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LIZARD MANAGEMENT PLAN

MACRAES PHASE 4 PROJECT

14 February 2025

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PREPARED BY: DYLAN VAN WINKEL
BIORESEARCHES (BABBAGE CONSULTANTS LTD.)
68 BEACH ROAD, AUCKLAND
DYLAN.VANWINKEL@BIORESEARCHES.CO.NZ

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CHRIS WEDDING, ECOLOGY MANAGER
BIORESEARCHES (BABBAGE CONSULTANTS LTD.)

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1 EXECUTIVE SUMMARY

- OceanaGold (New Zealand) Limited is proposing to extend the life of mine (LOM) at its Macraes Gold Project (MGP). The Macraes Phase 4 (MP4) Stage 3 Project is an extension to the existing consented projects and would extend the LOM to around year 2030. The MP4 Project is comprised of 11 Project Components (PCs), each of which represents an area of mine that would be subject to development, including the construction of new haul roads, realignment of existing roads, mining pit and waste rock disposal area expansions.
- A herpetofauna survey between April and September 2022 confirmed the presence of at least three native lizard taxa (*Oligosoma maccanni*, *Oligosoma chionochloescens*, and *Woodworthia* "Otago/ Southland large") in areas either directly and/ or indirectly impacted by the proposed MP4 activities. All three taxa are legally protected, and the latter two species are listed at 'At Risk—Declining' under the New Zealand threat classification system.
- An assessment of herpetofauna values and effects[1] identified that in the absence of mitigation measures, a level of effect ranging from Very low to High depending on the nature of the PC could be expected on native lizards. To avoid and/ or reduce the level of effect, the mitigation hierarchy (avoid, remedy, mitigate, offset, or compensate) was applied and measures to mitigate effects on native lizards and their habitat were outlined.
- This Lizard Management Plan identifies and guides actions required to manage lizards (and their habitats[2]) during the MP4 Project activities. Its purpose is to ensure that impacts on native lizards are reduced as far as practicable to comply with environmental legislation. Activities outlined in the LMP will be implemented under a Wildlife Act 1953 Authority (WAA), issued by the Department of Conservation for the purpose of protecting native wildlife (e.g., lizards).
- Measures proposed by OGL to address adverse effects on native lizards:
    - Avoidance of higher value lizard habitat through project redesign and refinement, avoidance of indirect effects of mining operations on the immediately surrounding landscape, and prioritisation of previously disturbed land for siting new project infrastructure to avoid unnecessary effects on undisturbed lizard habitat.
    - Remediate and rehabilitate waste rock stacks and re-create rocky habitats for lizards through deposition of larger aggregate and boulders.
    - Mitigate impacts by salvaging a target of 2,100 lizards from the impact areas and relocating them into an approximately 45 ha area where mammalian predators have been controlled and excluded by a combination of predator control and a pest-proof fence. The predator control operation will be two-phased to account for project timelines and will involve an interim intensive predator control programme over approximately 20 ha of land (surrounded by approximately 574 ha of buffer control), followed by the construction of the fence and eradication of predators within. Also,

[1] Bioresearches (2024). Herpetofauna Assessment: Macraes MP4. Unpublished technical report prepared for OceanaGold Limited. 68 p.
[2] The loss of vegetation and lizard habitat is largely addressed by the MP4 Impact Management Plan (Ahikā Consulting, 2024a).

mitigate any potential indirect effects of the MP4 activities on surrounding lizard habitat through site controls and operating practices.

- Offset and compensate for residual effects on native lizards and their habitat by applying an offset package (Whirika Consulting (previously Ahika Consulting) 2025), that includes contingencies, adaptive management, and long-term lizard monitoring to ensure stated goals are achieved in specified timeframes. An initial no net loss target has been established, but this is to be refined/ confirmed following consultation with relevant stakeholders.

- A key component of the LMP is the robust lizard monitoring programme that will provide information crucial for the evaluation of the impact and successes or otherwise of enacted management measures. The monitoring programme will include baseline monitoring, buffer area monitoring, and post-release lizard monitoring, which commenced in April 2024 and will continue for at least 10 years, or until no net loss/ Net gain targets are reached.
- A range of compensatory actions are provided for as contingency measures for unanticipated adverse effects on lizards resulting from the MP4 Project.

2 INTRODUCTION

OceanaGold is proposing to extend the life of mine (LOM) at its Macraes Gold Project (MGP). The Macraes Phase 4 (MP4) Stage 3 Project (hereafter "MP4 Project") is an extension of existing consented projects (e.g., Macraes Phase 3 [MP3]) and would extend the LOM to around year 2030. The primary development activities associated with the MP4 Project include open mining pit expansions (Coronation Pit Stage 6 and associated spillway for the pit lake, Innes Mills Pit Stages 9–10, and Golden Bar Stage 2 Pit), waste rock disposal (in pit backfilling and extending the Golden Bar waste rock stack), disposal of tailings from the ore processing in the Frasers Pit, rehandling waste rock from Northern Gully Waste Rock Stack, stockpiling of low grade ore, and a minor road realignment of Golden Bar Road.

The MP4 Project covers a total area of approximately 607 ha (i.e., Zone of Impact; ZOI), which includes a 329 ha impact footprint area (where mining activities will take place) and a 221 ha buffer zone (a 100 m buffer area surrounding the impact footprint where indirect effects of mining activities may be realised). The 607 ha project area is divided into 11[3] Project Components (PCs), each of which represents an area of mine that would be subject to development. The PCs range in size and are distributed widely across the OGL landholdings (Figure 2.1). Existing resource consent (consented under Macraes Phase 3, MP3) is held by OGL for mining activities over all except approximately 101 ha of the 607 ha MP4 Project area. Stage 3 seeks to obtain resource consent for an extension of mining activities over the differential area of land, which includes 101 ha of land directly impacted by mining and approximately 110 ha in a surrounding buffer zone where indirect effects are anticipated (i.e., some of the areas within the ZOI are already consented and therefore, effects on those areas have already been considered and addressed elsewhere) (Table 2.1; Figure 2.1).

The MP4 mining activities are expected to have potential adverse ecological effects on a range of biodiversity values within the ZOI (Whirika Consulting 2025), including impacts on resident, protected native lizards (Bioresearches 2024). Direct impacts on lizards are expected to occur over an area of approximately 90 ha of land that supports suitable lizard habitat. Accordingly, management measures for native lizards and their habitats are required to mitigate the adverse impacts resulting from the mine development (Bioresearches 2024) and a Wildlife Act Authority (WAA) is required to authorise lizard mitigation activities (i.e., lizard salvage and relocation). This Lizard Management Plan (LMP) has been prepared to identify and guide actions required to ensure potential adverse effects on lizards resulting from the MP4 mine developments are appropriately managed and that any activity that potentially impacts native lizards complies with environmental legislation (notably the Wildlife Act 1953[4]).

[3] For the purposes of this document the Frasers Backfill and Frasers WRS are combined into a single Frasers BF/WRS project component as these features will have very similar effects (being earthworks associated with excavation or deposition of rock) with large areas of overlap.

[4] For MP4, mitigation measures required under the Resource Management Act (1991) to address impacts on vegetation and landscape features that provide significant habitat for indigenous biodiversity (including lizards) are outlined in the project wide MP4 Impact Management Plan (Ahikā Consulting, 2024a).

Areal extent measurements

Areal extent measurements (in hectares, ha) of Project Component footprints and buffer zones were taken from shape files supplied by OceanaGold Limited and using high-definition aerial photographs (i.e., LINZ aerial basemaps and high-definition drone images) in the GIS programme, QGIS (v. 3.34.3) and supplied by Whirika Consulting. Similarly, the areal extents of various identified habitat types were mapped based on the most recently available (2020–2023) aerial imagery.

While all measurements were regarded as accurate at the time of report delivery, it is acknowledged that variations in areal extents across this and other technical reports are expected due to mapping inconsistencies by authors. Any discrepancies will be minor and should be considered immaterial given the landscape scale of the MP4 Stage 3 project.

Table 2.1. Macraes Phase 4 Project Components (PCs) and their areal extents (in ha), total area inside the footprints and 100 m buffers of all PCs combined (overlapping), and the overall area of the Zone of Impact (ZOI) (i.e., all PCs combined including PC overlap). Figures supplied by Whirika Consulting. Note: that the extent of lizard habitat within each PC is markedly less than the total land area. Also, Coronation 5 is included because lizard habitat will be impacted but is not part of the MP4 Project.

	Project Component name	Acronym	PC footprint area (ha)	PC buffer area (ha)	Unconsented PC footprint area (ha)	Unconsented PC buffer area (ha)
1	Coronation 6 Pit	CO6 Pit	25.0	26.6	5.5	7.1
2	Coronation North Backfill	CN BF	37.6	30.5	0.1	2.1
3	Coronation Pit Lake Spillway	CPLS	1.3	8.7	0.2	2.2
4	Northern Gully Waste Rock Stack	NGWRS	21.2	23.2[5]	0	4.5
5	Golden Bar Stage 2 Pit	GB2 Pit	22.7	20.1	22.7	20.1
6	Golden Bar Waste Rock Stack	GB WRS	48.0	32.8	48.0	32.8
7	Golden Bar Road realignment (indicative)	GB RR	1.2	16.6	1.1	13.1
8	Golden Point Backfill Buttress	GP BB	49.4	61.1	14.2	21.3
9	Innes Mills Stage 9 Pit	IM9 Pit	5.6	15.6	3.5	6.1
10	Innes Mills Stage 10 Pit	IM10 Pit	5.9	16.3	5.9	10.5
11	Frasers Backfill/Waste Rock Stack	Frasers BF/WRS	111.3	26.5[6]	0	0
	Total area inside footprints and buffers (non-overlapping)		**329.2**	**278.0**	**101.2**	**119.8**
	Total area inside ZOI		**607.2**		**221**	
	Coronation 5	C05	31	59.8	0	0

[5] It should be noted that the NGWRS footprint area is highly conservative. That is, the actual extent of the impact associated with the rehandling of waste rock will be smaller the PC outline. Therefore, the 100 m buffer has not been applied and instead, represents an estimate of the total area inclusive of a buffer zone.

[6] Excludes buffer around Frasers WRS.

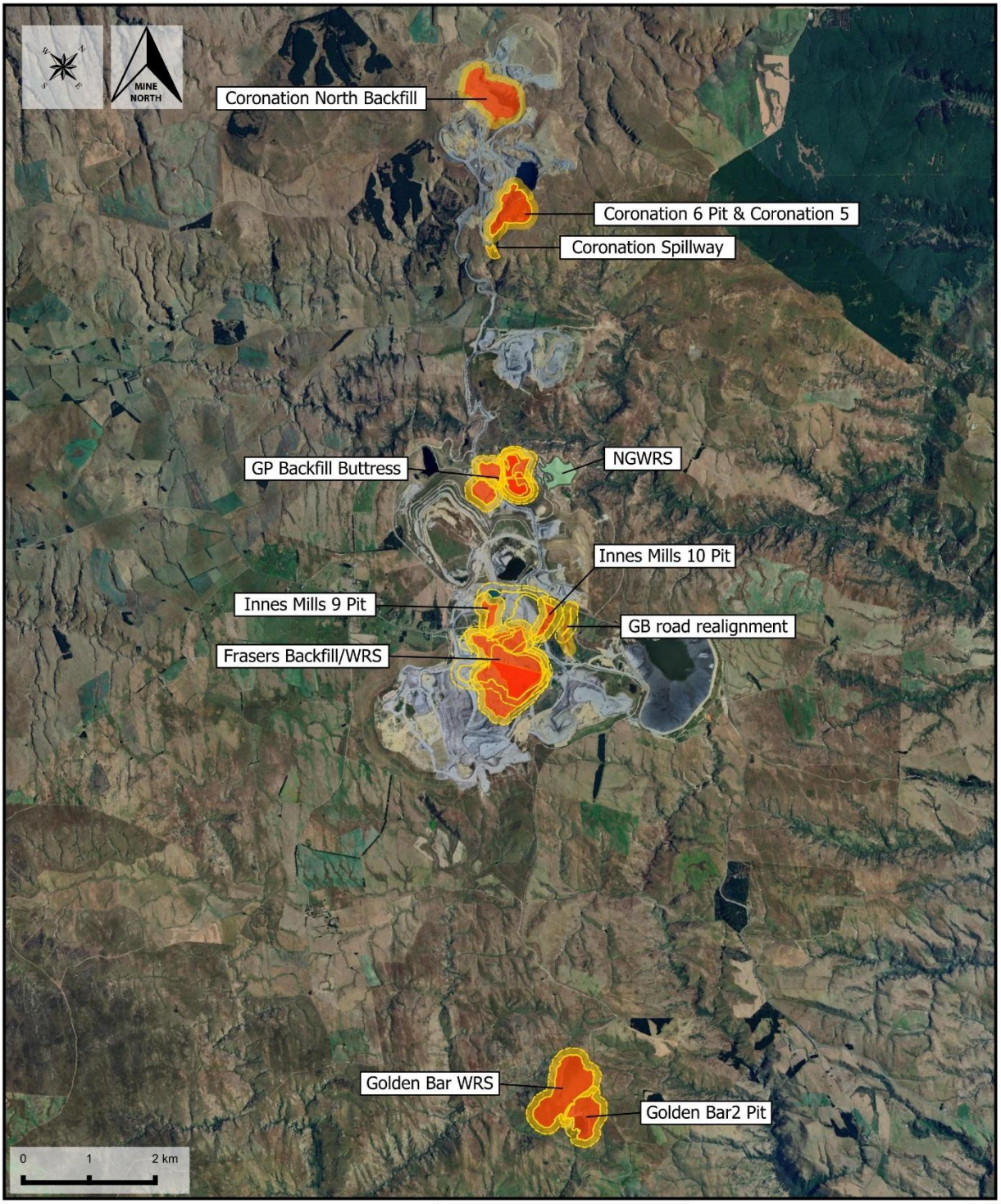

Figure 2.1
Macraes MP4 Stage 3: Zone of Impact (ZOI)

CLIENT / PROJECT
OceanaGold Limited

13 February 2025

MAP PROJECTION:
NZGD2000 / New Zealand Transverse Mercator 2000

SOURCES:
LINZ Basemap aerial

SCALE **@ A4 1:75,000**

61130#BEE09

Legend

MP4 Zone of Impact
Project Components

Impact areas (direct impact)

100 m buffer (indirect impact)

NOTE: Coronation 5 is not part of MP4

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3 CONTEXT OF THE LIZARD MANAGEMENT PLAN

Herpetofauna (reptiles and amphibians) comprise a significant component of New Zealand's terrestrial fauna. Mokomoko/ lizards (which includes skinks and geckos) are represented by 125 endemic taxa[7] (van Winkel *et al*. 2018; Hitchmough *et al.* 2021; Purdie 2022). Of these, more than 85% are classified as 'Threatened' or 'At Risk' of extinction under the New Zealand Threat Classification System (Townsend *et al.* 2008; Hitchmough *et al*. 2021; Rolfe *et al.* 2022). All native lizards are legally protected under the Wildlife Act 1953 ("WA") (and subsequent amendments) and significant habitats[8] of indigenous fauna (including lizards) are protected under the Resource Management Act 1991 ("RMA"). For Otago, the Proposed Otago Regional Policy Statement ("PORPS")[9] gives effect to the RMA through a variety of objectives and policies aimed at protecting, maintaining, and enhancing biodiversity values[10]. Thus, statutory obligations require the management of native lizards where they or their habitats are threatened by land disturbance or development.

