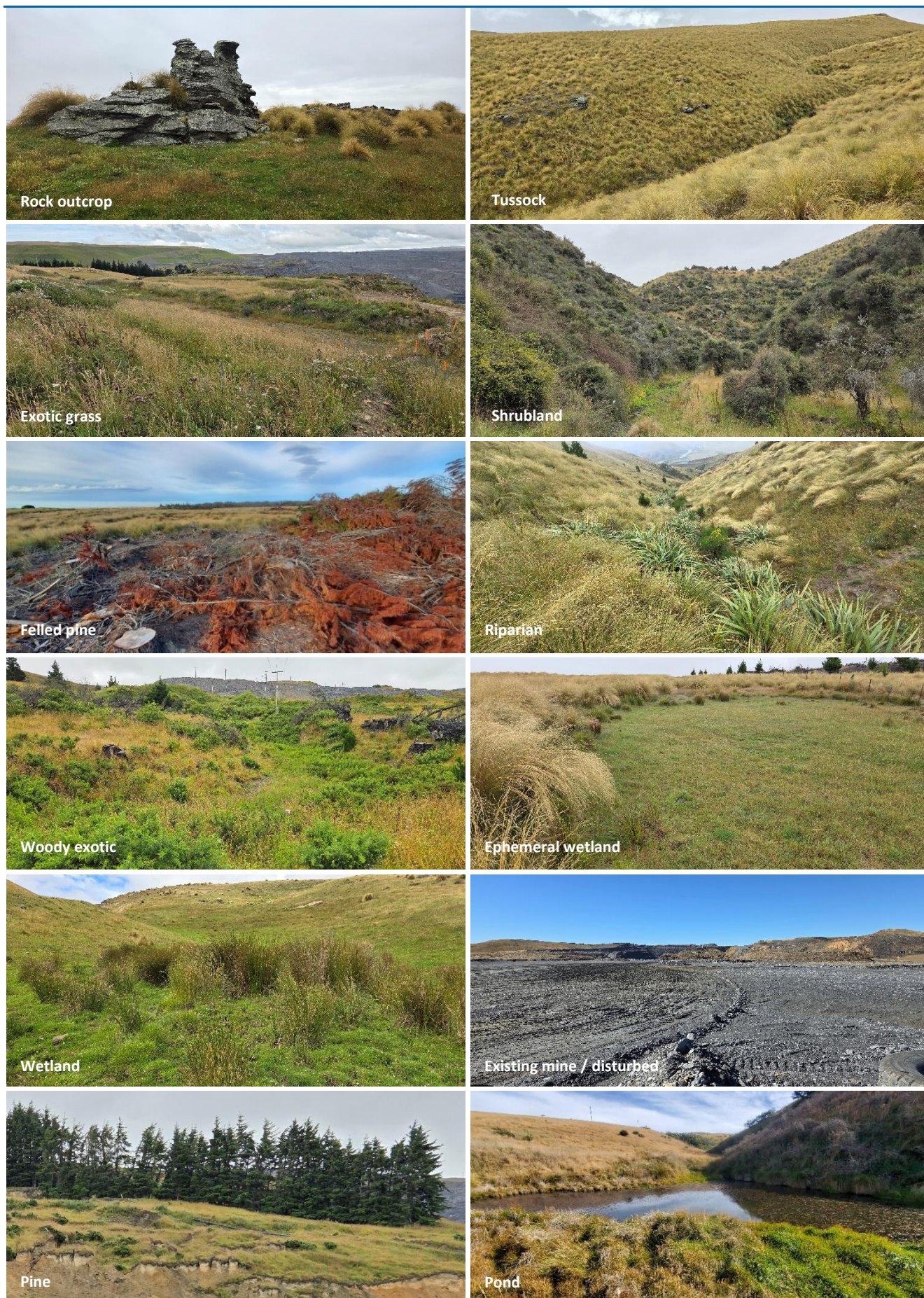


Figure 4.21. A selection of photographs of showing the identified habitat types within the MP4 Project Area.

Table 4.11. Areal (ha) extents of each identified habitat type within the MP4 Project area (includes impact area + 20 m buffer). Lizard habitats ranked according to quality. “-” = not recorded.

	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
Decreasing lizard habitat quality	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
	Existing mine/ disturbed	4.709	109.7	68.046	0.000	3.941	6.490	8.423	91.608	83.185
	Pine	0.021	-	1.172	0	0	0	0	1.193	1.193
	Pond	0.024	-	0.135	0	0.189	0	0	0.347	0.347
	Total all habitat	88.628	172	119.430	5.500	78.799	32.886	172.030	668.773	325.243
	Total suitable lizard habitat only	83.101	61.800	49.918	5.500	73.848	26.368	163.607	464.14	238.735

• Habitat types within GPUG broadly estimated from aerial imagery.

4.13 Lizard population size estimates

To estimate the number of lizards potentially present within each MP4 Project area and across the entire MP4 Project impact area, species-specific lizard density estimates based on the baseline monitoring results were extrapolated across the extent of suitable lizard habitat.

The size of the lizard population that will be directly affected by the MP4 Project is estimated to be approximately 155,564 lizards. Lizard population estimates for each species and for each of the broad habitat types within the MP4 Project Areas are presented in Table 4.12 and Table 4.13, respectively.

Most (56%) of the affected lizards will be represented by 'At Risk – Declining' southern grass skinks, with 'Not Threatened' McCann's skinks comprising 40%, and 'At Risk – Declining' kōrero geckos comprising a much smaller proportion (4%) of the total affected population.

It must be emphasised that the population estimates derived from the baseline monitoring programme are subject to several limitations, as outlined in Section 3.6.3: Estimated lizard density. Consequently, actual lizard numbers within the MP4 Project area may be higher than those estimated from the baseline monitoring data.

For example, recent lizard salvage operations undertaken for the Coronation North 5 Project and Continuity Consents Project Stage 2 recorded skink densities within tussock and exotic grassland habitats of up to 1,900 skinks per hectare—considerably higher than the densities estimated during the baseline monitoring programme. Extrapolating these higher observed densities across the direct MP4 impact footprint (excluding areas already consented) results in numbers of lizards an order of magnitude higher; potentially up to 450,000 individuals. While this figure is considered unrealistic due to varied habitat quality within the project footprint (i.e., not all habitats and areas will support high densities of lizards), lizard numbers are likely to be higher than predicted by the baseline monitoring data.

However, this report's approach has been to rely on measured data rather than inferred extrapolations from previous salvage operations. Consequently, the population estimates presented here should be regarded as approximate and used primarily as a guide to inform the Ecological Impact Assessment (Bioresearches 2026f), Residual Effects Analysis Report (Bioresearches 2026l), and the development of WAA lizard management requirements for the MP4 Project (Bioresearches 2026j).

Table 4.12. Lizard population estimates, by species, for each MP4 Project Area. Estimates based on measured lizard abundance.

	Coronation	GPUG	Central	FWFD	GB HR	Golden Bar	BRWRS	Total	Total impact area (excl. BRWRS & GPUG)
Lizard habitat extent (ha)	83.1	61.8	49.9	5.5	26.4	73.9	163.6	442.8	238.7
Species									
McCann's skink	22,452	41,960	12,434	1,474	6,728	18,909	50,769	154,727	61,997
Southern grass skink	30,277	16,060	18,107	2,134	9,834	27,461	57,752	161,626	87,813
Kōrero gecko	2,050	1,546	1,213	0	656	1,835	4,032	11,332	5,754
Total	54,779	59,566	31,754	3,608	17,219	48,204	112,554	327,684	155,564

• reflects lack of suitable habitat for kōrero gecko in FWFD area.

Table 4.13. Lizard (skink) population estimates, by broad habitat type, for each MP4 Project area and total MP4 Project impact area (excl. BRWRS & GPUG). Estimates based on measured lizard abundance

	Coronation	GPUG	Central	FWFD	GB HR	Golden Bar	BRWRS	Total	Total impact area (excl. BRWRS & GPUG)
Lizard habitat extent (ha)	83.1	61.8	49.9	5.5	26.4	73.9	163.6	442.8	238.7
Habitat type									
Tussock/ exotic grass/ rock outcrop	51,855	9,610	31,572	3,608	17,189	47,923	94,166	255,923	152,147
Shrubland	2,823	49,956	54	0	19	240	18,177	71,269	3,136
Other	101	0	127	0	11	41	212	492	280
Total	54,779	59,566	31,754	3,608	17,219	48,204	112,554	327,684	155,564

5 Ecological value and ecological significance assessments

5.1 Assessment of ecological value

Ecological values were assigned to both lizard communities/ habitats and individual species within each MP4 Project Area, using the criteria in the EclAG (see Table 7 of Appendix B).

- For lizard 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 based on their level of conservation concern (as per Tables 5 and 6 in Appendix B). Both the national New Zealand Threat Classification System (NZTCS; Hitchmough *et al.* 2026) and the Otago Regional Threat Classification System (RTCS; Jarvie *et al.* 2025) listings were considered. Where classifications differed, the highest threat category—whether national or regional—was applied.

The assessments are presented in Table 5.1 and Table 5.2.