A LMP is a site- or project-specific plan that is prepared to identify and guide actions required to manage lizards and their habitats when disturbance or modification to land is proposed. Lizard Management Plans aim to ensure that any activity that potentially impacts native lizards complies with environmental legislation. A LMP is implemented under a Wildlife Act 1953 Authority ("WAA") that is issued by the Department of Conservation ("DOC") for the purpose of protecting native wildlife (e.g. lizards).

3.1 PURPOSE OF THIS LMP

This Lizard Management Plan (LMP) has been developed to:

- Clearly document and describe the objectives, strategy, and actions that OGL will take to manage and mitigate adverse effects on native lizards arising from WAA and resource consent considerations relating to the MP4 Project and WAA considerations relating to Coronation 5.

Objectives of the LMP include:

- Detail the actions to be followed by OGL to avoid and minimise adverse effects of mining activities on lizard populations occurring in the MP4 Project and Coronation 5 areas;
- Ensure as far as practicable, that the management of lizards during the pre-mining, operation, and post-mining phases of the mine complies with any conditions or statutory approvals imposed;

[7] The term "taxa" is used instead of "species" because many New Zealand lizards, including some present within the project area, have not been formally described to species level.
[8] 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.
[9] The Proposed Otago Regional Policy Statement or PORPS is not yet operative. The hearings concluded in late 2023; however, it is not yet known when decisions will be issued.
[10] Under the PORPS, the following objectives and policies would apply to the Macraes Projects: Objectives ECO-01, ECO-02, and ECO-03 and Policies ECO-P1 (Kaitiakitaka), ECO-P2 (significant natural areas and taoka), ECO-P3 (protecting significant areas and taoka), ECO-P4 (provision for new activities), ECO-P6 (maintaining indigenous biodiversity), and ECO-P8 (enhancement). As well as APP2 – Significance criteria for indigenous biodiversity, APP3 – Criteria for biodiversity offsetting, and APP4 – Criteria for biodiversity compensation.

- Identify the methodologies that will be used to salvage and relocate lizards from affected areas to suitably protected and enhanced sites;
- Identify and implement measures to enhance populations of each lizard species in protected areas outside of the project impact areas (e.g., mitigation or offset sites) to achieve a no net loss (preferably net gain) outcome;
- Outline habitat enhancement measures relevant to lizards to be carried out within the MP4 and Coronation 5 mitigation sites;
- Identify monitoring that will be undertaken to assess progress against the objectives of the LMP and targets set in the MP4 Impact management plan (Whirika Consulting 2025); and
- Identification of compensatory actions to act as contingency measures for unanticipated adverse effects on lizards resulting from the MP4 Project.

3.2 MANA WHENUA AND STAKEHOLDER ENGAGEMENT

OceanaGold Limited has (since May 2022) and continues its efforts to engage with mana whenua and relevant stakeholders (DOC, Otago Regional Council, and lease holders) regarding cultural perspectives, land-use, and ecological management proposals (e.g., salvage and relocation of mokomoko/ native lizards) related to the MP4 Project. Cultural, social, and ecological perspectives, including the management and care of taonga/ taoka species, have been considered and incorporated into the LMP. OceanaGold Limited recognise the importance of mana whenua engagement in all aspects of the management of mokomoko as part of the MP4 Project (e.g., LMP refinement, capture, relocation, and monitoring) and are actively pursuing engagement with mana whenua directly and via Aukaha.

Since the LMP was first prepared, the Applicant has undertaken further direct consultation with Kāti Huirapa Rūnaka ki Puketeraki (who also represent Te Rūnanga o Moeraki and Ōtākou Runaka) on broader matters relating to OGL's operations at Macraes including consultation in respect of proposed lizard salvage for IM8, but there has not yet been direct discussion around the wildlife permit application for MP4.

Section 92 requests on the MP4 resource consents included questions which related to lizards, and these responses have been provided to the Councils. Engagement in respect of the MP4 Project has thus far not raised any significant concerns regarding the management of mokomoko. However, it is anticipated that further refinement to the proposed area, methods/ management actions proposed will occur through ongoing engagement with DOC, Waikato District Council ("WDC") and mana whenua.

3.3 PLAN STRUCTURE

This LMP addresses the management of effects related to the currently unconsented components of the MP4 Project for which mitigation, including salvage and relocation, and offsetting are required under both the RMA and the WA. The MP4 Project is comprised of several discrete project components across OceanaGold landholdings, and the effects management for all PCs are bundled together in one overarching Impact Management ('mitigation') Plan (Whirika Consulting 2025). The LMP does not

explicitly cover the management of effects on lizard habitats affected by MP4 (this is covered in the Impact Management Plan; Whirika Consulting 2025), but the LMP does address habitat enhancement required to increase the probability of the survival and long-term persistence of salvaged and relocated lizards as part of the MP4 Project. To provide clarity around how this LMP and the WAA application sit within this structurally complex project, a flow chart has been developed (Figure 3.1).

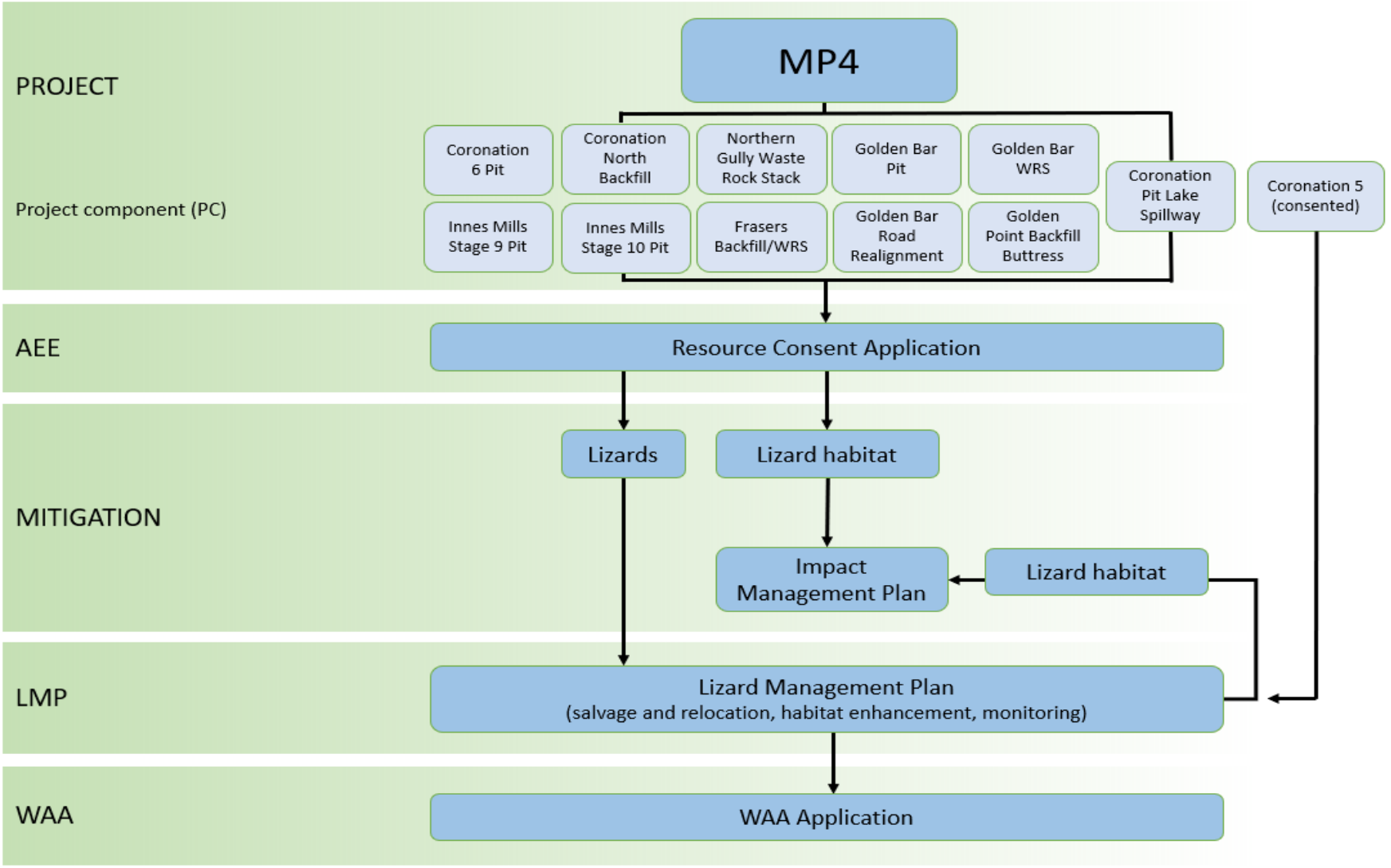

Figure 3.1. Flow diagram demonstrating how the different elements of the MP4 Project are related. Coronation 5 (consented) is also included but does not form part of the MP4 Project. Note: Only Project Components (PCs) mentioned in this LMP are shown. AEE=Assessment of Ecological Effects; LMP=Lizard Management Plan; WAA=Wildlife Act Authority.

3.3.1 Consistent and informed approach

To ensure national consistency, this LMP generally adheres to the Department of Conservation guidance and key principles for lizard salvage and transfer in New Zealand (NZLizardTAG 2019; Figure 2.2) though, some elements of the LMP have been adapted based on the expert opinion of the Project herpetologist.

Figure 2.2. The Department's nine key principles for lizard salvage and transfer:

1. Lizard species' values and site significance must be assessed at both the impact (development) and receiving sites.
2. Actual and potential development-related effects and their significance must be assessed.
3. Alternatives to moving lizards must be considered.
4. Threatened lizard species require more careful consideration than less-threatened species.
5. Lizard salvage, transfer and release must use the best available methodology.
6. Receiving sites and their carrying capacities must be suitable in the long term.
7. Monitoring is required to evaluate the salvage operation.
8. Reporting is required to communicate outcomes of salvage operations and facilitate process improvements.
9. Contingency actions are required when lizard salvage and transfer activities fail.

Pertinent to the current LMP are the recommendations that emerged from the Deepdell North III Project lizard salvage (LizardExpertNZ 2021; Appendix I). Several important lessons learnt, including but not limited to the risk of underestimating salvage numbers, 'stopping rules'[11], and appropriate salvage season, have been taken into consideration in developing this LMP. Additionally, the LMP recommendations have been considered alongside a draft lizard management strategy for Macraes mine to ensure a consistent approach and alignment with OGL's overarching lizard management strategy.

Since this LMP forms part of a wider ecological assessment and effects management package, the Plan has been informed or guided by, the following documents and information where relevant:

1. The Macraes MP4 Herpetofauna Survey report (Bioresearches 2024a);
2. MP4 Project: Assessment of Effects on Vegetation & Avifauna. (Ahikā Consulting 2024b);
3. MP4 Impact Management Plan (Whirika Consulting 2025);
4. Analysis of Macraes Flat lizard monitoring data – year 1 (baseline) (MacKenzie & Bratt 2024).
5. Macraes Continuity Consents Project (Innes Mills 8 Extension) Lizard Management Plan (Bioresearches 2024b) and IM8 Lizard Findings Report (Bioresearches 2024c); and
6. Draft lizard management strategy: OceanaGold Operations, Macraes Flat (in development).

[11] A stopping rule is a mechanism for deciding whether to cease a process based on the present position and past events. In the context of this LMP, a stopping rule is a trigger (e.g., amount of effort, number of lizards) that once reached, leads to the cessation of a lizard salvage programme.

3.4 RESPONSIBILITIES AND COMPETENCIES

The roles and responsibilities for implementation of the LMP are set out as follows. OGL hold overall accountability and the environmental/ sustainability and project managers will be responsible for implementation and compliance with this part of the over-arching Impact Management Plan (Whirika Consulting 2025).

The Project herpetologist (Appendix V) takes a technical lead and must be suitably qualified and experienced in lizard handling, including salvage and relocation operations, and hold a current WAA to capture, handle and relocate protected native lizards. The Project herpetologist will liaise with the other roles through OGL's Project Manager. Supporting ecologists and/ or ecological sub-contractors that will contribute to the LMP protocols required before, during, and after mine development shall be suitably experienced in lizard surveys and handling and will act under the supervision of the lead Project herpetologist.

4 LIZARD EFFECTS ASSESSMENT OVERVIEW

A comprehensive effects assessment for the MP4 Project is provided by Whirika Consulting (2025) and Bioresearches (2024a). These documents should be read in conjunction with this LMP; however, the effects assessments are briefly summarised below for convenience.

4.1 AREAS OF AFFECTED HABITAT

4.1.1 MP4 Project

The MP4 Project is comprised of 11 PCs that are widely distributed across the OGL landholdings (Figure 2.1). Each PC represents an area of land that would be subject to the effects of mining development and all PCs combined form the ZOI. Detailed descriptions of the vegetation and lizard habitat values identified within each of the PCs is provided by Ahikā Consulting (2024), Whirika Consulting (2025), and Bioresearches (2024a).

Ten broad habitat types[12] were identified in the ZOI and of these, eight were considered to provide habitat value for lizards. These included rock tors/ tor complexes, shrubland, tussockland, riparian vegetation, exotic grassland (including rough and improved pasture, and rehabilitated WRS surfaces), ephemeral wetlands, exotic treeland (e.g., pine plantation, shelterbelts), and slash/ felled pine (Figure 4.1). Project components or parts of PCs that occur within existing pit disturbance limits (e.g., mine workings) were not considered to hold values for native lizards (e.g., Frasers BF/WRS). The areal extents of each habitat type within each of the PCs is presented in Table 4.1.

4.1.2 Coronation 5

The area of affected habitat comprising Coronation 5 includes approximately 7 ha of the consented Coronation Pit footprint that has yet to be mined. Three broad habitat types, including tussockland (degraded), slash/ felled pine, and ephemeral wetland, were identified in the Coronation 5 footprint (Table 4.1).

[12] Whirika Consulting (2025) identified 13 vegetation types but for the purpose of the LMP, “Rehabilitated Waste Rock Stack”, “Improved pasture” and “Rough pasture” have been consolidated into an ‘exotic grassland’ category.

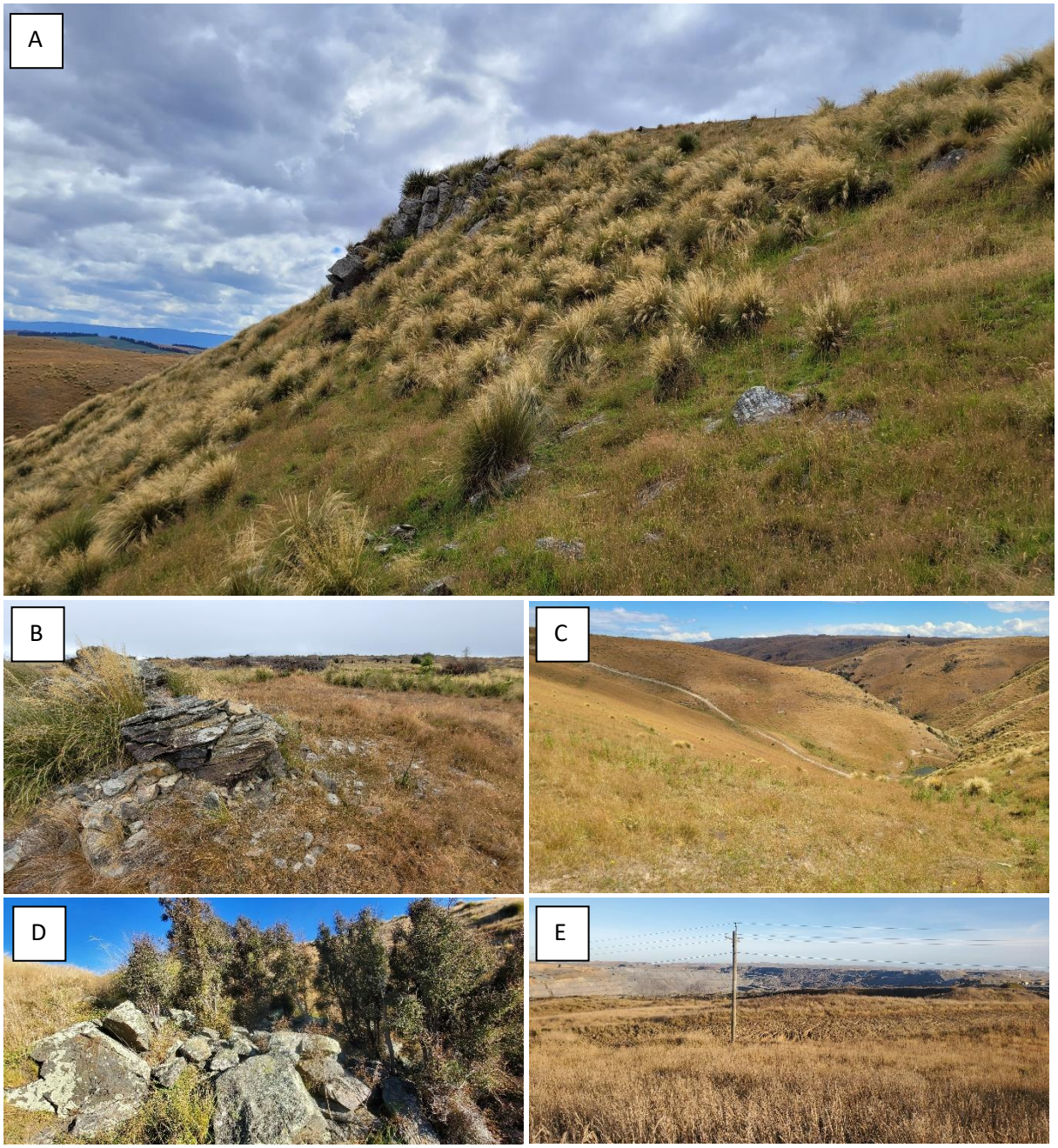

Figure 4.1. Selection of photographs showing some habitats considered suitable for lizards across the MP4 Project area (A, Golden Bar WRS; B, Coronation Pit; C & D, Golden Bar WRS; and E, Golden Bar Road Realignment).

Table 4.1. Areal extent (ha) of lizard habitat types directly impacted (i.e., within the footprint) in each Project Component (PC). Total values include PC/ habitat overlap. The number of tors is represented by an approximate count. Green shaded squares indicate suitable lizard habitats. "Mine workings" and "Open water (ponds)" habitat categories do not provide suitable habitat for lizards.

		MP4 Project Component												
	Habitat type	CO6 Pit	CN BF	CPLS	NGWRS	GB2 Pit	GB WRS	IM9 Pit	IM10 Pit	Frasers BF/WRS	GB RR	GP BB	Total (MP4 footprint)	CO5
Decreasing lizard habitat quality ↓	No. rock tors/ tor complexes	1	0	0	0	6	5	0	0	0	0	0	**12**	0
	Rock tors	0.002	0	0	0	0.01	0.03	0	0	0	0	0	**0.04**	0
	Shrubland	0	0	0	0	0	0.04	0	0	0	0	0	**0.04**	0
	Tussockland	2.9	0	0.2	0	4.9	23.5	0	0.2	0	0.06	0	**31.7**	5.9
	Riparian vegetation	0.02	0	0	0	0.03	0.3	0	0.1	0	0	0	**0.42**	0
	Exotic grasses/pasture	0	0.02	0	17.6[13]	8.8	24.0	0.6	3.6	0	0.9	0.6[13]	**56**	0
	Ephemeral wetlands	0.02	0	0	0	0	0	0	0	0	0	0	**0.02**	0.08
	Felled pine	2.6	0	0	0	0	0	0	0	0	0	0	**2.60**	1.0
	Exotic treeland (incl. pine)	0	0	0	0	0	0	0	0	0	0	0	**0**	0
	Mine workings	0	0.03	0	3.6	9.0	0	2.9	2	0	0.26	13.6	**33.6**	0
	Open water (ponds)	0	0	0	0	0.05	0.1	0	0	0	0	0	**0.15**	0
Total (all suitable lizard habitat)		**5.5**	**0.02**	**0.2**	**16.7**	**13.7**	**48.0**	**0.6**	**3.9**	**0**	**0.9**	**0**	**89.3**	**7**
Total (all habitat types)		**5.5**	**0.05**	**0.2**	**21.2**	**22.8**	**48.0**	**3.5**	**5.9**	**0**	**1.2**	**14.2**	**122.5**	**7**

[13] Habitat types are referred to as "Rehabilitated mine workings" in Whirika Consulting (2025). NGWRS habitat considered suitable for lizards based on Knox *et al*. 2013.

4.2 AFFECTED LIZARD SPECIES AND POPULATIONS

The Otago Region supports a high diversity and abundance of lizards due in part to the presence of rock outcrops and the nature of schist rock, which tends to form horizontal crevices and large flat pancake-like stacks of rock slabs that provide habitat and refuge for lizards. The region is known to support 30 native lizard taxa and two introduced frogs (DOC Herpetofauna database; accessed November 2022). The Macraes Ecological District ("Macraes ED"), which covers an area of 1.14 M ha, supports a much lower herpetofauna diversity; represented by seven (or eight[14]) lizard taxa (Table 4.2). Macraes ED is the strong hold for populations of 'Nationally Endangered' grand skink (*Oligosoma grande*) and Otago skink (*O. otagense*).

4.2.1 MP4 lizards

The diversity of lizards known from the MP4 Project ZOI includes three species, kōrero gecko (*Woodworthia* "Otago/Southland large", 'At Risk—Declining'), tussock skink (*Oligosoma chionochloescens*, 'At Risk—Declining'), and McCann's skink (*O. maccanni*, 'Not Threatened'). Not all taxa were recorded in each of the PCs. Where detected, the relative abundance of McCann's skink and kōrero gecko in rocky outcrop/ tor, shrubland, rough pasture, and tussockland was relatively high, and tussock skinks were found at moderate abundance in an isolated pocket of grassy habitat and damper ground at Golden Bar WRS. Indeed, Golden Bar WRS supported a much higher abundance of lizards relative to other PCs (Bioresearches 2024).

The potential presence of other lizard species such as grand skink, Otago skink, Otago green skink, and herbfield skink in the PCs cannot be dismissed based solely on the results of the herpetological surveys (Bioresearches, 2024). Recent (2014) records of Otago skinks in the upper Murphys catchment on OGL landholdings (EcoGecko, 2015) and very recent records of Otago green skinks (January 2023) and grand skinks (December 2023) from the landscape immediately surrounding the MP4 Project area suggest that remnant populations of these large and rare lizards may persist in the parts of the MP4 Project area. Similarly, the existence of herbfield skink in the wider surrounding landscape suggests the possibility of this taxon being present in one or more PCs. The rocky outcrops and schist tors in the buffer zone of the Golden Bar WRS appear to offer highly suitable habitat for the large saxicolous[15] grand and Otago skinks and the damper riparian and seep/ wetland habitats at Coronation 6 Pit and Golden Bar WRS could harbour residual populations of herbfield skink, or even the rarer Otago green skink.

4.2.2 Coronation 5 lizards

The confirmed diversity of lizards known from the Coronation 5 area includes two species tussock skink (*O. chionochloescens*, 'At Risk—Declining') and McCann's skink (*O. maccanni*, 'Not Threatened'). A third species, kōrero gecko (*W.* "Otago/Southland large", 'At Risk—Declining') may also be present given its occurrence in the adjacent Coronation 6 Pit PC. Lizard abundances in the CO5 area are similar to those recorded in the Coronation 6 Pit PC.

[14] There is one 'suspect' record of a *Naultinus* sp. gecko (likely *N. gemmeus*) from the southern extent of the Macraes ED. This record has largely been ignored for purpose of this assessment because of the high unlikelihood that *Naultinus* gecko populations currently exist in the ED (Jewell & McQueen, 2007).

[15] Living on or among rocks.

Table 4.2. Herpetofauna of the Macraes Ecological District, corresponding NZ threat status (Hitchmough *et al.*, 2021) and occurrence within 20 km of the MP4 and CO5 Project areas. 20 km distance arbitrarily chosen to reflect 'local' lizard populations.

	Common name	Scientific name	NZ threat status*	Date of most recent record	Recorded in Macraes ED	Reported within 20 km
Native	Otago skink	*Oligosoma otagense*	Nationally Endangered	2016	✓	✓
	Grand skink	*Oligosoma grande*	Nationally Endangered	2023[A]	✓	✓
	Korero gecko	*Woodworthia* "Otago/ Southland large"	At Risk – Declining	2023	✓	✓
	Jewelled gecko	*Naultinus gemmeus*	At Risk – Declining	2019[B]	?[A]	✓
	Tussock skink	*Oligosoma chionochloescens*	At Risk – Declining	2024	✓	✓
	Herbfield skink	*Oligosoma murihiku*	At Risk – Declining	2019	✓	✓
	Otago green skink	*Oligosoma* aff. *chloronoton* "eastern Otago"	At Risk – Declining	2023[C]	✓	✓
	McCann's skink	*Oligosoma maccanni*	Not Threatened	2024	✓	✓
Exotic	Whistling tree frog	*Litoria ewingii*	Introduced & Naturalised	2023	✓	✓

[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 Waianakarua Scenic Reserve, located north of Shag River and approximately 17.5 km northeast of MP4 Project area.

[C] 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 the Coronation 6 Pit PC (M. Tocher, unpub. data). This record was later verified 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).

4.3 LIZARD POPULATION SIZE ESTIMATES

Understanding the size of populations occurring in the impact areas is fundamental to accurately assessing potential effects of the proposed mining development. However, determining the size of a lizard population size is inherently difficult due to imperfect detection caused by ecological and behavioural traits such as their small size, cryptic (secretive) nature of many taxa (e.g., herbfield skink, Otago green skink), the complexity of the habitats in which they live (e.g., some habitats such as rock tors cannot be searched/ surveyed effectively), and the large size of the impact areas.

For this LMP, attempts were made to estimate lizard density and lizard population size in select PCs and across MP4 impact area as a whole. Three methods were used, including 1) literature informed lizard density (skinks/ ha) extrapolations, 2) N-mixture modelling, and 3) Capture-Mark-Recapture analyses. Additionally, actual lizard densities (skinks/ ha) calculated following the Innes Mills 8 lizard salvage (Bioresearches 2024b, c) were used to test the accuracy of the population estimates. The population estimation methods are briefly explained below.

4.3.1 Density extrapolation (literature informed)

To estimate lizard population sizes, we synthesised data from multiple sources, including on-site survey results and both grey and peer-reviewed scientific literature.