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

Area	Criteria	Justification and value assignment
Coronation Mining Area		
	Representativeness	Habitats are primarily modified (grazed) tussock land typical of the surrounding landscape, with ephemeral wetlands and small, isolated rock outcrops present. Lizard communities in this area are representative of the modified tussock habitats. The larger-bodied, more threatened lizard species such as Otago green skink, grand skink, and Otago skink are absent, but these are also largely absent from modified tussock habitats elsewhere on OGNZL landholdings and in the Macraes ED. Moderate value
	Rarity/ Distinctiveness	Three species of lizard occur, including two 'At Risk – Declining' and one 'Not Threatened' species. Lizards, including the 'At Risk – Declining' species, are widespread and considered moderately abundant in this area. High value
	Diversity and pattern	The lizard diversity is typical of modified tussock habitat found on the OGNZL landholdings and in the Macraes ED, though diversity represents only 43% of the total lizard diversity within the Macraes ED. Moderate value
	Ecological context	The lizard community fills some ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, seed dispersers, and pollinators. Potential ecosystem function is reduced due to the lack of larger-bodied lizard species, which are apex lizard predators and important seed dispersers. Introduced mammalian predators and habitat modification are the likely drivers of decline in large-bodied lizards, though smaller-bodied species can persist despite these anthropogenic influences. The PC shares ecological connectivity with similar modified tussock habitat to the north, east, and south and thus, the lizard community will be contributing to gene flow within the wider population. Moderate value
	Overall value	Moderate
Golden Point Underground		
	Representativeness	Habitats are comprised of mixed modified (grazed) tussock land and tussock-grey shrubland communities, interspersed with rock outcrops typical of the more natural surrounding landscape. Densely vegetated gullies, typical of Deepdell Creek catchment are represented. Lizard communities in this area are representative of the more natural habitat across OGNZL landholdings and the wider Macraes ED, though larger-bodied, more

Area	Criteria	Justification and value assignment
		threatened lizard species such as grand skink and Otago skink are not known to be present. If present, they will be restricted to small, isolated pockets of higher value rock outcrops and will occur at low abundance. High value
	Rarity/ Distinctiveness	Three species of lizard are confirmed from this area, including two 'At Risk – Declining' and one 'Not Threatened' species. These lizards are widespread and moderately abundant in this area, due to the existence of areas of largely unmodified habitat. Threatened Otago and grand skinks could potentially be present due to the abundance of suitable habitat but were not recorded during surveys. High value
	Diversity and pattern	The lizard diversity is typical of modified tussock habitat found on the OGNZL landholdings and in the Macraes ED, though diversity represents only 43% of the total lizard diversity within the Macraes ED. Moderate value
	Ecological context	The lizard community fills some ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, seed dispersers, and pollinators. Potential ecosystem function partially reduced due to the lack or limited number of larger-bodied lizard species, which are apex lizard predators and important seed dispersers. Introduced mammalian predators and habitat modification in some areas of the PC are the likely drivers of decline in large-bodied lizards, though smaller-bodied species can persist despite these anthropogenic influences. The Project Area shares good ecological connections with modified and more natural tussock habitat to the north, east, and south and thus, the lizard 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. The habitat poorly represents typical lizard habitat of the surrounding landscape. The lizard community is underrepresented with only two skink species present (McCann's and southern grass skink). Kōrero gecko and the larger-bodied, more threatened lizard species such as Otago green skink, grand skink, and Otago skink are absent. Low value
	Rarity/ Distinctiveness	Two species of lizard occur, including one 'At Risk – Declining' and one 'Not Threatened' species. Lizards, including the 'At Risk – Declining' species, are widespread and considered to occur at moderately abundance in this area.

Area	Criteria	Justification and value assignment
		High value
	Diversity and pattern	The lizard diversity is low compared to surrounding areas that support more natural vegetation and habitats (e.g., modified tussock) on the OGNZL landholdings and Macraes ED. Lizard diversity represents only 29% of the total lizard diversity within the Macraes ED.
		Low value
	Ecological context	The lizard community fills some ecological niches (terrestrial diurnal roles) and partially contributes to ecosystem function as predators, prey, seed dispersers, and pollinators. Potential ecosystem function is much reduced due to the lack of nocturnal (e.g., kōrero gecko) and larger-bodied lizard species, which are apex lizard predators and important seed dispersers. Introduced mammalian predators and habitat disturbance and modification likely on-going pressures for lizards in this area. Areas within this Project Area are isolated from surrounding lizard habitats by active mine workings (haul roads, pits, workshop areas), and there is very limited ecological connectivity with more natural lizard habitat in the surrounding landscape. Accordingly, gene flow considered to be very limited.
	Overall value	Low value.
Frasers West French Drain		
	Representativeness	Habitat is almost entirely highly modified grassland weed-dominated vegetation. The habitat poorly represents typical lizard habitat of the surrounding landscape. The lizard community is underrepresented with only two skink species likely present (McCann's and southern grass skink). Kōrero gecko and the larger-bodied, more threatened lizard species such as Otago green skink, grand skink, and Otago skink are absent.
		Low value
	Rarity/ Distinctiveness	Two species of lizard likely to occur, including one 'At Risk – Declining' and one 'Not Threatened' species. Lizards, including the 'At Risk' species, are widespread and considered to occur at moderately abundance in this area.
		High value
	Diversity and pattern	The lizard diversity is low compared to surrounding areas that support more natural vegetation and habitats on the OGNZL landholdings and Macraes ED. Lizard diversity represents only 29% of the total lizard diversity within the Macraes ED.
		Low value
	Ecological context	The lizard community fills some ecological niches (terrestrial diurnal roles) and partially contributes to ecosystem function as predators, prey, seed dispersers, and pollinators. Potential ecosystem function is much reduced due

Area	Criteria	Justification and value assignment
		to the lack of nocturnal (e.g., kōrero gecko) and larger-bodied lizard species, which are apex lizard predators and important seed dispersers. Introduced mammalian predators and habitat disturbance and modification likely on-going pressures for lizards in this area. Some ecological connectivity to surrounding low value habitat exists and gene flow considered to be very limited. Low value
	Overall value	Moderate
Golden Bar Haul Road		
	Representativeness	Habitat for lizard is largely absent inside the proposed haul road footprint, with some lower values habitat on the fringes. Lizard community is poorly represented with only one species of skink (McCann's skink) present in disturbed, rocky habitat, and other species absent. Very low value
	Rarity/ Distinctiveness	One 'Not Threatened' species present; widespread but occurring at low abundance due to the footprint largely occurring with a historical haul road that is currently grazed by stock. Low value
	Diversity and pattern	The lizard diversity is low compared to surrounding areas that support more natural vegetation and habitats (e.g., modified tussock) on the OGNZL Macraes landholdings and Macraes ED. Lizard diversity represents only 29% of the total lizard diversity within the Macraes ED. Low value
	Ecological context	The habitats are mostly disturbed (historical mine haul road and frequent grazing by stock) and largely devoid of lizard habitat, and only species of common lizard is present. Accordingly, many of the potential ecological niches are not filled and ecosystem function is poor. Introduced mammalian predators and habitat disturbance present ongoing pressures for lizards in this area. The Project Area shares good ecological connections with modified and more natural tussock habitat in the immediate surrounding landscape and thus, the lizard community will be contributing to gene flow within the wider population. Low value
	Overall value	Low
Golden Bar Mining Area		

Area	Criteria	Justification and value assignment
	Representativeness	Habitats are comprised of mixed modified (grazed) tussock (some areas support dense tussock), with small pockets of tussock-grey shrubland communities, sparsely interspersed with small rock outcrops. Two vegetated gullies support some damper and more complex lizard habitat, but these are not representative of more densely vegetated gullies in the wider landscape. Lizard communities in this area are moderately representative of the more natural habitat across OGNZL landholdings and the wider Macraes ED. That is, three species are present, but kōrero gecko are not common, and the larger-bodied, more threatened lizard species such as grand skink and Otago skink are not known to be present. Moderate value
	Rarity/ Distinctiveness	Three species of lizard are confirmed from this area, including two 'At Risk – Declining' and one 'Not Threatened' species. Kōrero geckos are not common and are restricted to small, isolated rock outcrops. The two skink species are widespread and moderately abundant in this area. Large skinks are not present inside the impact footprint but could occupy the large rock outcrops to the immediate east. High value
	Diversity and pattern	The lizard diversity is typical of modified tussock habitat found on the OGNZL landholdings and in the Macraes ED, though kōrero gecko is not common diversity represents only 43% of the total lizard diversity within the Macraes ED. Moderate value
	Ecological context	The lizard community fills some ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, seed dispersers, and pollinators. Potential ecosystem function partially reduced due to the lower abundance of kōrero geckos and the lack of larger-bodied lizard species, which are apex lizard predators and important seed dispersers. Introduced mammalian predators and habitat modification in some areas of the Project Area are the likely drivers of decline in large-bodied lizards, though smaller-bodied species can persist despite these anthropogenic influences. The PC shares good ecological connections with modified and more natural tussock habitat (especially to the west) and thus, the lizard community will be contributing to gene flow within the wider population. High value
	Overall value	High
BRWRS		

Area	Criteria	Justification and value assignment
	Representativeness	Habitats are primarily modified (grazed) 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. Lizard communities in this area are representative of the modified tussock habitats, with three species found to be common and widespread. The larger-bodied, more threatened lizard species such as Otago green skink, grand skink, and Otago skink are likely to be absent, but it is possible that small, undetected Otago and Otago skinks populations occur in isolated pockets of habitat. High value
	Rarity/ Distinctiveness	At least three species of lizard occur, including two 'At Risk – Declining' and one 'Not Threatened' species. Lizards are widespread and considered moderately abundant. Three other species (herbfield skink, Otago skink, and Otago green skink) may be present in small, isolated populations within the site but have not been confirmed. High value
	Diversity and pattern	The lizard diversity is typical of modified tussock habitat found on the OGNZL landholdings and in the Macraes ED. Lizard species diversity represents 43% of the total lizard diversity within the Macraes ED; however, diversity may be higher if additional species are found to be present. Moderate value
	Ecological context	The lizard community fills some ecological niches (terrestrial nocturnal and diurnal roles) and contributes to ecosystem function as predators, prey, seed dispersers, and pollinators. Potential ecosystem function is reduced due to the lack of larger-bodied lizard species, which are apex lizard predators and important seed dispersers. Introduced mammalian predators and habitat modification are the likely drivers of decline in large-bodied lizards, though smaller-bodied species can persist despite these anthropogenic influences. The large PC shares ecological connectivity with similar modified and more natural tussock habitats to the north, east, and south and good connections with the Deepdell Creek catchment that supports very high quality habitat for lizards. Thus, the lizard community will be contributing to gene flow within the wider population. High value
	Overall value	Very High

Table 5.2. Ecological value for species of lizard present in the MP4 Project area, as per the EIANZ EcIA Guidelines.

Species	Presence and abundance in the Project area	National threat listing (NZTCS)	Regional threat listing	Assigned ecological value
McCann's skink	Abundant in all habitat types, especially in areas of grassland (exotic and tussock), shrubland, and rock outcrops. Species is tolerant of disturbance and occupies ostensibly low value habitats such as wind rows, roadsides, and grazed pasture where suitable debris is available (e.g., rocks, logs, inorganic debris)	Not Threatened	Regionally Not Threatened	Low
Southern grass skink	Favours denser grassland areas such as rank exotic grass, tussock, and damp gullies, where they occur in abundance.	At Risk – Declining	Regionally Declining	High
Kōrero gecko	Abundant in rocky habitats such as rock outcrops and rock piles. Less common in tussock and grassland/ shrubland areas without rock features and likely using these habitats to disperse between rock outcrops rather than using them as permanent occupancy sites.	At Risk – Declining	Regionally Declining	High

5.2 Significance criteria under the policy framework

Assessing the lizard values against the NPS-IB, ORPS 2021, and WDP significance criteria resulted in all MP4 Project Areas qualifying as significant (Table 6.1; Table 6.2; Table 6.3).

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

6 Summary of lizard values

The MP4 Project area supports widespread and locally abundant lizard populations characteristic of the Macraes ED. Three lizard species—McCann's skink, southern grass skink, and kōrero gecko—were confirmed within the Project area, with McCann's skink being the most widespread and abundant species recorded. Kōrero geckos were strongly associated with schist rock outcrops and rocky habitats, while southern grass skinks were most commonly associated with tussock grassland, damp gullies, and dense grassland habitats.

Extensive areas of suitable lizard habitat occur throughout the MP4 Project area, particularly within tussock grasslands, shrublands, rocky outcrops, and gully systems.

The ecological values associated with lizard communities and habitats within areas proposed for direct mining disturbance, generally ranged from Low to Moderate. The lowest lizard values were associated with the Golden Bar Haul Road area, while the highest values were identified within the Coronation and Golden Bar areas, where extensive high-quality habitat and abundant lizard populations occur.

In contrast, areas not directly subject to mining disturbance, such as the GPUG area and BRWRS (to be avoided), supported substantially higher lizard values, including areas assessed as Very High value due to the extent and quality of habitat present and the abundance of lizards recorded.

The Camp Creek and Coal Creek areas also support high lizard values. Although these areas are already consented, they remain subject to WAA requirements, and the management of lizards within these areas will be addressed through the MP4 Lizard Management Plan.

No populations of grand skink or Otago skink were identified within areas proposed for direct disturbance under the MP4 Project, although a remnant Otago skink population persists within the wider Murphys Creek catchment outside the Project impact footprint.

Ecological significance criteria under the NPS-IB, ORPS 2021, and Waitaki District Plan were met in multiple areas due to the presence of indigenous lizard habitat, naturally occurring indigenous biodiversity, and populations of 'At Risk – Declining' lizard species.

Table 6.1. Assessment of lizard values in each of the MP4 Project Areas against the National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB) significance criteria.

NPS-IB criteria	Significance assessment	Coronation	GPUG	Central	FWFD	GB HR	GB	BRWRS
Representativeness	The habitats for lizards 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 lizards 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 lizards and/ or lizard habitats, like the diversity at the level of the Macraes ED.	x	✓	x	X	x	✓	✓
Rarity and distinctiveness	The area supports species, or habitats used by species, that are 'At Risk' (southern grass skink, kōrero gecko). Lizard species in the area occur at their distribution limits, are endemic to the Otago region, or are of biogeographic interest. Threatened grand and Otago skinks were not considered because they were not recorded or expected to occur in areas directly impacted by the MP4 Project. Genetically distinct forms of two lizard species (McCann's skink and kōrero gecko) are present in the area, though these distinct forms are not currently managed as separate taxonomic units.	✓	✓	✓	✓	✓	✓	✓
Ecological context	The terrestrial ecological features in the area, as they pertain to indigenous lizards, provide some connectivity between the site and adjoining sites, and provide resources (e.g., food, refuge, breeding sites) for lizards.	✓	✓	x	X	x	✓	✓
Qualifies as significant		Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6.2. Assessment of lizard values in each of the MP4 Project Areas against the Otago Regional Policy Statement 2021 (ORPS 2021) significance criteria.

ORPS criteria	Significance assessment	Coronation	GPUG	Central	FWFD	GB HR	GB	BRWRS
Representativeness	The habitats for lizards 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' (e.g., southern grass skink, korero gecko) and/ or potentially threatened (e.g., grand skink).	✓	✓	✓	✓	✓	✓	✓
Diversity	The area supports a diversity of indigenous lizards and/ or lizard habitats, like the diversity found within the immediately surrounding landscape and at the level of the Macraes ED.	✓	✓	x	x	x	✓	✓
Distinctiveness	Lizard species in the area occur at their distribution limits, are endemic to the Otago region, or are of biogeographic interest. Threatened grand and Otago skinks were not considered because they were not recorded or expected to occur in areas directly impacted by the MP4 Project. Genetically distinct forms of two lizard species (McCann's skink and kōrero gecko) are present in the area, though these distinct forms are not currently managed as separate taxonomic units.	✓	✓	x	x	x	✓	✓
Ecological context	The terrestrial ecological features in the area, as they pertain to indigenous lizards, provide some connectivity between the site and adjoining sites, and provide resources (e.g., food, refuge, breeding sites) for lizards.	✓	✓	x	x	x	✓	✓
Qualifies as significant		Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6.3. Assessment of lizard values in each of the MP4 Project Areas against the Waitaki District Plan significance criteria.

Waitaki District Plan criteria	Significance assessment	Coronation	GPUG	Central	FWFD	GB HR	GB	BRWRS
Representativeness	The area supports habitats and ecological processes (e.g., lizard 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' lizard species and lizard habitats (e.g., rock tors) that are important in the lifecycle of protected or threatened indigenous lizards.	✓	✓	✓	✓	✓	✓	✓
Diversity and pattern	The area supports a relatively diverse lizard fauna (at least three taxa), a diversity of habitats for indigenous lizards, and ecological processes (e.g., lizard seed dispersal, lizard plant pollination, lizards as prey for other fauna and as predators of invertebrates, 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	Lizard habitats within the area share ecological connections with adjoining habitats allowing dispersal of lizards through the landscape and provides regular resources (e.g., food, refuge, breeding sites) for lizards.	✓	✓	x	x	x	✓	✓
Qualifies as significant		Yes	Yes	Yes	Yes	Yes	Yes	Yes

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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.

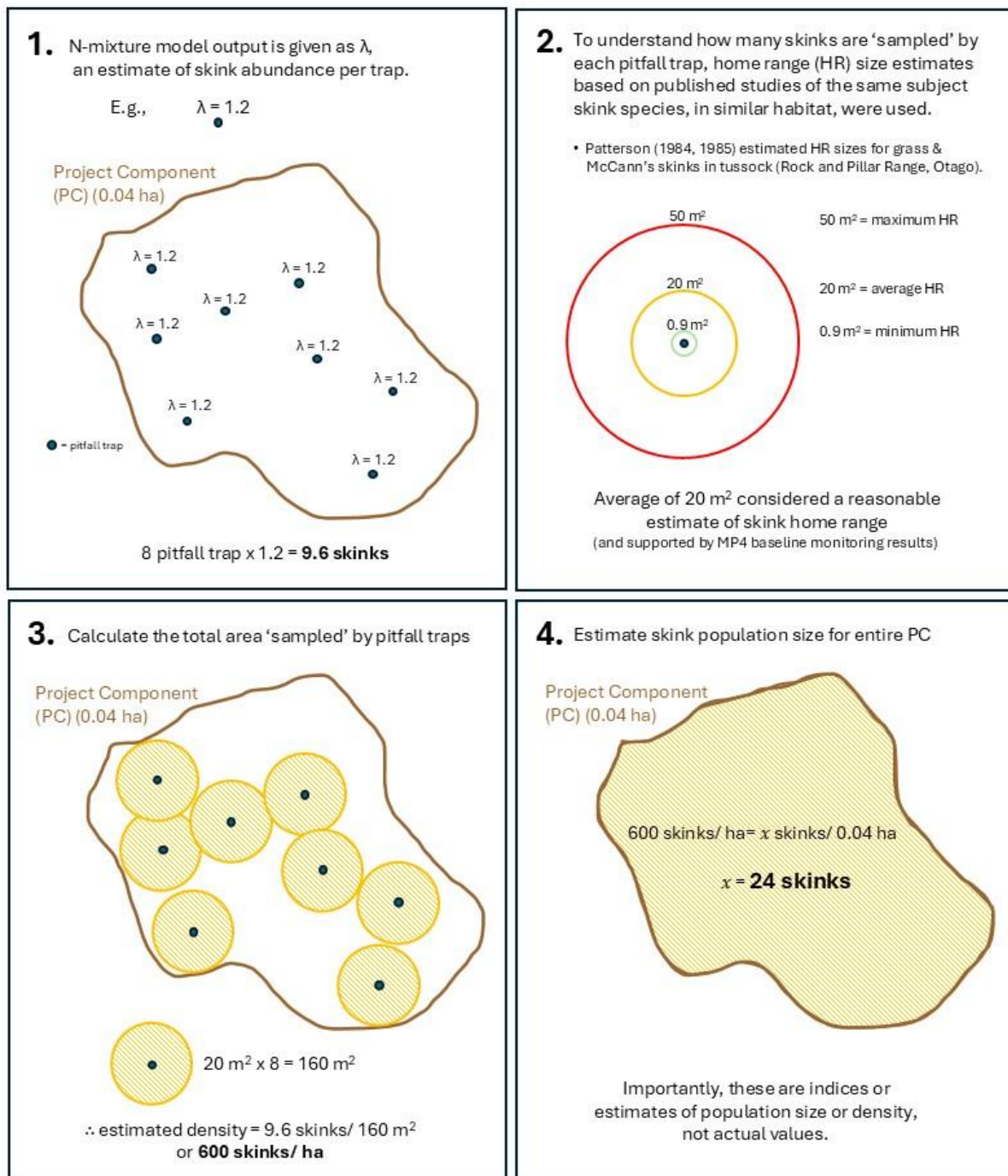
Reliability of Investigation

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. No guarantees are either expressed or implied.