Specifically, information was gathered from the following sources:

1. Systematic searches across areas of OceanaGold landholdings (including the MP3 Back Road Waste Rock Stack ["BRWRS"], unnamed tributaries of Deepdell Creek, and the MP4 impact areas) by a herpetologist (D. van Winkel) in September 2022 and February 2023 (Bioresearches 2024a);
2. Walkthrough and targeted Gee's Minnow trapping surveys of BRWRS and unnamed tributaries of Deepdell Creek by a herpetologist (M. Tocher, Lizard Expert NZ) over March to April 2022;
3. Historical lizards survey and monitoring results from previous projects/ stages of the Macraes mining operation (Ecogecko 2013a, 2013b, 2015; LizardExpertNZ 2021);
4. Historical lizard salvage results from previously projects/ stages of the Macraes mining operation (Ecogecko 2013b; LizardExpertNZ 2021); and
5. Published literature on estimated population densities of lizards in similar habitat types in the Otago Region (Patterson 1984, 1985; Dixon 2004; Clark 2006; Jones 2013).

We retrieved estimated lizard density values for populations inhabiting similar habitat types in the Otago Region. The density values were then scrutinised by the Project herpetologist and professional judgment used to make predictions of expected population size ranges for each taxon within the MP4 impact area ("informed density range estimates") (Table 4.3). The Project herpetologist's field observations of habitat extent, quality, and relative lizard abundance across the impact areas, and professional experience implementing numerous lizard salvages nationally weighed heavily in considering the expected population size ranges for each species. Furthermore, previous Macraes mine lizard salvage numbers and densities provided by Ecogecko (2013b) and LizardExpertNZ (2021) provided 'real-life' data that assisted in refining the estimates.

The informed density estimates were then extrapolated to the PC, overall MP4 impact, and Coronation 5 areas to approximate the likely lizard population sizes.

It is acknowledged that this method of population estimation is prone to subjectivity, uncertainty, and error, not in the least because lizards are not uniformly distributed across the landscape and extrapolation can result in misleading estimates. Furthermore, the absence of methods to accurately quantify population size for some lizard species (e.g., kōrero gecko) means that estimates of lizard population size using this method will underrepresentation true values.

Table 4.3. Lizard density estimates (# lizards/ hectare; indexed and modelled; refer to relevant 'Reference' for methods) for Otago species reported in the literature. Information on sampled sites and habitats is also provided for context. Note: population estimates generated from the baseline monitoring programme will refine or potentially replace the literature-based density estimates presented in the table.

	Densities (lizards/ ha) reported in the literature & reference										
Reference	**Patterson (1984)**	**Patterson (1985)**	**Dixon (2004)**	**Clark (2006)**	**Jones (2013)**	**Ecogecko (2013a)**	**Ecogecko (2013b)**	**Ecogecko (2013b)**	**Ecogecko (2015)**	**LizardExpertNZ (2021)**	**Informed density range estimate[A] (lizards/ ha)**
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)	(Rock outcrops, gullies; Green skink survey, Murphys, ~35 ha)	(Tussock, rank grass, rock tors; MPIII Deepdell North III salvage, 109 ha)	**For MP4 Project areas**
Species											
Tussock skink	-	769[B]	572–2250[C]	2–35[B]	683–777	1–8	3	13		5	**10–50**
McCann's skink	423				~300	-	11	0		14	**10–300**
Kōrero gecko	-	-	-	-	-	3–9	0.2	7		14	**5–50**
Herbfield skink	No available density data										**0–0.1**
Otago green skink	No available density data										**0–0.06**
Grand skink	No available density data										**0–0.06**
Otago skink									0.06		**0–0.06**

[A] Estimated density range informed by literature and by field experience/ expert opinion of the author (Project herpetologist).

[B] Figure includes tussock, McCann's, and cryptic (herbfield) skink combined.

[C] Figures include tussock and McCann's skink combined.

4.3.2 Modelled population estimates

Statistical methods (N-mixture modelling and Capture-Mark-Recapture) were used to estimate the size of lizard (skink) populations occurring within the MP4 impact area. This was achieved through a landscape scale lizard trapping and release programme involving repeated count and capture-mark-recapture data collection that was implemented in April 2024.

To provide confidence in data collection approach and analytical methods, the study design was reviewed and validated by an experienced biometrician from *Proteus*, an ecological statistical consulting company based in Mosgiel, New Zealand.

A stratified random sampling regime was used to select locations for pitfall trap arrays that were installed across representative areas[16] in 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 area of the landscape (Figure 4.2; Table 4.4). A 20 m x 20 m grid was chosen as this encompassed the expected home range of target lizard species (i.e., estimate home range size of 20 m^2 for McCann's and tussock skinks; Patterson 1985); therefore, ensuring each sampling site was spatially independent. At each sampling site, a pitfall trap (covered by an *Onduline* ACO) was installed. The pitfall traps were activated (cleared of vegetation and fruit bait added) and inspected over nine consecutive days between 15th and 23rd April 2024. Lizard capture (and recapture) data were collected over this period. These data were modelled by a qualified biostatistician (see MacKenzie & Bratt 2024; Appendix VI) to generate estimates of skink[17] relative abundance and detection probabilities. 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 PCs and the overall MP4 impact area.

4.3.2.1 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 (c.f. 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).

[16] Representative PCs (e.g., CO6 Pit, GB2 Pit, GB WRS, BRWRS, and Murphys EEA) were used in sampling regime as it was not feasible to operate pitfall traps across all 11 PCs in the nine-day sampling period.
[17] Kōrero geckos were excluded from the analysis due to very low captures.

4.3.2.2 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 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 (N-mixture models are at the scale of a single trap) (MacKenzie & Bratt 2024).

4.3.2.3 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 PC and in the MP4 impact area 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 tussock skinks ($\overline{x}$ = 20.6 m^2 as reported by Patterson 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 determine the expected density of skinks within MP4 PCs that did not have specific sampling data (e.g., CN BF, NGWRS, CO5 etc.) an average skink density from CO6 Pit, GB2 Pit, and GBWRS[18] (including upper and lower estimates) was calculated. The averaged skink density was extrapolated across the areal extents of suitable lizard habitat in each PC of the MP4 impact area (~90 ha) and Coronation 5 (7 ha) to estimate affected lizard population sizes (Table 4.5).

[18] Other sampling areas (e.g., BRWRS, MEEA, MurphysBuffer) were excluded as they did not occur inside the MP4 impact area and were not considered representative of the MP4 PCs or Coronation 5.

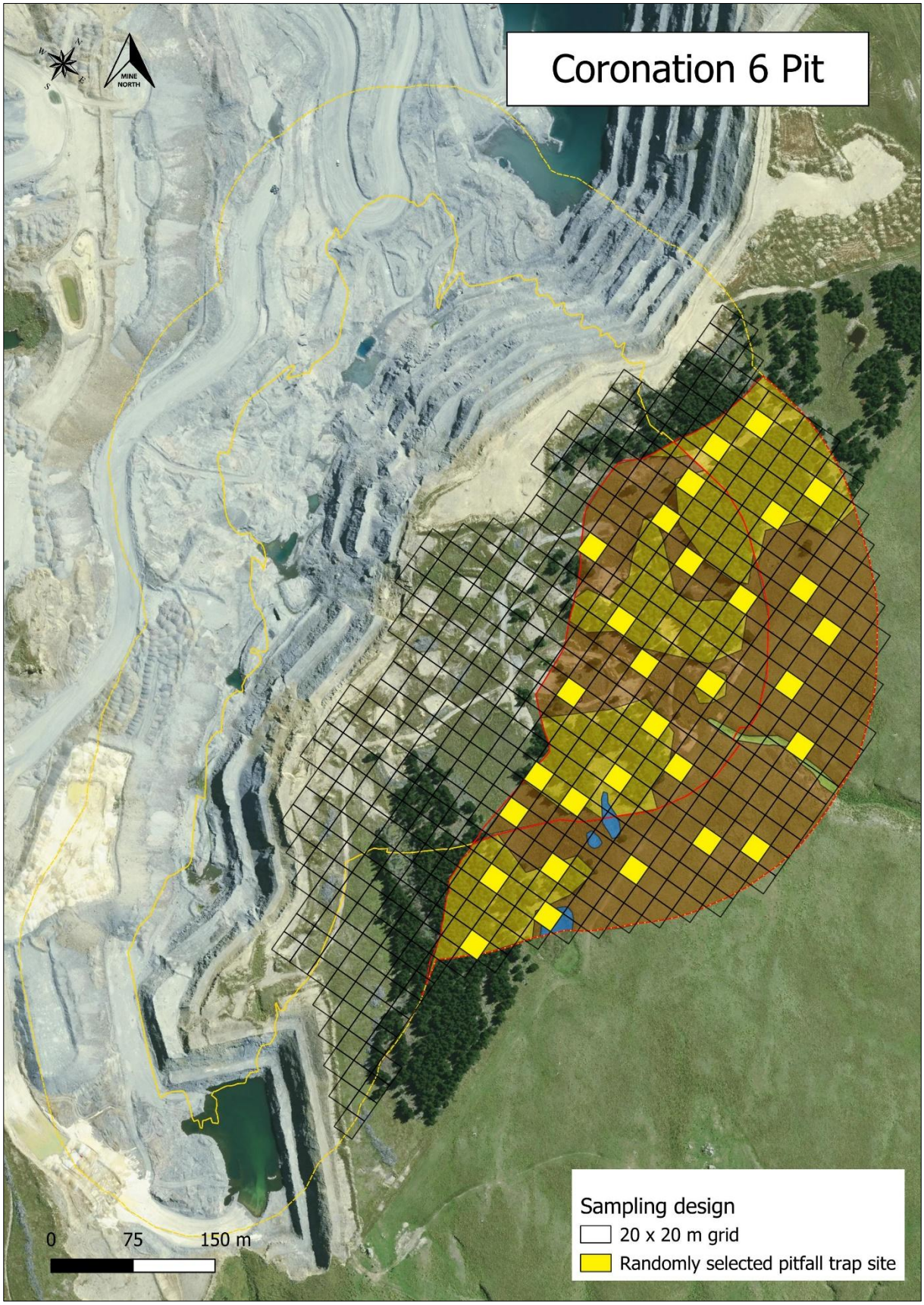

Figure 4.2. An example of random stratified sampling design for monitoring lizard populations at Coronation 6 Pit (CO6 Pit). Coronation 5 area is immediately west. NB the pine tress have now been felled and harvested.

Table 4.4. The number of sites (pitfall traps) in each of the monitoring areas.

Monitoring area	Number sites (pitfall traps)
Back Road Waste Rock Stack[19]	40
Coronation Pit	29
Golden Bar Pit	36
Golden Bar WRS	40
MEEA	40
MEEA buffer	39
Total	**224**

4.3.3 MP4 affected lizard population size

Skink population size estimates for the MP4 impact area varied markedly across the three different methods, with the literature-informed density extrapolations producing the lowest estimates ($\overline{x}$ = 18,744 skinks), followed by CMR ($\overline{x}$ =26,387 skinks) and N-mixture models ($\overline{x}$ = 111,559 skinks).
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 MP4 impact area, 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 PCs 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 PC 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 PCs (i.e., less than one trap per skink home range[20]), 'gaps' in the trapping coverage are likely, meaning estimates will be underestimates.
- 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 the literature-informed, CMR, and N-mixture methods across the overall MP4 impact area to estimate affected lizard population sizes is a

[19] Monitoring will include the MP3 consented Back Road Waste Rock Stack as a reference site, because the area is largely representative of the natural wider surrounding landscape and will not be mined as part of MP4 Stage 3.
[20] The low trap density was intentional and a function of the study design, which primarily focussed on N-mixture models. N-mixture models require independence between sampling units (e.g., pitfall traps).

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 PCs, and that lizard detection probability is relatively high. It 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 the impact area), 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 PCs (D. van Winkel, pers. obs.), it is estimated that the total lizard population (skinks and geckos) could be approximately 10–15% 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 large confidence intervals surrounding the population size.

Overall, the lizard population size for the MP4 impact area is likely higher than the average literature-informed density extrapolation estimate of 16,741 and probably lies in between the CMR and N-mixture modelling estimates (i.e., between 20,783 and 86,999 lizards) (Table 4.5; Appendix VII). On average, lizard densities inside the MP4 Project area range from (239–860 skinks/ ha; mean = 499 skinks/ ha). In comparison, lizard density values calculated from the IM8 lizard salvage programme, were approximately 778 lizards/ ha[21].

Of the total number of affected lizards, it is estimated that most (~65–70%) will be represented by 'Not Threatened' McCann's skinks, with approximately 15–20% and 10–15% represented by 'At Risk—Declining' tussock skinks and 'At Risk – Declining' kōrero geckos, respectively. If present, herbfield, grand, Otago, and Otago green skinks combined are likely to contribute approximately 1% of the total population.

For Coronation 5, the size of the lizard population in the footprint is estimated to be approximately 1,215 (359 – 3,159) individuals (Table 4.5).

[21] Density based on 88 skinks (66 captured and an estimated 22 missed) from 0.113 ha of cleared habitat.

Table 4.5. Estimated skink population size based on literature-informed density extrapolations, Capture-mark-recapture, and N-mixture modelling methods for each of the MP4 Project Components and Coronation 5 (only considers lizard habitat). Mean population size is reported as well as the lower and upper ranges (in parentheses).