APPENDIX A

ESTIMATING SKINK POPULATION SIZE OR DENSITY FROM N- MIXTURE MODELLING OUTPUTS

Estimating skink abundance and density using N-mixture models (theoretical example)



Underlying assumptions:

- That the Patterson (1984, 1985) study site is directly comparable to Macraes MP4 PCs.
- Uniform skink distribution across the landscape, irrespective of habitat.

APPENDIX B

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))

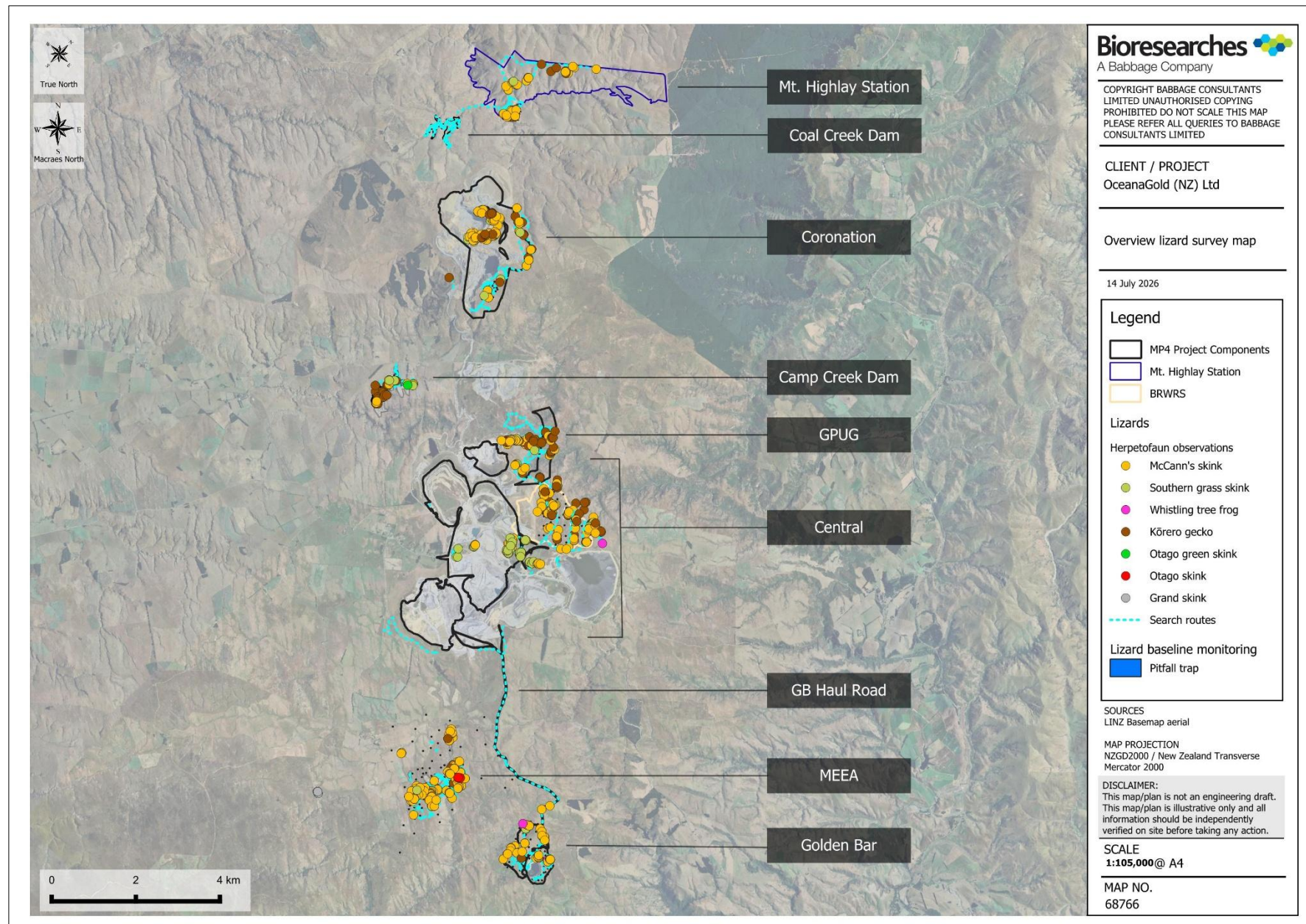
Magnitude	Description
Very high	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very 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

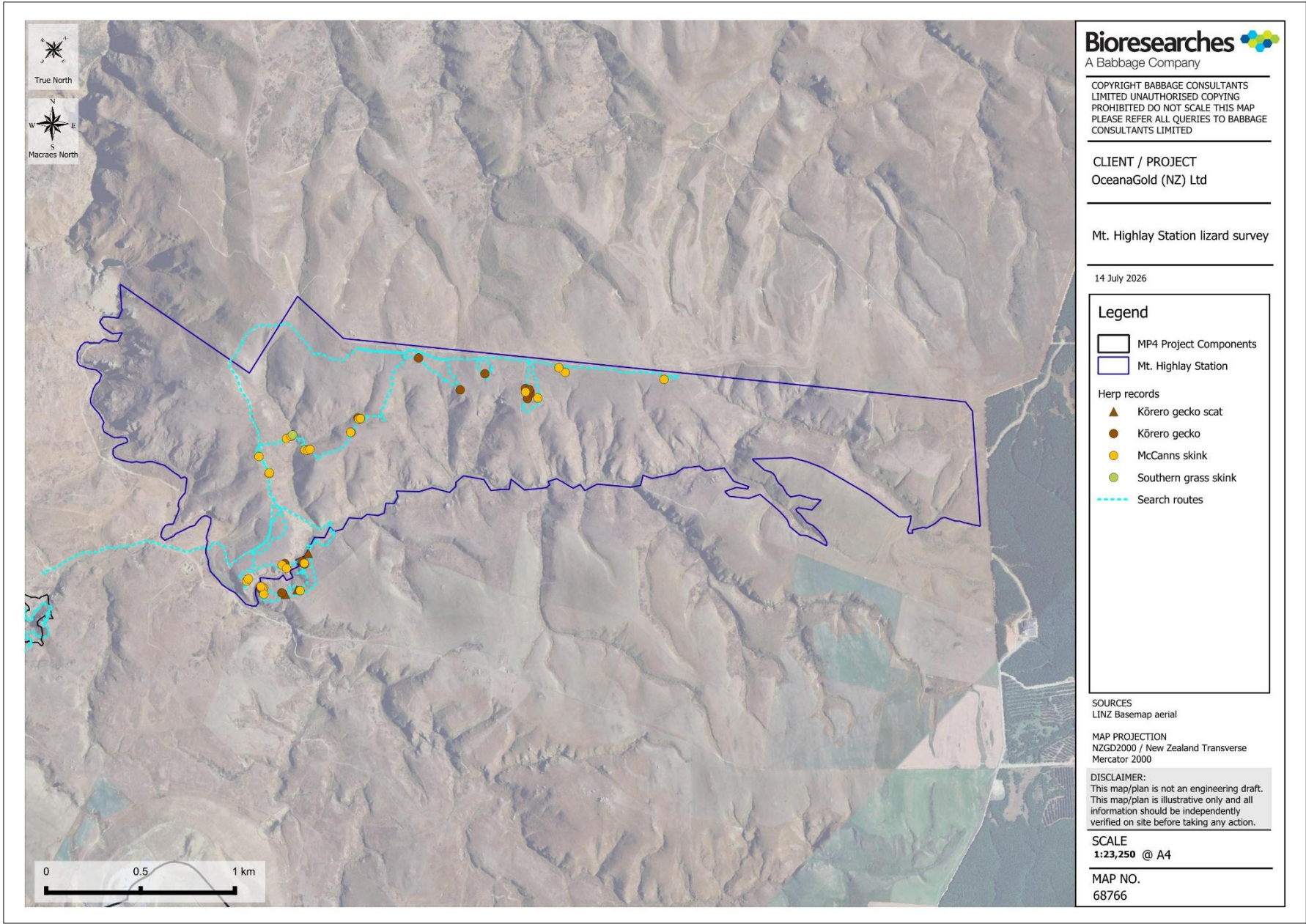
Table 10. Criteria for describing level of effects (Adapted from Regini (2000) and Boffa Miskell (2011))

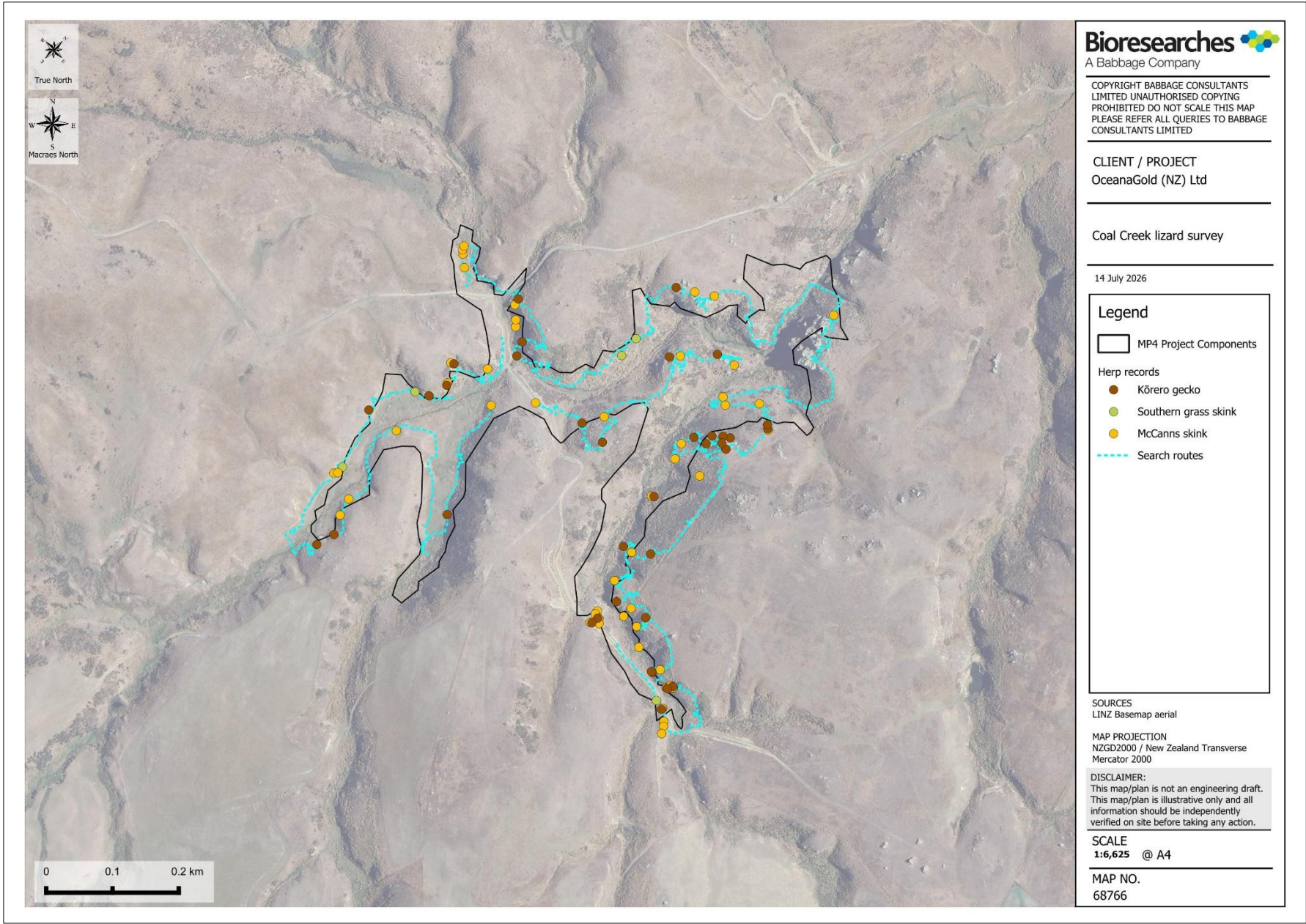
Ecological Value ► Magnitude ▼	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very Low	Very low	Very low	Very low
Positive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