		Estimated skink population size			
Project Component	**Available lizard habitat (ha)**	**Density extrapolation**	**CMR**	**N-mixture modelling**	**Average (all methods)**
CO6 Pit	5.5	1,018 (110 – 1,925)	454 (133 – 1,442)	1,392 (604 – 4,079)	954 (282 – 2,482)
CN BF	0.02	37 (4 – 70)	51 (5 – 52)	51 (22 – 148)	46 (10 – 90)
CPLS	0.2	37 (4 – 70)	188 (126 – 280)	820 (542 – 1,300)	348 (224 – 550)
NGWRS	17.6	3,256 (352 – 6,160)	1,452 (427 – 4,614)	4,455 (1,933 – 13,054)	3,054 (904 – 7,942)
GB2 Pit	13.7	2,535 (274 – 4,795)	6,318 (3,857 – 10,441)	26,079 (16,351 – 44,268)	11,644 (6,827 – 19,834)
GB WRS	48	8,880 (960 – 16,800)	11,883 (6,524 – 21,670)	52,864 (31,370 – 95,016)	24,542 (12,951 – 44,495)
IM9 Pit	0.5	85 (9 – 161)	38 (11 – 121)	116 (51 – 341)	79 (23 – 207)
IM10 Pit	3.9	722 (78 – 1,365)	322 (95 – 1,022)	987 (428 – 2,893)	677 (200 – 1760)
Frasers BF/WRS	0	N/A	N/A	N/A	N/A
GB RR	0.9	172 (19 – 326)	77 (23 – 244)	235 (102 – 690)	161 (48 – 420)
GP BB	0	N/A	N/A	N/A	N/A
MP4 impact area	**90**	**16,741 (1,810 – 31,672)**	**20,783 (11,202 – 39,885)**	**86,999 (51,763 – 161,789)**	**41,508 (21,591 – 77,782)**
C05	7	1,295 (140 – 2,450)	578 (170 – 1,835)	1,772 (769 – 5,192)	1,215 (359 – 3,159)

4.4 POTENTIAL ADVERSE EFFECTS

The clearance of vegetation and habitat features used by native lizards can result in direct adverse effects such as significant injury or mortality and/ or loss of important resources (e.g., food and refuge sites) from the landscape. Potential indirect effects such as displacement of lizards into surrounding areas of lower habitat quality or the reduction in ecological linkages/ corridors in the landscape may also adversely impact local lizard communities.

These effects are not constrained to areas supporting moderate- or high-quality habitats. Ostensibly low value habitats such as dense weedy thickets, rank grassland, waste rock piles, and inorganic debris (e.g., corrugated iron, farming materials, etc.) are frequently used by native lizards, and these 'habitats' also need to be considered as part of any effects assessment. For this reason, all potentially suitable lizard habitat (see Table 4.1) was considered, not just the highest quality habitats (e.g., rock tors, shrubland).

For the MP4 Project and Coronation 5 areas, the potential effects on lizards from mining operations include:

- Injury or mortality as a result of vegetation clearance, land development, construction activities, and waste rock deposition;
- Permanent loss of important lizard habitats such as tussock, shrubland, riparian vegetation, and rock outcrops/ tors and associated resources (e.g., invertebrate prey, refuge structures);
- Displacement of resident native lizards into adjacent habitat that may be of lower habitat quality with lower carrying capacity or may already be at population carrying capacity; and
- Habitat fragmentation, isolation, and increased habitat edge effects.

Potential indirect and ongoing effects resulting from operation and maintenance of mining activities include:

- Decreased landscape and habitat connectivity through fragmentation;
- Population and genetic isolation;
- Anthropogenic disturbance effects (e.g., dust, noise, vibration, artificial lighting); and
- Lost opportunities for maintaining ecological corridors across the landscape.

4.5 MANAGING POTENTIAL ADVERSE EFFECTS ON NATIVE LIZARDS

The RMA, and associated planning instruments and policy statements (e.g., National Policy Statement for Indigenous Biodiversity or "NPSIB"), require that adverse effects on biodiversity, including protected native lizards, be managed by applying the effects management hierarchy (i.e., effects are avoided, remedied, or mitigated and where necessary, consideration given to offsetting and compensation to further redress residual adverse effects of activities). Specifically, the NPSIB sets out objectives, policies, and implementation requirements to manage natural and physical resources to maintain indigenous biodiversity (i.e., the maintenance and at least no overall reduction in biodiversity

and where necessary, restoration and enhancement of ecosystems and habitats) under the RMA. Under the WA, the focus is on providing a protective benefit to wildlife (i.e., individuals or populations).

The measures proposed by OGL to address adverse effects on native lizards are outlined in Table 4.5. In addition, Whirika Consulting have assessed wider project effects and advised OGL on the measures to address adverse impacts in the MP4 Impact Management Plan (Whirika Consulting 2025), which should be read in conjunction with this LMP. A summary of the MP4 Impact Management Plan strategies are provided in Appendix II[22]. The excerpts in this Appendix are largely verbatim; however, there have been some minor amendments to improve readability and to focus the excerpts on lizards.

Table 4.5. Effects management proposed for the MP4 Project, with specific emphasis on native lizard related management measures. See Whirika Consulting (2025) for a description of the overall effects management package.

Avoid
1. Avoidance of higher value lizard habitat in the Round Hill and SPIM pit extension areas. These extensions were removed from the current project design as further work is required to understand potential ecological impacts and other technical uncertainties. 2. Avoidance of higher value lizard habitat (rocky tors and riparian vegetation) in the GBWRS footprint, through project redesign and refinement. 3. Avoiding indirect effects of mining operations on the immediately surrounding landscape through project footprint demarcation and barriers, where practicable (e.g., roadside windrows or fences, and rock intercept fences at the toe of waste rock stacks [WRSs]). 4. Prioritisation of previously disturbed land for siting new project infrastructure (roads, tailings storage facilities) to avoid unnecessary effects on undisturbed lizard habitat.
Remedy
1. Rehabilitation of WRSs via revegetation and re-creation of rocky habitats for lizards through deposition of larger aggregate and boulders. a. Revegetation of some WRS areas to narrow-leaved tussock grassland, including supplementation with fruit-bearing plants, to restore vegetation cover and enhance lizard habitat. b. Rock stacks (like the ones created as part of the Coronation Project; Ecogecko, 2019) and 'rock tors' (like those created at the Camp Creek research area; C. Rufaut unpub. data.), will be recreated across some of the flat or shallow sloping land on WRSs. It has been demonstrated that created rock stacks are colonised by three species of native lizard (McCann's skink, tussock skink, and kōrero gecko) (Ecogecko, 2019). Similarly, created 'rock tors' at Camp Creek have been colonised by kōrero gecko (D. van Winkel, pers. obs., February 2023). In addition, scree or talus slopes (slopes with accumulated loose rock of varying sizes) may be recreated on steeper sloping land (e.g., WRS embankments) to replicate complex sloped rocky habitat for lizards.

[22] Details of the proposed offset and associated management measures have been designed by Whirika Consulting (previously Ahikā Consulting) and have been relied upon by the author.

Mitigate
1. Operational management plans and procedures to control the effects of dust, noise, disturbance, sediment, contaminant suppression, weed surveillance, and fire on areas of lizard habitat surrounding mining operations. 2. Implementation of a Lizard Management Plan that will include appropriate vegetation and habitat clearance protocols to reduce harm to lizards, a salvage and relocation programme, and relocation site management (see section 5 “Lizard salvage and relocation protocols” below).
Offset and Protective Benefit
1. An offset package that addresses the residual ecological effects of the MP4 Project and to provide a protective benefit to lizards has been prepared (Whirika Consulting 2025; a summary is provided in Appendix II) and will be implemented. 2. The offset will address residual effects related to all aspects of terrestrial and wetland ecology, including lizards and their habitats (i.e., the loss of lizard habitat and any individuals not salvaged and relocated will be accounted for in the offset design as far as practicable). 3. The loss of lizard populations (individuals of lizards) will be addressed by a two-phase mammalian predator control operation in the Murphys Ecological Enhancement Area (“Murphys EEA” or “MEEA”; approximately 45 ha enclosed by a mammal exclusion fence) (Appendix III). The purpose of this site will be to protect and greatly enhance ecological (including lizard) values on OGL landholdings and will provide the primary recipient site for lizards salvaged as part of the MP4 activities (Harper & Thorsen 2023). Further detail surrounding the predator control programme, including a summary of longer-term management of the fenced population and biosecurity and maintenance (Harper & Thorsen 2023) are captured in Appendix II; the predator exclusion fence design and construction (Xcluder 2024; Appendix III) and the interim intensive predator control (Harper 2024 - Appendix IV). 4. There will be baseline monitoring of lizard populations and long-term monitoring to measure lizard response against management targets. 5. Contingency triggers and adaptive management procedures to ensure lizard response targets are achieved in the desired timeframes.
Compensation
1. Installation of ~35 created ‘rock tors’, made from stacking of locally sourced plate schist, in the MEEA. Tors to be positioned along the existing access road to minimise impact of tor construction activities on natural habitats. 2. Further compensatory actions are provided for in this LMP to act as contingency measures for unanticipated adverse effects on lizards. See section 7 “Compensatory/ Contingency Actions”.

5 LIZARD SALVAGE AND RELOCATION PROTOCOLS

A lizard salvage and relocation programme will be carried out for the MP4 Project and Coronation 5 to mitigate adverse effects on native lizards. Salvage and relocation aims to reduce injury or mortality to individuals as far as practicable prior to, during, and after impacts occur. Post-impact management is concerned with ensuring the highest possible likelihood of relocation success, and will involve measures such as habitat enhancement, long-term monitoring, and where appropriate, contingency actions.

The salvage and relocation programme will primarily target the three lizard taxa known to occur in the project footprints (tussock skink, kōrero gecko, and McCann's skink) but will also include any other taxa that may be encountered (e.g., herbfield skink, Otago green skink, Otago skink, and/ or grand skink) (see callout box entitled "Response to the detection of rare or threatened lizard species" on page 41).

The salvage will utilise a variety of industry standard and proven lizard capture techniques (e.g., ACOs, pitfall traps, Gee's minnow traps, and systematic searches). These techniques are relatively indiscriminate in terms of their ability to detect and capture a range of lizard species. This means there will be opportunities to salvage other lizard species that may potentially occur but have not previously been recorded in the impact areas.

The lizard salvage and relocation programme is broadly categorised into three phases (Figure 5.1), each of which is discussed in detail below.

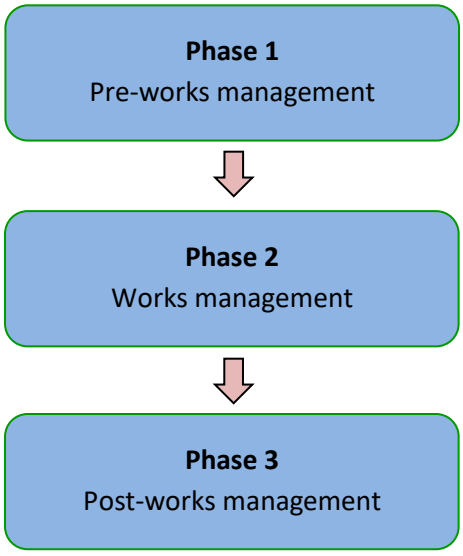

Figure 5.1. The three phases of the lizard salvage and relocation programme for the MP4 Project.

5.1 PROJECT STAGING AND TIMING OF SALVAGE OPERATION

The MP4 Project will be staged over several years (MP4: 2024–2030) and although the staging programme has yet to be finalised, the indicative timeframes for each project are shown in Figures 5.2. Full site rehabilitation is proposed to start in 2031.

The lizard salvage and relocation programme will align with the project staging, with relevant lizard management measures carried out in the months and weeks preceding and during each mining stage. The initial stage, involving stripping of CO5 and CO6 Pit is scheduled to commence outside the existing consented area ca. mid-2025, requiring the capture and transfer of salvaged lizards in Q1 2025 to the MEEA relocation site (see section 5.2 "Relocation site selection"). The MEEA predator exclusion fence will not be constructed by the time CO6 Pit lizards need to be released and therefore, an area of approximately 20 ha on the true right of Murphy's Creek has been designated as an interim intensive predator control area to receive the initial propagule of relocated lizards (see section 5.6.2 "Lizard release strategy", inset box on pg. 48, and Appendices III and IV). The intensive predator control will be in place before any lizards are relocated and will continue to be maintained during the fence construction period and subsequent pest mammal removal. This strategy will provide the best chances of lizard survival following relocation.

Lizard salvage activities (i.e., capture, handling, and relocation) will only take place within the generally accepted South Island lizard season, from October to March, inclusive. The activities will be focussed when ambient temperatures range between 12–22°C. While the relocation of lizards will strictly occur only within this temperature range, salvage activities may take place during cooler or warmer temperatures where necessary. Seasonal and temperature limitations on the salvage period will ensure that any relocated lizards will be released at a time of year when activity is highest, allowing lizards to move and settle into new environments at the release site(s).

Mining schedule

MGP Phase	Pits	Stage	2025	2026	2027	2028	2029	2030
MP3	GT	Stage 5						
MP3	IM	Stage 7						
MP4 & CCP	IM	Stage 8 and ext						
MP4	IM	Stage 9/10						
MP4	CO	Stage 6						
MP4	GB	Stage 2						
MP4	GP	NGWRS						

Waste disposal schedule

MGP Phase	Pits	WRS/BF	2025	2026	2027	2028	2029	2030
MP3	FR	FWBF						
MP3	FR	FSBF2						
MP3	FR	FRBF						
MP4/MP5	CN	CNBF3						
MP4	CO	COWD						
MP4	CO	TWRS						
MP4/MP5FT	CO	COBF						
MP4	GB	GBWD						
MP4	GP	GPBF AEE						

Figure 5.2. Indicative MP4 Project staging timeline. The main habitat disturbances are during the pit mining schedule when pit extents are increased (top) necessitating Golden Bar Road Realignment, and GBWRS expansion when the waste disposal areas are being expanded.

5.2 RELOCATION SITE SELECTION

The relocation site selection process involved a combination of predefined criteria, reviews of aerial imagery, deductive reasoning to determine the most appropriate recipient site for salvaged lizards, and at a local scale, a site visit to confirm the practicalities of constructing a mammalian predator exclusion fence.

To assist with site selection, the key principles for lizard salvage and transfer guidelines (NZLizardTAG 2019) were reviewed, from which a set of site selection criteria were established. These criteria included:

1. The site(s) must be ecologically appropriate and have long-term security;
2. The habitat at the site(s) must be suitable for the salvaged species;
3. The site(s) must provide protection from predators;
4. The site(s) must be protected from future human disturbance (i.e. covenanted);
5. The distance between the receiving site(s) and the original population (i.e., capture site) should be minimised as far as practicable;
6. The site must not compromise future potential mining opportunities (i.e., the site must not occur on land that could be designated for mining); and
7. The views of mana whenua must be included in the site selection process.

Aerial imagery was reviewed to scope potential sites on OGL landholdings and within the wider landscape, with consideration given to size, topography, and variety of lizards habitat present. Preference was given to covenanted sites as these held existing land protection status. The process was also coupled with consultation with Whirika Consultants' ecologists regarding appropriate mitigation sites to address project-wide (including lizards) effects, including recognition of practical issues related to fencing and future maintenance.