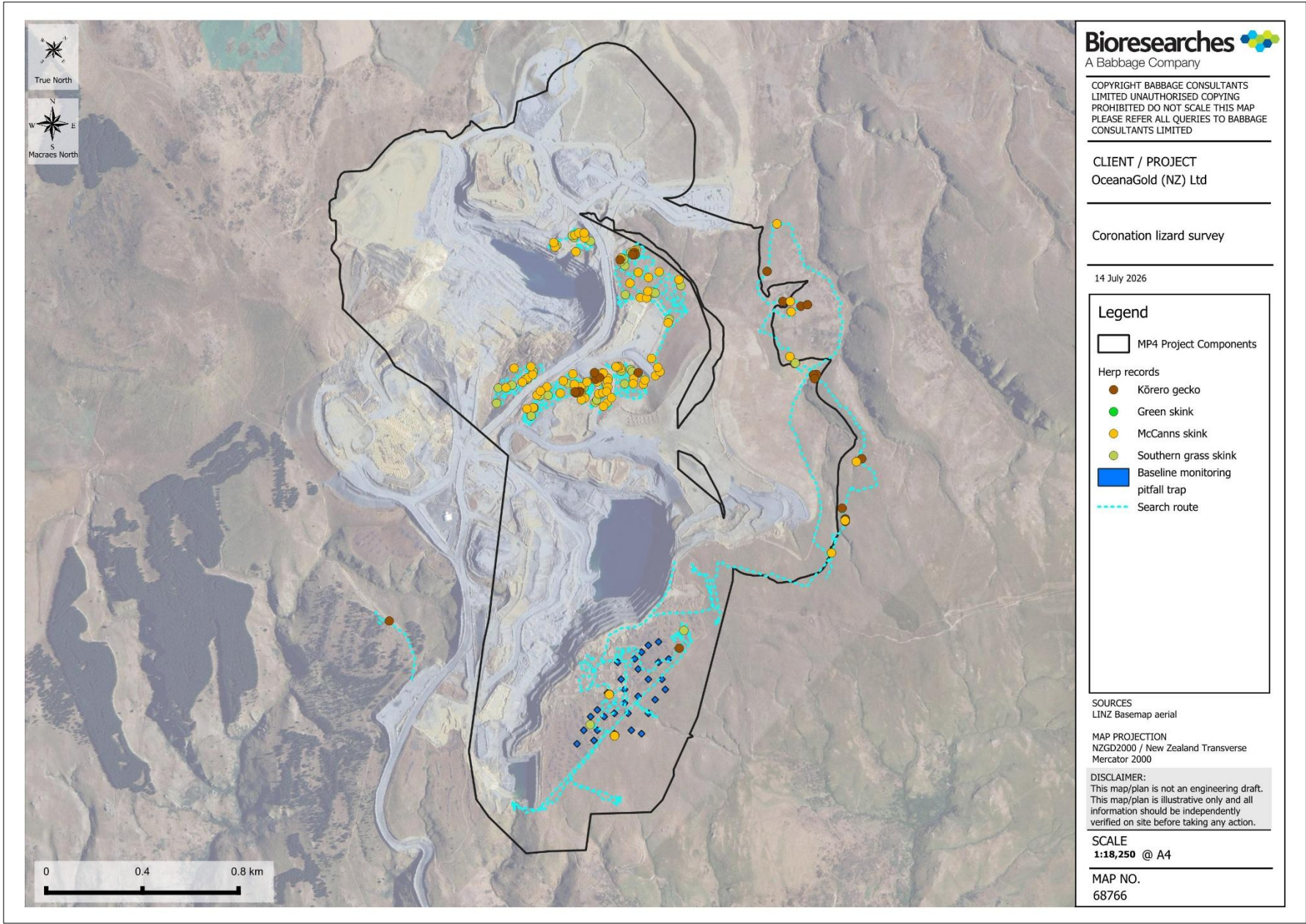
APPENDIX C

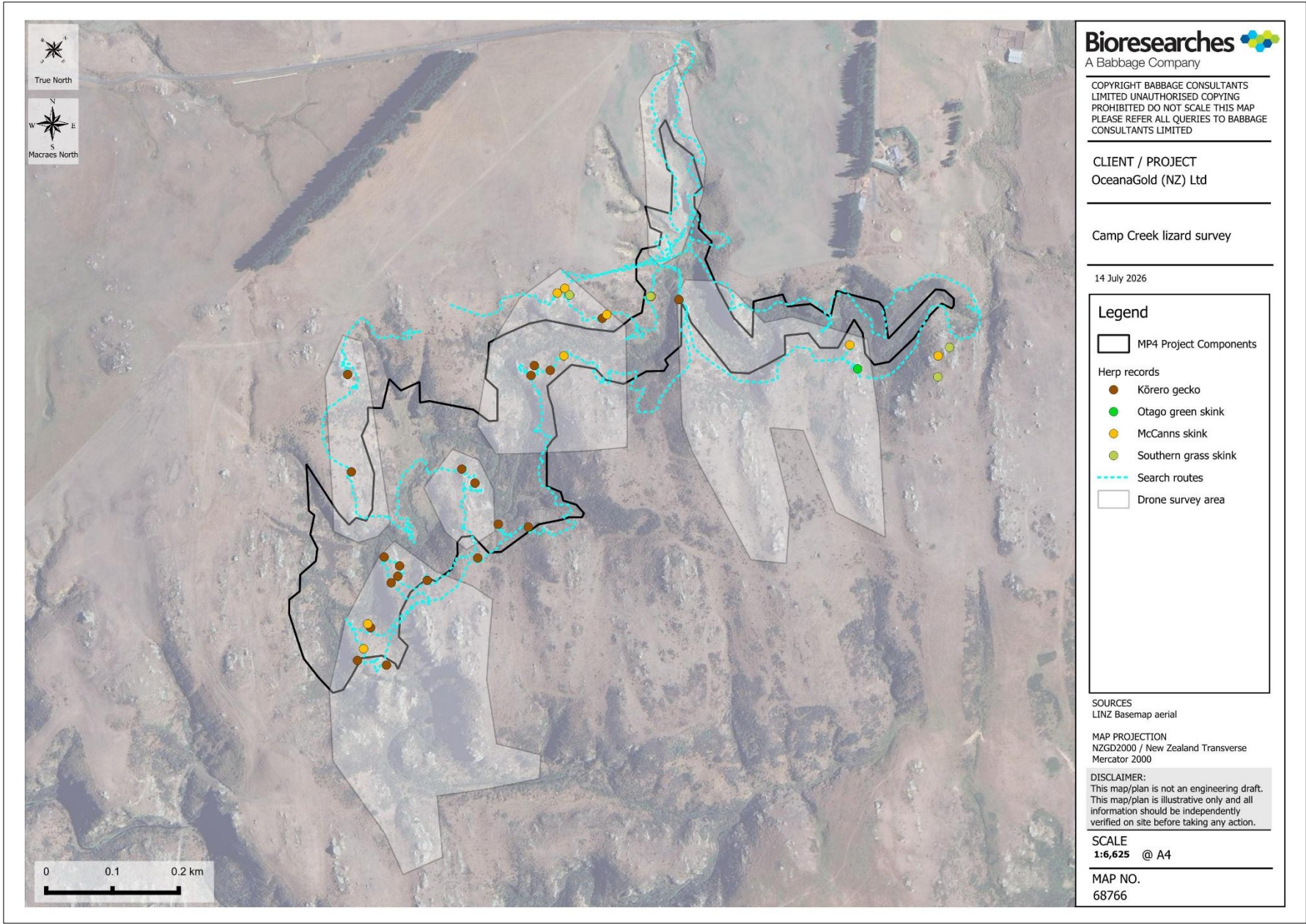
LIZARD SURVEY AREAS

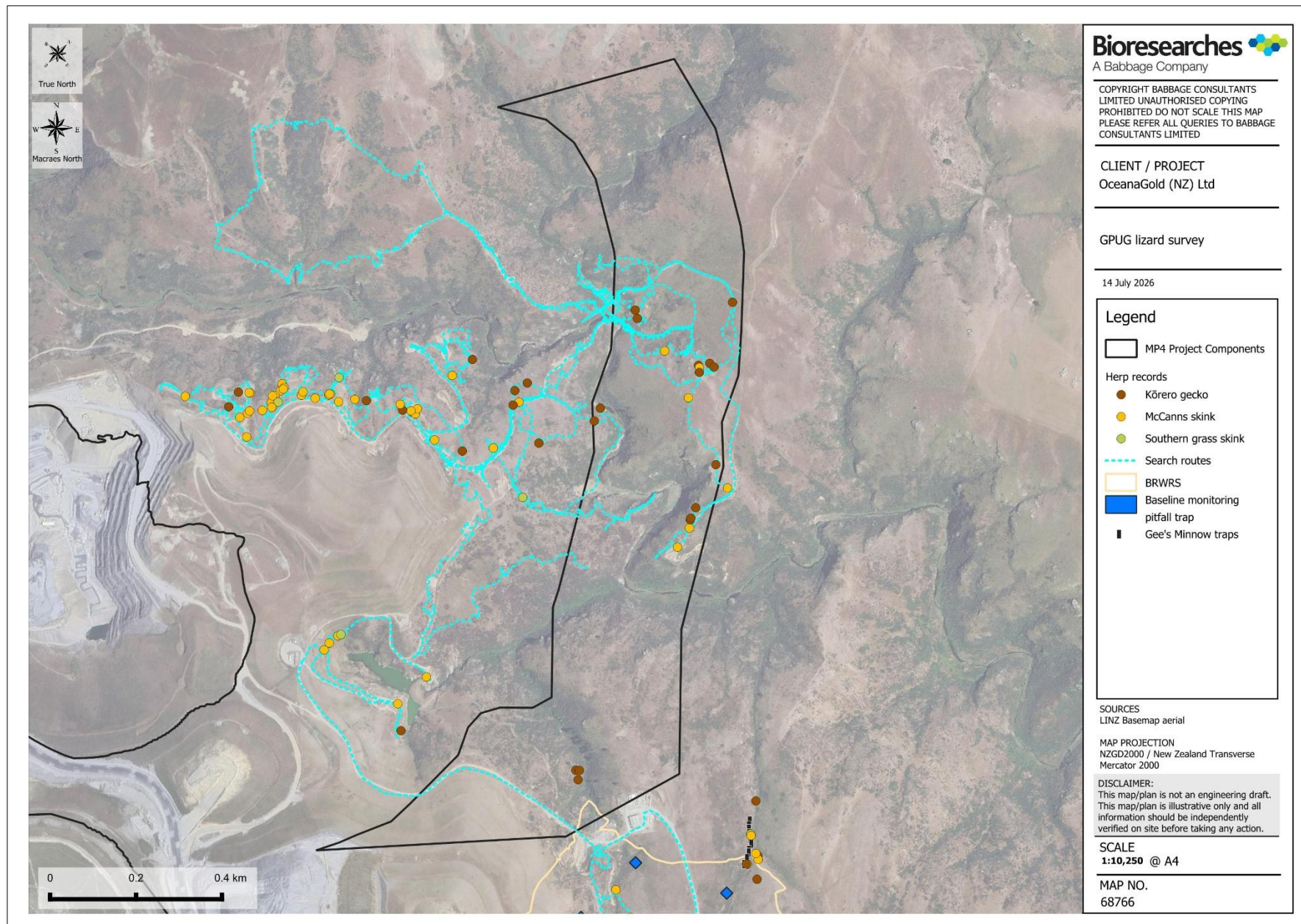


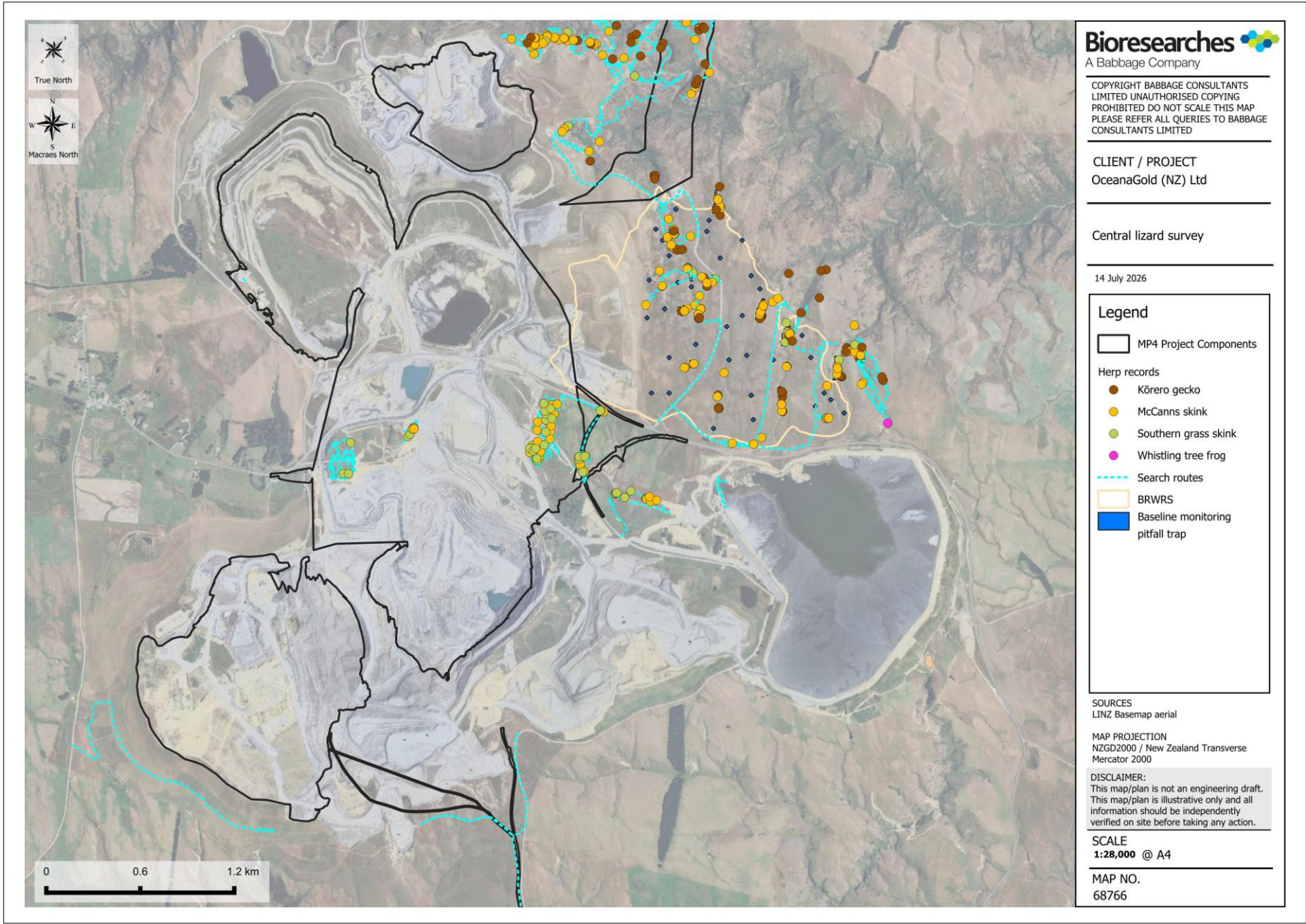


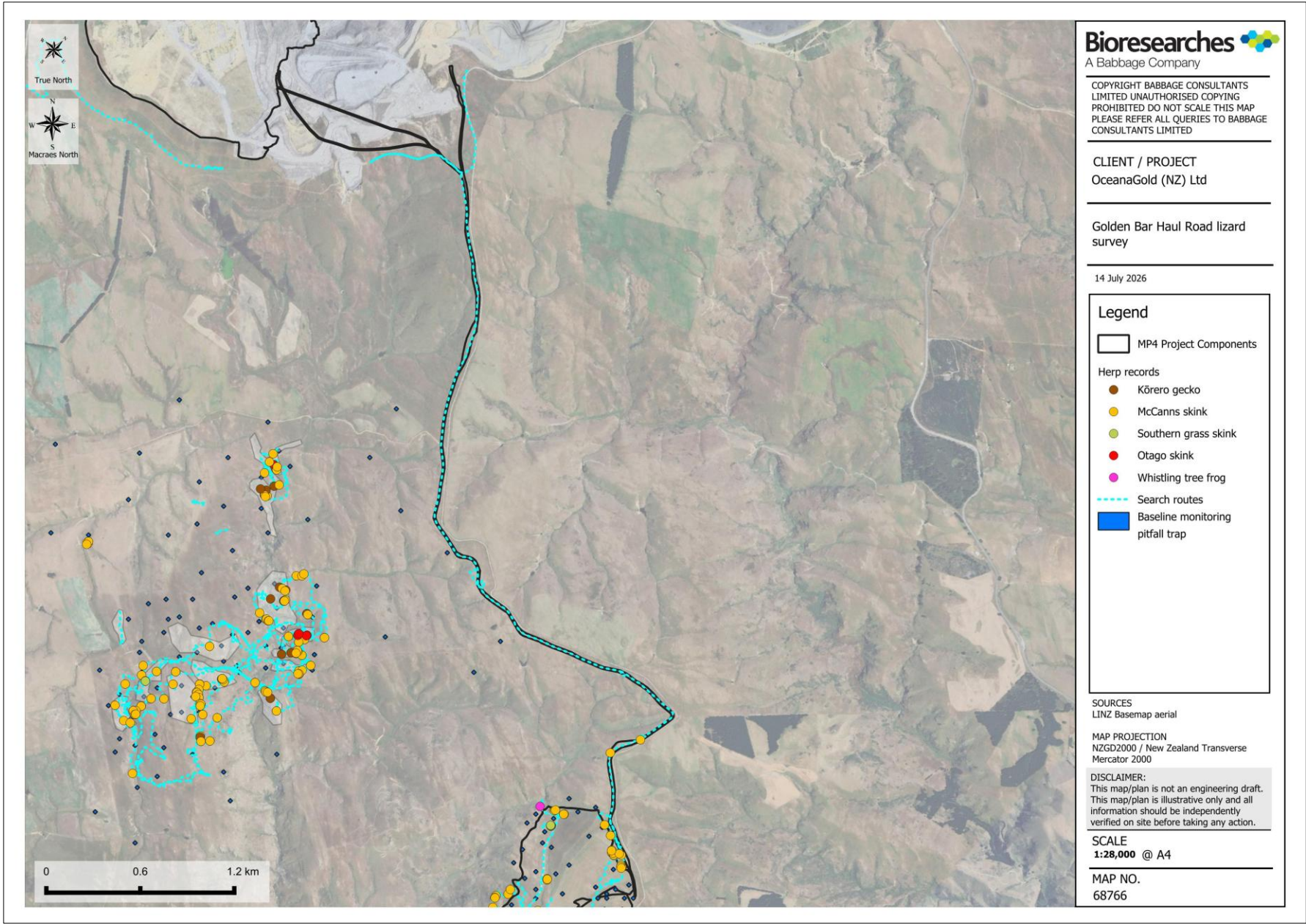


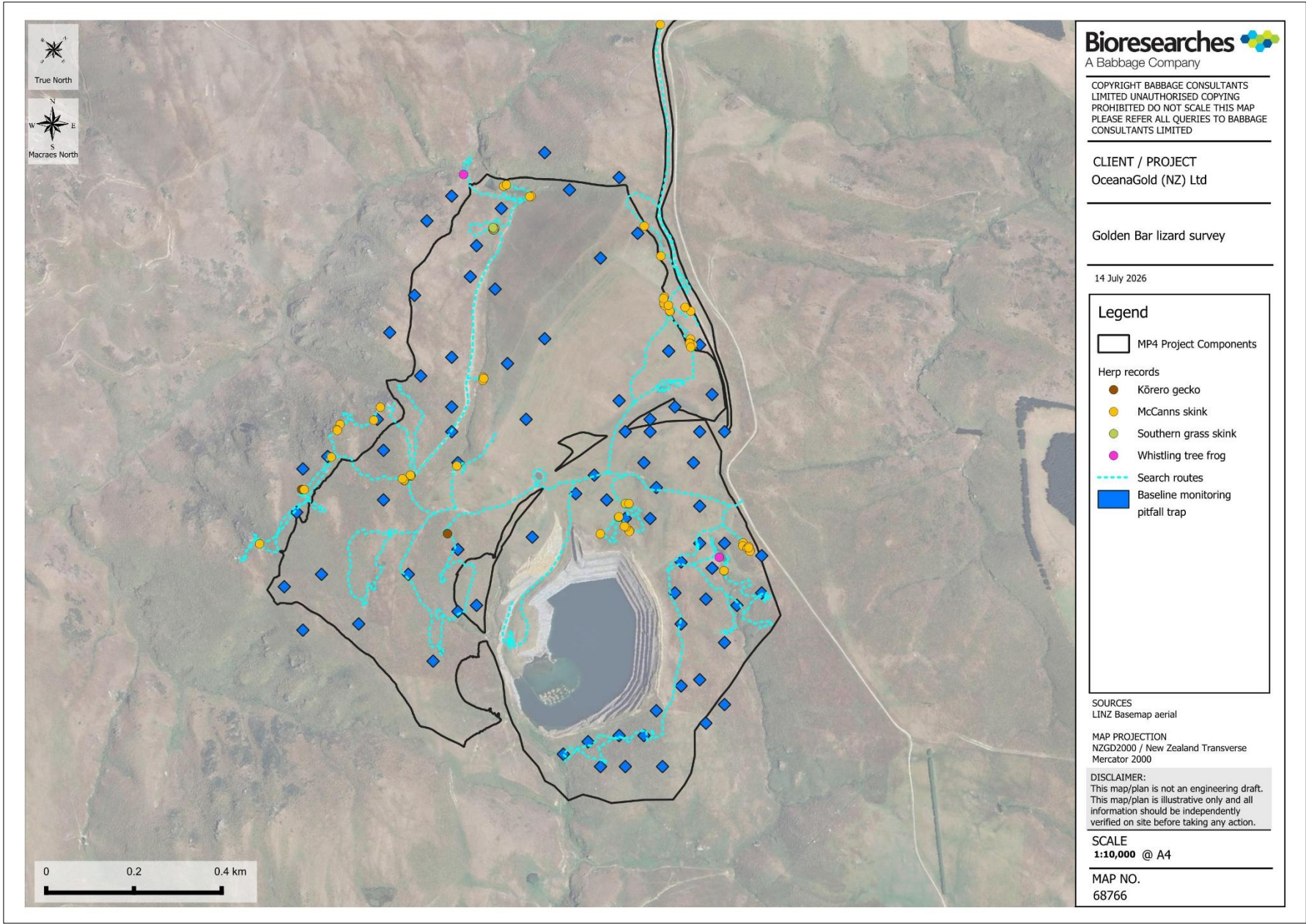


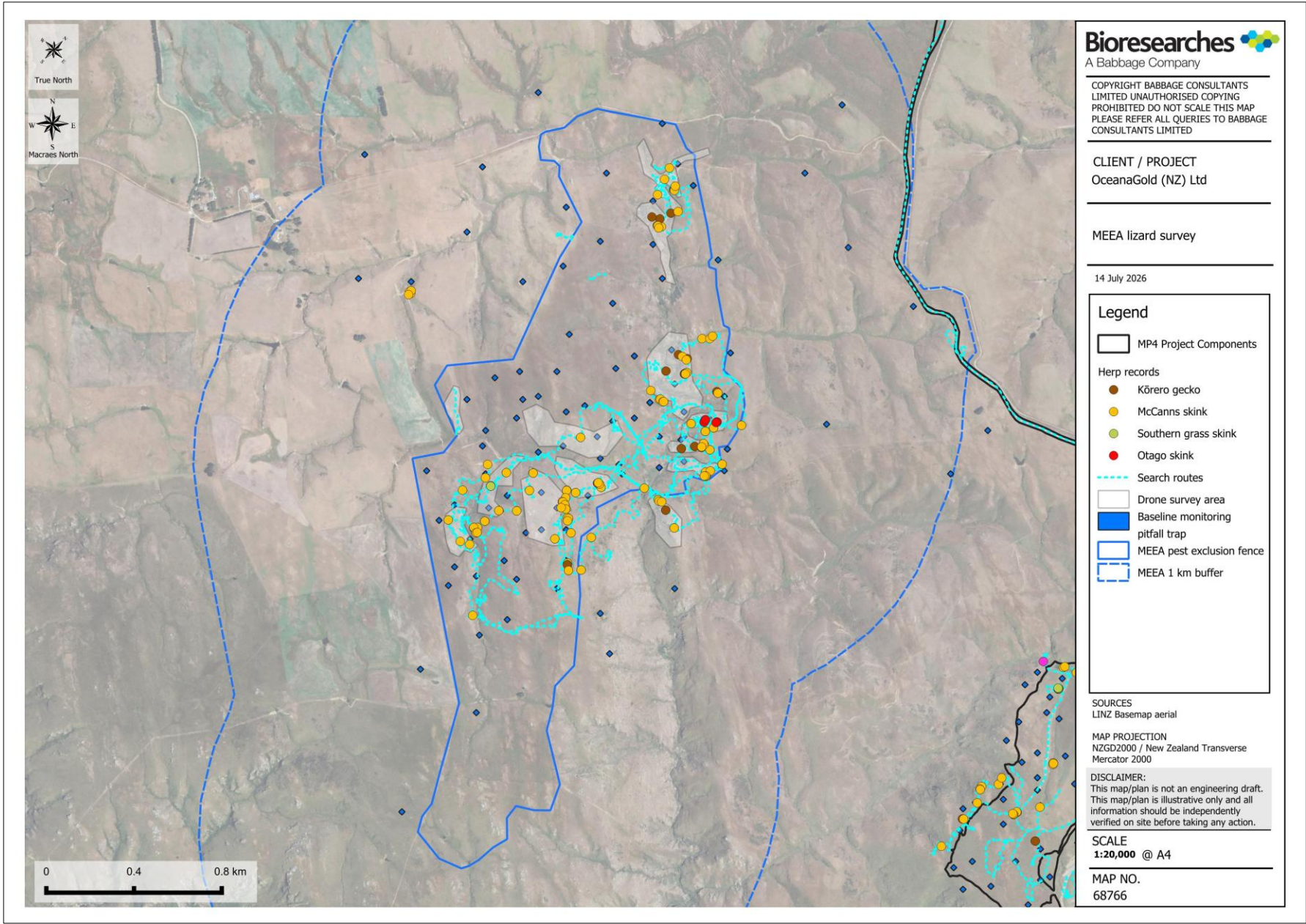






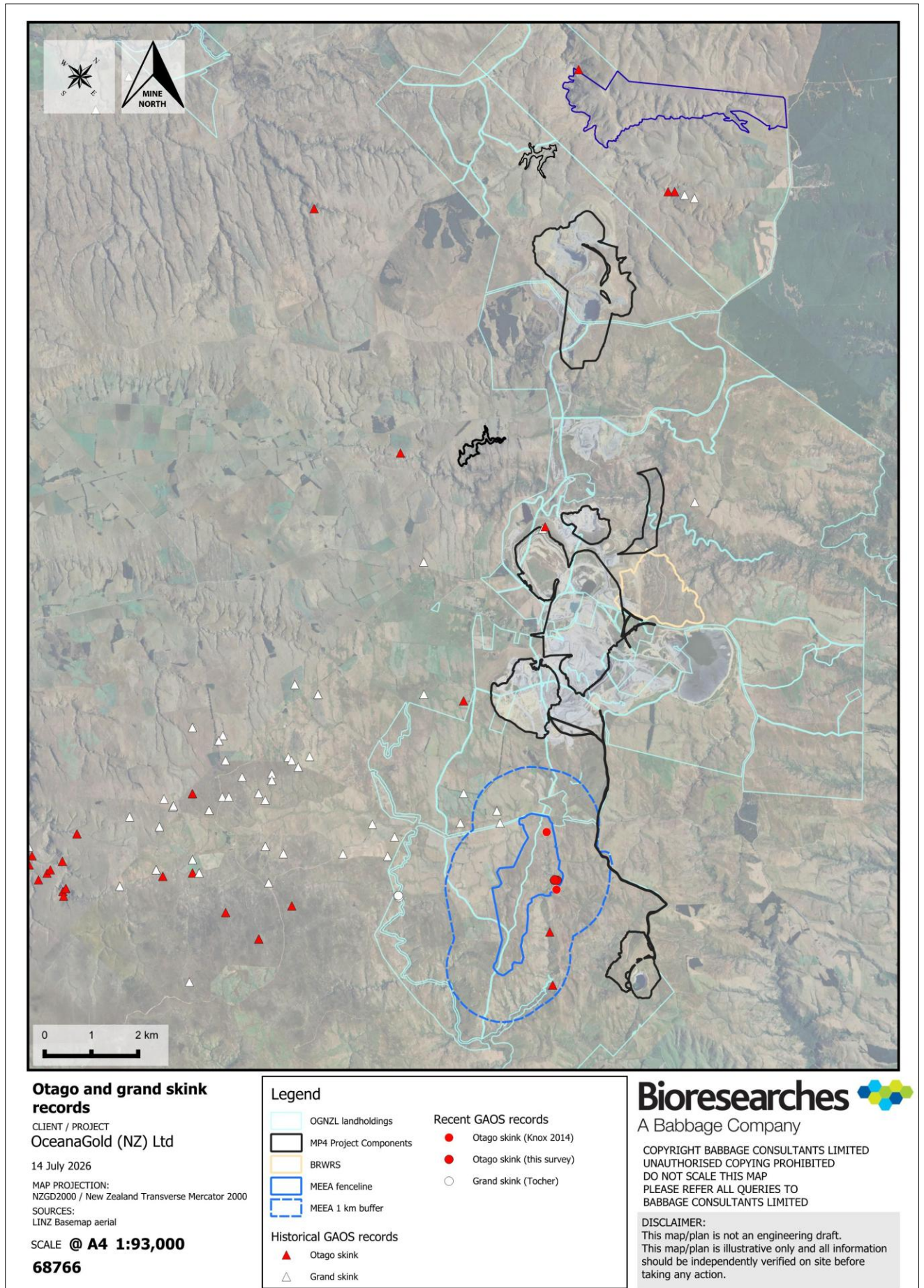