Seven potential sites were considered in detail. Site information was tabulated, and the suitability of each site assessed against the site selection criteria (Table 5.1). A suitable relocation site was then selected through deductive reasoning (i.e., selecting sites that met the highest number of criteria). Other sites meeting a high proportion of the assessment criteria were considered potential options for contingency sites (i.e., 'spill-over' sites) (see section 7 "Compensatory/ Contingency Actions"), should they be required.

The outcome of this process identified the Murphys Ecological Enhancement Area ("Murphys EEA" or "MEEA") (Figures 5.3 & 5.4) as the most appropriate site for both broad-scale ecological mitigation and as a highly suitable relocation site for lizards. The MEEA location was adjusted to provide a suitable setback (a minimum of approximately 500 m) from a potential gold resource target known as "Ounce Prospect" and to accommodate movement of stock by the farm lease holder. The proposal for the MEEA site is to construct a mammalian predator exclusion fence around at least 45 ha of land encompassing part of the Murphys Creek catchment. The specific location of the 45 ha fence is yet to be finalised and will be defined based on further engagement with DOC, Iwi, and construction contractors. In the interim, an indicative 91 ha area of the Murphys Creek catchment has been

selected, within which the ~45 ha predator exclusion fence can be constructed (Figure 5.4). Further details of the MEEA are outlined by Whirika Consulting (2025), Harper & Thorsen (2023), Xcluder (2024) and Harper (2024) (see Appendices II, III & IV).

5.2.1 Selected lizard release site(s)

Considering the site selection criteria, capacity to receive high numbers of native lizards, and the proposal for extensive ecological enhancement, MEEA will be used as the receiving site for native lizards salvaged as part of the MP4 Project. Deepdell Station Ecology Covenant rated highly as a suitable site for native lizards; however, the active lizard monitoring and research programme at the site precluded it as a contingency relocation site for the MP4 Project. The other highly rated site was Island Block Ecology Covenant, with its extensive areas of highly suitable rock tors, shrubland, and tussockland. It is recommended that this site be chosen as a contingency or 'spill-over' site for the salvage-relocation programme (see section 7 "Compensatory/ Contingency Actions").

Lizards salvaged as part of Coronation 5, will also be relocated to the wider Murphys Creek area, specifically into the MEEA covenant but outside of where the predator-proof fence will be constructed. The reason why Coronation 5 lizards would not be relocated into the MEEA fenced area, is to avoid 'interference' with the MP4 Project lizard compensation targets (see Whirika Consulting 2025).

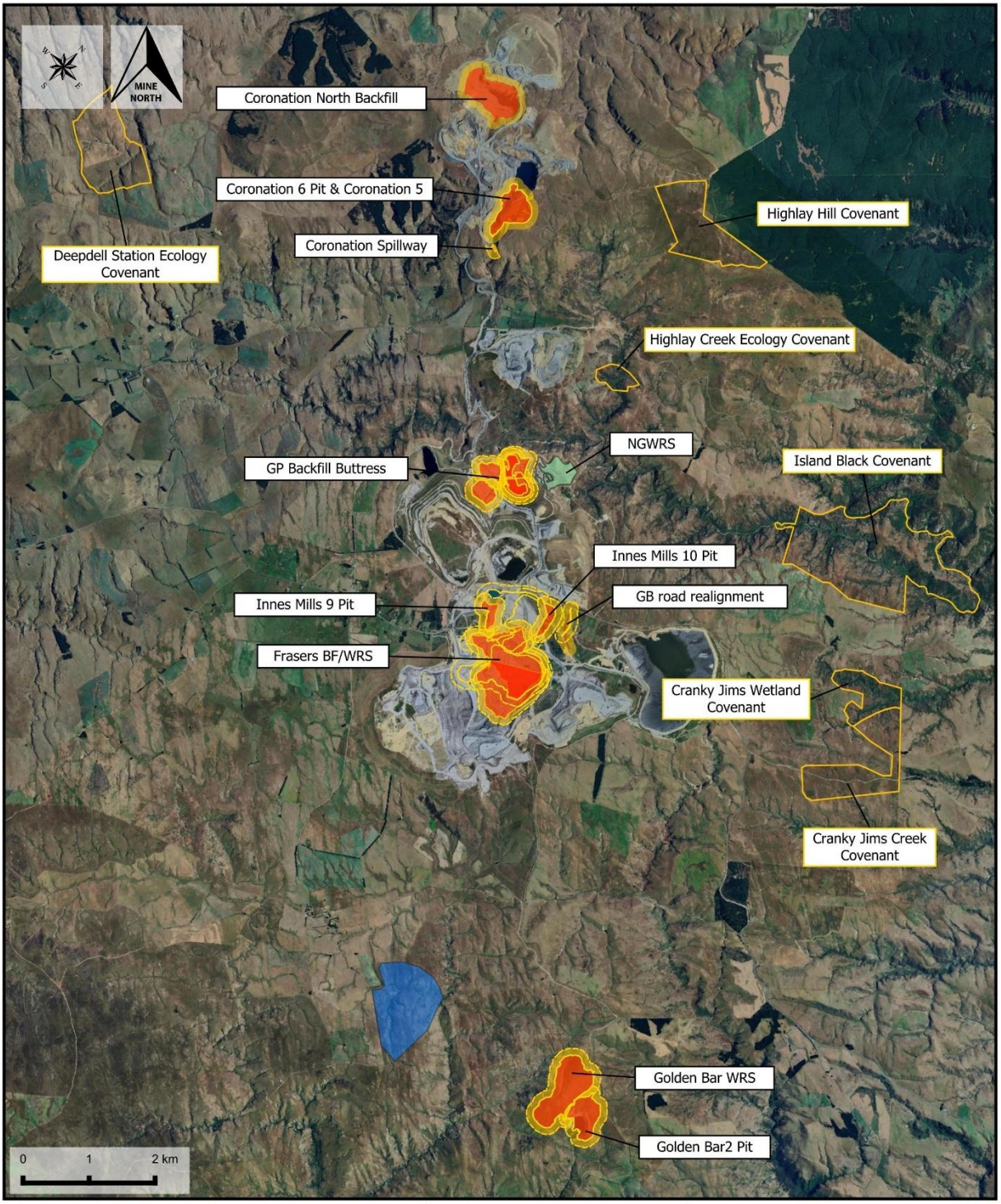

Figure 5.4 MP4 Stage 3: MEEA & Ecology Covenants

CLIENT / PROJECT
OceanaGold Limited

13 February 2025

MAP PROJECTION:
NZGD2000 / New Zealand Transverse Mercator 2000

SOURCES:
LINZ Basemap aerial

SCALE **@ A4 1:75,000**

61130#BEE09

Legend

- Macraes Ecology Covenants
- MEEA (indicative)

MP4 Zone of Impact
Project Components

- Impact areas (direct impact)
- 100 m buffer (indirect impact)

NOTE: Coronation 5 is not part of MP4

Bioresearches
A Babbage Company

Table 5.1. Assessment of potential lizard relocation sites within OceanaGold landholdings and wider surrounding landscape. Criteria definitions provide in text above.

Site name	Areal extent	Land status	Distance from centre of project area	Brief description	Criteria						
					1	2	3	4	5	6	7
Deepdell Station Ecology Covenant	110 ha	QEII covenant	~8.8 km	An area of indigenous tussock grassland intersected by gullies containing a diverse range of native vegetation. A considerable number of rock tors and bluffs are present. Lizard surveys and monitoring have been undertaken, which have identified the presence of four species (McCann's skink, tussock skink, herbfield skink, and kōrero gecko). All but herbfield skink occur in high abundance (Ecogecko, 2013a, c). An active monitoring/ research programme is currently underway at this site (M. Tocher, pers. comm.). Mammalian pest control is being carried out at this site. The site is also grazed by stock, although areas subject to intensive lizard monitoring are in the process of being fenced.	?	✓	✓	✓	✓	✓	?
Highlay Creek Ecology Covenant	16.9 ha	Covenant	~3.9 km	A deep gully system dominated by indigenous scrub and tussocks. Rocky outcrops, tors, slabs, and boulders are present in abundance. Lizard surveys and monitoring have been undertaken in Highlay Creek Ecology Covenant, which have identified the presence of three species (McCann's skink, tussock skink, and kōrero gecko); all species occurred at low to moderate abundance (Ecogecko, 2013a, c). Mammalian predator control is not currently operational.	✓	✓	x	✓	✓	✓	?

Highlay Hill Covenant	100 ha	Covenant	~6.2 km	A higher elevation site predominantly covered by grassland (tussocks) and supporting a basalt rock cone. No information is available on the lizard species or numbers present at the site. Mammalian predator control is not currently operational.	?	?	x	✓	✓	✓	?
Cranky Jims Creek Ecology Covenant	47 ha	Covenant	~5.4 km	Cranky Jims Creek Ecology Covenant supports an area of high value native bush, scrub and bracken, tussocks, and grassland. There is a considerable amount of steep rock bluffs lining the gullies, with some rock tors on the plateau. Lizard surveys and monitoring undertaken in Cranky Jims Creek Ecology Covenant identified the presence of three species (McCann's skink, tussock skink, and kōrero gecko) but all species occurred at very low abundance (Ecogecko, 2013a, c). The low lizard abundance was attributed to the structure of the rock at Cranky Jims not providing an abundance of suitable crevices or thin rock plates for lizards to refuge and the extensive forest cover having a cooling effect on the surrounding rock, shading out potential lizard habitat (Ecogecko, 2013a, c). Kōrero geckos (N = 843) were relocated into Cranky Jims Creek Ecology Covenant as part of the Deepdell North III project. Lizard monitoring was established on-site in February 2023, but no monitoring results are currently available.	?	x	x	✓	✓	✓	?

Cranky Jims Wetland Open Space Covenant	49 ha	Covenant	~5.3 km	Cranky Jims Wetland Open Space Covenant is an area of open tussock and grassland, supporting sparse rock tors. No lizard surveys or monitoring have been carried out at the site. Mammalian predator control is not currently operational.	✓	?	x	✓	✓	✓	?
Island Block Covenant	291 ha	Covenant	~4.8 km	A deeply incised gully system along the margins of Deepdell Creek. The area supports an abundance of mixed native and exotic shrubland, extensive areas of tussock and grassland, and an abundance of rocky outcrops and tors. No lizard surveys have been carried out at the site, presumably because of the treacherous and largely inaccessible terrain. However, a small area of this covenant is subject to a lizard research project associated with the Continuity Consents Project IM8 lizard salvage. The research involves testing leaky fence pens as a tool for protecting relocated lizards (Bioresearches 2024b, c.). Mammalian predator control is not currently operational.	✓	✓	x	✓	✓	✓	?
Murphys Ecological Enhancement Area (Murphys EEA)	~45 ha	Proposed covenant	~5 km	A series of steep gullies along the margins of Murphys Creek. The area supports an abundance of mixed native and exotic shrubland, extensive areas of tussock and grassland, and an abundance of rocky outcrops and tors. Part of the site was surveyed for lizards in 2014, during investigations into the presence of Otago green skink (Ecogecko, 2015). Four lizard species were recorded (McCann's skink, tussock skink, Otago skink, and kōrero gecko). A preliminary site investigation and cursory lizard survey	✓	✓	✓	✓	✓	✓	?

				was undertaken in February 2023, which recorded McCann's skink, tussock skink, and kōrero gecko and noted an abundance of suitable habitat for native lizards (including Otago, grand, and Otago green skink). The site is currently grazed and not subject to mammalian pest control; however, an extensive and intensive pest control programme is proposed as part of the Impact Management Plan for the MP4 Project. Habitat restoration and enhancement also forms part of the proposed package.	

Figure 5.4. Photographs of the vegetation and habitat features present in Murphys EEA. Photographs provided by Whirika Consulting.

5.3 SALVAGE PROGRAMME PARAMETERS AND STRATEGY

A lizard salvage programme of the scale associated with the MP4 Project presents several challenges, including but not limited to the type and intensity of salvage methods employed, managing potentially very high numbers of lizards, and selecting a suitable relocation site(s) that can accommodate potentially high numbers of lizards. The lizard salvage operation undertaken as part of the 109 ha Deepdell North III Project between November 2020 and March 2021, where approximately 1,500[23] lizards were captured and relocated, was subject to many of these challenges (LizardExpertNZ 2021). In particular, the difficulty of managing large numbers of lizards was highlighted. The salvage numbers were 50% greater than anticipated, which meant lizards had to be held in temporary captivity—a relatively stressful situation for the lizards—and an additional relocation site had to be organised to accept the 'surplus' individuals. Several recommendations emerged from the Deepdell North III salvage-relocation, including taking a highly conservative approach to estimating lizard numbers in the salvage footprint, that future large-scale salvages strive to avoid unexpected outcomes as far as practicable, and having flexibility in 'stoppings rules' (LizardExpertNZ 2021; Appendix I).

[23] 1,500 lizards was considered an underestimate of the total lizard population size in the affected area given that not all lizards were able to be captured and relocated (LizardExpertNZ 2021).

For the MP4 lizard salvage operation, both an attempt to identify inherent challenges upfront and learn from the outcomes of previous salvages have been incorporated into the programme design. Initially, two primary limitations to the prospective programme were identified. These were 1) the number of lizards that can feasibly be managed under a salvage programme (i.e., how many lizards can be physically captured and relocated without compromising the success of the relocation programme), and 2) population capacity limitations associated with the release site(s) (i.e., what is the upper limit number of lizards that can be relocated into a site(s) that already supports native lizard populations). Understanding and addressing these limitations is fraught with difficulty, due to a paucity of relevant exemplars to base decisions on and high levels of uncertainty.

5.3.1 Lizard salvage recovery rate

The approach taken in this LMP has been to set an upper limit (+ 5% contingency) for the number of lizards of all encountered taxa that will be captured and relocated (recovered), and appropriately managed at the release site. The upper limit value has been informed by a combination of

1) learnings from the Deepdell North III salvage project;
2) the physically ability of herpetologists to manage the number of lizards expected to be salvaged;
3) the expert opinion and experience of the author based on previous lizard salvage-relocation projects; and
4) predictions of the lizard population size and capacity (based largely on lizard population recovery rates in similar environments and under similar management regimes, e.g., mammalian pest control) at the selected relocation site.

The number of lizards proposed to be salvaged during the MP4 Project and Coronation 5 has been set at approximately 2,100 individuals[24] (though, see inset box entitled “Response to the detection of rare or threatened lizard species” on page 41). This figure is largely based on the physically ability of herpetologists to adequately manage the expected number of salvaged lizards to the extent that lizard welfare is not compromised and that relocated lizards are afforded the highest chances of survival. Considering the large population size estimates for the MP4 impact area, the capture and relocation of 2,100 lizards (i.e., the recovery rate or percentage of the total estimated population to be salvaged) will be very low (e.g., approximately 2–10% of lizard population estimated to occur in the MP4 and Coronation 5 impact areas).

The establishment of a salvage limit (i.e., up to 2,100 lizards) requires a set of parameters (or ‘stopping rules’) that will guide the salvage effort invested in each of the affected PCs. That is, for each stage of mine development, an indicative timeframe, dedicated level of effort, and number of lizards will be allocated (Table 5.2). For example, during the salvage if time, effort, or the number of lizards, whichever comes first, has been reached in a specific PC then the salvage operation for that PC ceases (though, see inset box entitled “Response to the detection of rare or threatened lizard species” on page 41). All captured lizards will be relocated into the mitigation/ offset site (MEEA) and any lizards remaining in the impact areas will be left in situ and the impacts on them considered residual effects

[24] This figure may be subject to refinement following consultation with OceanaGold and the Department of Conservation.

that will be addressed through offset and compensation measures as outlined in the MP4 Impact Management Plan (Whirika Consulting, 2025).

If the overall lizard salvage numbers are unexpectedly exceeded by more than 5% of the anticipated number, during any one of the staged salvage operations, all 'excess' individuals will be released into the existing Island Block Covenant site and/ or other suitable area, without any habitat enhancement or follow up monitoring requirements (see Section 7 'Compensatory/ Contingency Actions').

The salvage parameters are subject to refinement following consultation with relevant experts from the Department of Conservation, Otago Regional Council, and mana whenua. Additionally, adaptive management will be applied throughout the delivery of this LMP to improve management practices incrementally over the years. Therefore, the salvage parameters detailed below should be interpreted as indicative only and are likely to be revised and amended over time.

Response to the detection of rare or threatened lizard species.

The current lizard salvage and relocation protocols are largely designed to target 'Not threatened' and 'At Risk' species known to be present in the impact areas. Though it is acknowledged that rarer (e.g., herbfield and Otago green skink) or more threatened (e.g., grand and Otago skinks) species could potentially be present in affected areas. Where such species are detected during the salvage operation, a diversion of some salvage effort will take place to target areas supporting these rare or threatened lizards. The Department of Conservation would be notified and consulted with upon the detection of threatened lizards in the impact areas. Targeted capture effort would then be invested and maintained at sites supporting threatened species until such time that the Project herpetologist was confident that all rare or threatened lizards had been captured at the specific site. The effort to salvage 'Not threatened' and 'At Risk' species would not cease entirely during this time, and the numbers of more threatened lizard species would be in addition to the cap of 2,100 lizards set by the salvage programme.

5.3.2 Relocation site (MEEA) carrying capacity

Ensuring the relocation site has sufficient carrying capacity for resident and relocated lizards is also critical to the success of the relocation programme. The carrying capacity of a site is determined based on the size site, the estimated size of the resident lizard population, and expected lizard population response to proposed management.

For the MP4 Project, the approximately 45 ha MEEA site has been selected as the most appropriate lizard release site. An estimate of the current resident lizard population size in the 45 ha MEEA, based on the data collected during baseline monitoring in April 2024 and the methods described section 4.3.2.3 "Skink density estimates from modelled data" is between approximately 23,265–65,790 lizards. It has been demonstrated that up to a four-fold increase in lizard numbers can be achieved in areas subject to intensive mammalian predator control (Reardon *et al*., 2012; Norbury *et al*., 2022). Therefore, it is expected that a substantial increase in the resident lizard population in the MEEA would occur as a result of the proposed MEEA mammalian predator exclusion, and consequently, the carrying

capacity of the site is expected to be very high and much greater than the existing lizard population levels.

The anticipated relocation of approximately 2,000 lizards as part of MP4 (noting that 100–200 lizards may be salvaged from Coronation 5 areas and would be released into the surrounding covenant area), would equate to a release of ~44 lizards/ hectare into the MEEA predator-proof fence area. This density is very low in comparison to the reported lizard densities in Otago Region (see Table 4.3) and the number of lizards is significantly below the estimated density of lizards currently in the MEEA (i.e., ~871 [517–1462] lizards/ ha; see section 4.3.2.3 “Skink density estimates from modelled data”). It should be recognised that the number of lizards salvaged and relocated at any point in time will be markedly lower than 2,100 (e.g., ≤1,000 lizards) due to the MP4 Project schedule requirements (see section 5.1. “Project staging and timing of salvage operation”). Furthermore, the exclusion of stock and removal of mammalian predators from the MEEA (see Whirika Consulting 2025) will greatly enhance the capacity of the relocation site to support growing lizard populations. Therefore, the relocation of ~2,000 lizards into the MEEA is not considered to have measurable effects on the lizard populations already resident there.

Table 5.2. Indicative lizard salvage parameters ('stopping rules') for the MP4 footprint (~90 ha of lizard habitat) and Coronation 5 area (7 ha), including staging, timeframes, salvage effort, and estimated number of salvaged lizards. Parameters to be refined as the salvage programme progresses.

Project Component	Salvage timeframe	Indicative salvage effort	kōrero gecko	tussock skink	McCann's skink
CO6 Pit	3 weeks	• 500 pitfall trap nights, • 300 funnel trap nights, and • 240 search hours.	50	150	200
CN BF	2–4 days	• 16 search hours.	0	10	20
CPLS	2–4 days	• 16 search hours, and • 50 pitfall trap nights	0	25	25
NGWRS	2–4 days	• 16 search hours	40	50	50
GB2 Pit	3 weeks	• 800 pitfall trap nights, • 400 funnel trap nights, and • 480 search hours.	100	150	200
GB WRS	3 weeks	• 800 pitfall trap nights, • 400 funnel trap nights, and • 480 search hours.	140	200	250
IM 9 Pit	1 week	• 16 search hours, and • 100 pitfall/ funnel trap nights.	0	20	40
IM 10 Pit	1 week	• 250 pitfall trap nights, • 250 funnel trap nights, and • 160 search hours.	0	50	60
Frasers BF/WRS	N/A	N/A	N/A	N/A	N/A
GB RR	1 week	• 500 pitfall trap nights, • 300 funnel trap nights, and • 240 search hours.	10	50	100
GP BB	2–4 days	• 16 search hours, and • 100 pitfall/ funnel trap nights	0	20	20
CO5	1 week	• 16 search hours, and • 100 pitfall/ funnel trap nights	10	30	30
			350	**755**	**995**
			2,100		

5.4 DEMARCATION OF THE WORKS FOOTPRINT

Salvage effort will be invested in all suitable lizard habitats throughout areas directly affected by mining activities. Buffer areas not proposed to be directly affected will not be subject to salvage.

Prior to any vegetation clearance or land disturbance, lizard salvage areas will be clearly demarcated to ensure everyone involved clearly understands the work extents and that works do not encroach into peripheral habitat areas.

An interactive GIS application, showing the works footprint boundary, aerial imagery, and other relevant overlays will be carried in the field by the Project herpetologist to assist with orientation and boundary recognition.

5.5 PHASE 1 – PRE-WORKS LIZARD MANAGEMENT

Pre-works lizard management will involve activities undertaken by the Project herpetologist and salvage team prior to commencement of vegetation clearance or habitat disturbance in the affected areas. Refer to the inset box on page 49 ("Timing of mammalian predator management") for details of the staged predator control to be implemented during the pre-works phase.

A variety of reliable and proven live trapping and capture techniques will be employed to increase the probability of lizard capture. Techniques will include, but may not be limited to, pitfall traps, layered *Onduline* artificial cover object (ACOs), Gee's Minnow traps, and systematic searches (both diurnal and nocturnal).

The indicative level of salvage effort for each project component and stage of the mine development is outlined in Table 5.2. The information presented in this table may change adaptively as the programme progresses through time and alterations to the salvage programme would be at the discretion of the Project herpetologist, with approval from OGL and other relevant stakeholders.

All native lizards captured during the pre-works period would be relocated to the approved relocation sites (see section 5.2 "Relocation site selection").

Once the pre-works salvage programme has been satisfactorily delivered in accordance with this LMP, the Project herpetologist will consult with/ notify OGL and the next phase of the salvage will commence.

5.5.1 Lizard capture methods

5.5.1.1 Pitfall traps

Pitfall trapping is a standard and effective technique for capturing terrestrial lizards in New Zealand (Hare, 2012a). Pitfall trapping will involve the installation of 4 litre plastic pails, dug into the ground with the top of the bucket flush with ground level, and covered with a lid (e.g., wooden board or *Onduline* ACO) wider than the aperture of the pail. A small amount of soil and leaf litter is placed in

the bottom of the traps to provide cover for captured lizards, and traps will be activated by adding a lure (e.g., soft fruit or protein-based lure).

Both the existing 'monitoring' pitfall traps and newly installed arrays of pitfall traps (their specific locations determined by the Project herpetologist) will be used throughout the staged impact areas. The locations of all pitfall traps would be recorded on a GPS and traps would be inspected at least every 24 hours for the duration of the pre-works salvage operation.

5.5.1.2 Gee's Minnow traps (funnel traps)

Gee's Minnow traps or funnel traps are small fish traps that typically consist of two funnel-shaped entrances at either end of a mesh cylinder. Funnel traps are a passive sampling method because they rely on lizards to willingly encounter and enter the trap. They can be used to capture lizards in a wide range of habitats because they can be positioned on or above ground, can be nestled among dense vegetation, and can easily be relocated without disturbing the soil (Hare, 2012b).

Arrays of funnel traps will be installed throughout the staged impact areas; their specific locations determined by the Project herpetologist. Each funnel trap would be half-filled with vegetation matter and baited with a lure (e.g., soft fruit or protein-based lure). The locations of all funnel traps would be recorded on a GPS and traps would be inspected at least every 24 hours for the duration of the pre-works salvage operation.

5.5.1.3 Artificial cover objects (ACOs)

Artificial cover objects (ACOs) are at standard (best practice) tool for detecting, surveying, capturing, and monitoring lizards in New Zealand (Lettink & Cree, 2007; Wilson *et al.*, 2007; Lettink *et al.* 2011; Lettink, 2012; Lettink & Hare, 2016).

The ACOs used will constitute single- or double-layered, 400 mm x 475 mm corrugated *Onduline* sheets. *Onduline* is a bituminous corrugated roofing material that has heat retention properties, providing refuge and thermoregulatory benefits for lizards.

ACOs require a period of settlement following installation to allow any scent to equalise, and lizards to find and become familiar with the devices. It is recommended that at least 2–3 months of settling is required before ACOs can be inspected for lizards (Lettink, 2012). ACOs are then repeatedly inspected, and all lizards found beneath are captured. To assist in the capture of lizards, a portable plastic or metal shroud will be used to enclose the ACOS and prevent lizards from escaping during inspections.

Lizard use of ACOs is dependent on environmental factors such as proximity to dense, complex vegetation and weather conditions, as well as disturbance frequencies (Lettink *et al*. 2011). These factors will be taken into consideration during the placement and inspections of ACOs, to increase lizard detection probability.

Arrays of ACOs will be installed throughout the staged impact areas; their specific locations determined by the Project herpetologist. The locations of all ACO would be recorded on a GPS and ACOs would be inspected at least every 24 hours for the duration of the pre-works salvage operation

5.5.1.4 Systematic searches

Systematic searches are a commonly used method for herpetofauna surveys (Hare, 2012c) and are frequently used during salvage operations to find and capture lizards. Both diurnal and nocturnal systematic searches will be carried out across the staged impact areas.

5.5.1.4.1 Diurnal searches

Diurnal visual and hand searches will be carried out by the lizard salvage team who will move through the landscape searching for active sun-basking lizards and searching habitat features (e.g., lifting rocks and debris, searching crevices in rock outcrops) to reveal refuging lizards. Accessible areas of dense vegetation such as fern clumps or vegetation overhanging rocky outcrops will be physically searched for lizards by lifting, moving aside, or removing foliage. In addition to systematic searches, opportunistic searches[25] will be carried during all salvage activities in the impact areas.

5.5.1.4.2 Nocturnal spotlight searches

Nocturnal searches of gecko habitats (rock outcrops ad tors) will be undertaken to target night-active kōrero geckos. The lizard salvage team would progressively move over or along rocky outcrops after dusk, aided by headlamps/ torches, searching the rock faces and overhangs, and rock crevices for emerged geckos, or partially retreated geckos. Diurnal lizard species may also be encountered in rocky habitats at night, and these too will be targeted. Binoculars may be used to assist with detecting active geckos (i.e., gecko eye-shine) from afar before approaching the specific rock feature.

5.6 PHASE 2 – WORKS MANAGEMENT

Phase 2 of the lizard salvage will involve targeted and opportunistic capture of lizards during vegetation and habitat clearance activities. Site preparation for mining activities involves the stripping of vegetation and topsoil and removal of unstable rock tors to create a uniform and structurally stable surface for excavation or deposition of waste rock. It is during this pre-mining process that the Project herpetologist and salvage team will work directly with machine operators to progressively dismantle habitat features and clear vegetation to facilitate the capture of lizards.

These activities will not be carried out across the entire site due to the extensive areas of clearance required but rather, key areas of habitat would be identified by the Project herpetologist and salvage team prior to commencing the searches.

5.6.1 Physical vegetation and habitat removal methodology

It is crucial that there is clear coordination and communication between the herpetologists and machine operators to ensure effective capture of lizards and to minimise health and safety risks. The Project herpetologist and machine operator(s) would discuss the methodology and agree on processes and activities prior to commencing this work in the field.

[25] Opportunistic searches are considered 'non-dedicated searches' that will be undertaken while walking between sites or during other activities in the impact area. Effort associated with opportunistic searches will not necessarily be recorded/ quantified.