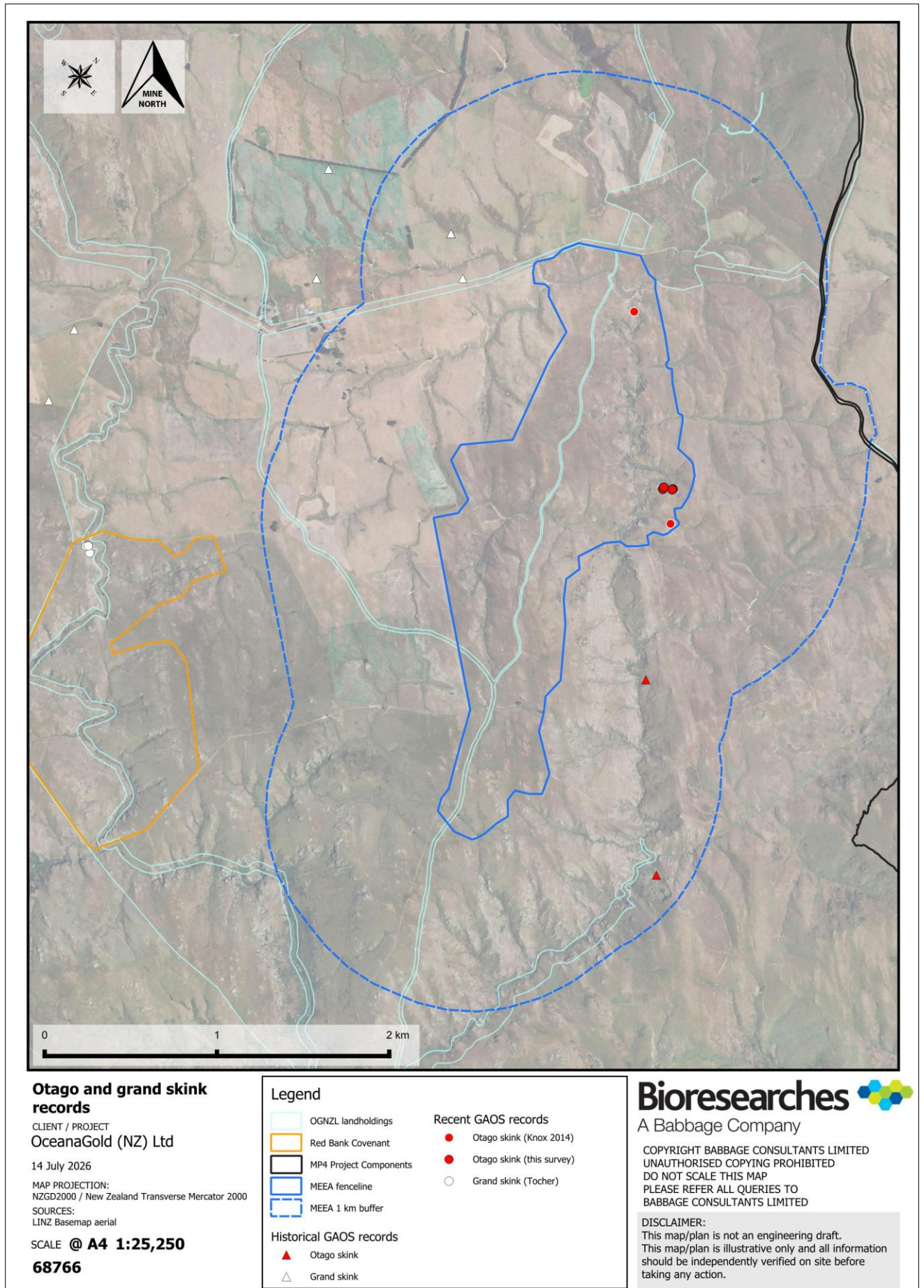




APPENDIX D

GRAND AND OTAGO SKINK RECORDS ON OGNZL LANDHOLDINGS AND WITHIN THE WIDER SURROUNDING LANDSCAPE





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