For areas that support abundant and dense vegetation cover such as shrubland, riparian, and tussockland habitats, clearance will be carried out by an excavator, fitted with a toothed bucket or root raker attachment, and supervised by the Project herpetologist and/ or salvage team. Lizards will be captured by hand during the vegetation stripping process.

In instances where debris, rocks, or rock outcrops/ tors cannot be physically moved or searched by the salvage team, an excavator(s) dedicated to the lizard salvage would be used to lift or dismantle the feature to reveal lizards for hand capture. It is recommended that the excavator(s) use a grapple attachment to allow precision lifting of objects (e.g., rocks, schist rock slabs) and to reduce scraping or shearing of rock surfaces, which may injure or kill lizards. In some instances, a toothed bucket attachment may be used to lift or roll large heavy objects (Figure 5.3).

Recoverable material (e.g., schist rock slabs) will be sourced and transferred to the lizard mitigation site(s) to be used to recreate rocky habitat features (see section 5.6.3 “Lizard Habitat Enhancement”).

Figure 5.3. Machine-assisted dismantling of a rock tors during the Deepdell North III Project. Image by M. Tocher.

5.7 PHASE 3 – POST-WORKS MANAGEMENT

Post-works management is concerned with the relocation of lizards, provision of habitat enhancement, and lizard monitoring to ensure the best possible outcome for salvaged individuals and to measure lizard population level response to enacted management.

5.7.1 Lizards release strategy

A direct wild-to-wild release of lizards is proposed for the MP4 Project and Coronation 5. Lizards will be 'hard released' (*versus* penned) into habitats suitable for each species (e.g., kōrero released into rocky habitats, tussock skink released into damper grassland/ tussock habitats). Lizards salvaged as groups (e.g., kōrero tor community or family groups) will be released together into the same area to preserve group structure. Lizards will not be marked (neither temporarily nor permanently) nor will photographic identification techniques be used. The reason being the relatively high 'cost to reward' ratio of mark-recapture programmes involving large populations (i.e., for large populations, high effort is required to mark or photo-identify individuals, yet the probability of recapture is typically very low) (further details on lizard population monitoring are outlined in section 6 "Lizard Monitoring Programme").

The proposed salvage and relocation programme does not include provisions for captive holding of lizards. The reasons being that captivity can lead to stress, injury or mortality in lizards and captive holding is resource intensive, which can divert resources away from other activities. There are also no tangible benefits of holding lizards in captivity prior to release though, it is acknowledged that survival probability may be increased by holding lizards in captivity temporarily when the weather conditions are deemed unsuitable for release (e.g., when temperatures are low and compromise lizard activity/ movement).

The release of lizards at the recipient site will be guided both by selection of appropriate and suitable habitat for each species and the monitoring programme design (see section 6 "Lizard Monitoring Programme"). The inherent staging of the MP4 Project will reduce the number of lizards released at any point in time and accurate records of release locations and release numbers during each stage will eliminate the risk of 'overstocking' areas of the recipient site.

Based on the preselected number of salvage individuals (~2,100 of all species, including ~2000 as part of MP4) and the potential size of the MEEA relocation site (~45 ha), a relocation 'stocking density' in the MEEA of ~44 lizards/ ha (2,000/ 45 = ~44) will be realised. It must be re-emphasised that not all 2,100 lizards will be relocated at once, and it is more likely that 150–500 lizards will be released at any one time (i.e., 'stocking density' of ~3–11 lizards/ ha). Since the lizard population carrying capacity in MEEA will be increased (e.g., twofold and potentially up to fourfold) as a result of the mammalian predator control programme (Reardon *et al.* 2012; Norbury *et al.* 2022) and lizard habitat enhancement (see section 5.7.2 "Lizard habitat enhancement"), it is considered that the site could comfortably accommodate relocated lizards at the aforementioned 'stocking density'. That is, the anticipated increase in capacity of MEEA to support additional lizards (of all species) as a result of the mammalian predator control programme, is far greater than number of salvaged lizards that would be released at the site.

Timing of mammalian predator management

To meet the lizard salvage timing required by the MP4LOM schedule, the fence will need to be established in H2 2025, once a Resource Consent and Wildlife Act Authority are granted.

Acknowledging that lizards will need to be relocated in Q1 2025 from Coronation 5 and Coronation6 Pit, prior to construction of the fence, a two-phase predator control strategy is proposed. Phase 1 will involve intensive predator control (trapping) over approximately 20 ha area on the north facing slopes of Murphy's Creek tributary where lizards will be relocated and a larger area (~574 ha) having extensive large-predator removal infrastructure to intercept cats and mustelids (Figure 5.4). Further details of Phase 1 are outlined in Harper (2024) (Appendix IV).

Intensive predator control will be carried out approximately 6 months prior to lizards being released to ensure mammalian predator numbers have been sufficiently knocked down/ suppressed (confirmed using dedicated mammalian predator monitoring tools).

Upon receiving Resource Consent and a WAA for MP4, the mammalian predator exclusion fence will be constructed and the complete predator control package, as outlined by Whirika Consulting (2025), implemented.

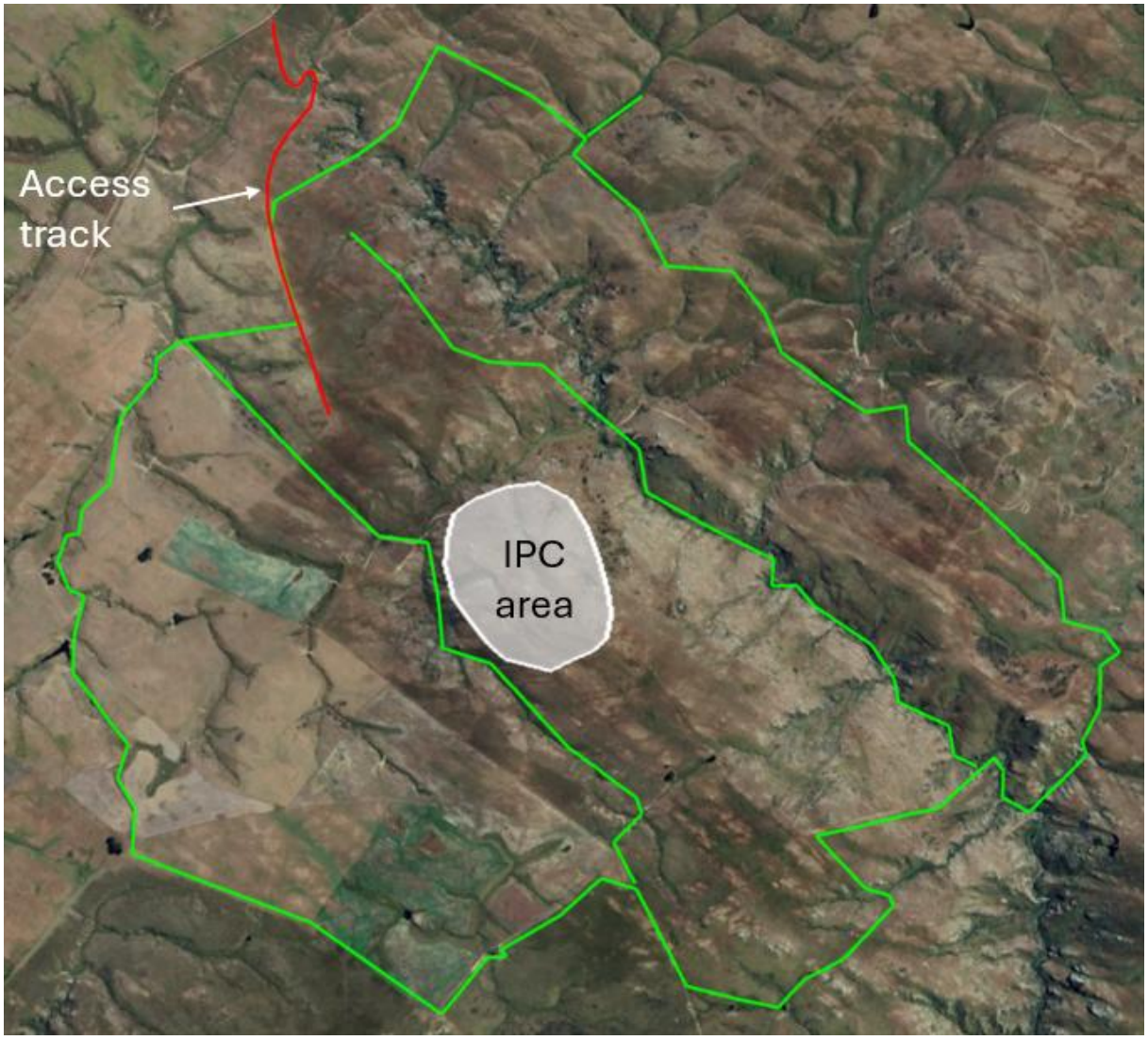

Figure 5.4. Aerial view of Murphys Creek showing indicative locations of the lizard transfer fenced site, and the large predator trapline and trap sites. Source: Harper (2024).

5.7.2 Lizard habitat enhancement

Lizard habitat enhancement in the form of intensive mammalian pest control/ exclusion; vegetation restoration via stock exclusion, weed management and native revegetation; land covenanting, and provision of supplementary refuge structures would be provided for the MEEA site.

The mammalian pest control/ exclusion and vegetation restoration components of the proposed habitat enhancement as outlined in the Impact Management Plan (Whirika Consulting 2025) and are not described here.

Supplementary refuges, in the form of constructed rock tors and rock stacks, will be provided at the lizard relocation site, partly to partially replace rock tors lost in the impact areas but also to provide additional habitat for resident and relocated lizards. The constructed rock tors and rock stacks will follow the designs of C. Rufaut (unpub. data) and Ecogecko (2019), respectively (Figure 5.5). These two designs will be used because they have proven effective in attracting and supporting up to three

species of native lizard (McCann's skink, tussock skink, and kōrero gecko) (Ecogecko 2019; D. van Winkel, pers. obs.).

It is proposed that 35 rock tors and/ or rocks stacks will be installed in Murphys EEA, primarily on the ridges close to access roads to avoid disturbance to existing habitat by machinery required to install the rock features. The number of created rock tors/ rock stacks equates to a rock tor replacement ratio of 3:1 (i.e., 12 rock tors will be lost as part of the MP4 Project and approximately 35 rock tors/ rocks stacks will be created). Low-growing, fruit-producing, and divaricating or vine-type native plants (all appropriately sourced, see Whirika Consulting 2025) will be planted around the rock features to provide additional cover and food sources for lizards once the plants establish.

In the instance where excess salvaged lizards are released into Island Block, no supplementary refuges (constructed rock tors, rock stacks, or otherwise) would be provided due to the significant abundance of existing rocky habitat features at this site (D. van Winkel, per. obs.).

Figure 5.5. Example of rock tors and rocks stacks that will be created and installed along the Murphys EEA access to enhance lizard habitat. A, C. Rufaut (unpub. data) design and B, Ecogecko (2019) design.

5.8 LIZARD CAPTURE AND HANDLING

Native lizards will be captured and handled by a DOC-authorised herpetologist only (Appendix V). All native lizards captured prior to and during vegetation clearance operations will be placed immediately into containment boxes and held temporarily for release. Captured lizards will be measured, sexed, weighed, and photographed, prior to being released.

The retention of lizards in captivity for periods longer than 24 hours will be avoided as far as practicable, but it is recognised that unsuitable weather conditions may delay the release of lizards. In this instance, lizards will be held in ventilated containment boxes in a cool room, out of direct sunlight, until release can occur. Water and substrate will be provided, and food provision (e.g., invertebrates) will be necessary if lizards are held for longer than 48 hours.

If any individual(s) of the larger, rare lizard species (Otago green skink, Otago skink, grand skink) are found during the salvage operation, the individual(s) will be managed in the same way as other species and will be released into suitable habitat within the intensive mammalian predator control area of MEEA (see section 6 “Lizard Monitoring Programme”). The Department of Conservation will be notified of these finds and will be consulted on any additional management, should it be required.

5.9 INADVERTENT LIZARD INJURY OR DEATH

Considering the extensive area of habitat impacted by the projects and some of the destructive habitat methods employed during the salvage(s) (e.g., machine-assisted searches), injuries to and deaths of native lizards are expected.

The following steps will be implemented when an injured or deceased lizard(s) is(are) found during the salvage:

- The Project herpetologist will record, for each species, the number of injured and deceased lizards encountered throughout the salvage and will report these figures to the Department at the conclusion of each stage of the salvage operation.
- Any injured ‘Not Threatened’ and ‘At Risk’ lizard assessed as having severe life-threatening injuries, will immediately be humanely euthanized via blunt force trauma to the cranium, followed by cranial pithing, at the capture site. The Department will need to agree to this method of euthanasia, or recommend another appropriate method, prior to commencement of the salvage operation.
- Any injury or death of a ‘Threatened’ lizard species will be reported to the Department within 24 hours (preferably immediately) of the observation.
- All injured ‘Threatened’ species will be taken to a suitably qualified veterinarian as soon as possible, or if deemed appropriate by DOC, sent to the Dunedin Wildlife Hospital for treatment and care. Injured lizards will be kept in an appropriate portable enclosure (a well-ventilated plastic container with substrate) under the direction of the project herpetologist to ensure the animal is handled appropriately until the lizard can be assessed and treated by a veterinarian.

- Any 'Threatened' lizard assessed by a veterinarian as uninjured, or otherwise in suitable condition for release, will be transported to the relocation site in the portable enclosure and released.
- If any lizard is injured or killed, appropriate measures will be undertaken to minimise further injuries or deaths as the salvage progresses. Measures include but are not limited to adjusting the salvage strategy, ensuring additional support personnel are present to assist with the salvage, and conversing with or replacing machine operators.
- All deceased lizards will be retained and stored in preservative (70% ethanol) inside labelled vials. The samples will be submitted to the Department or under the guidance of the Department, submitted to the Museum of New Zealand Te Papa Tongarewa for accessioning into their collection.

5.10 DATA RECORDING AND ANALYSIS

During both the pre-works and works periods, environmental and lizard catch data will be accurately recorded, and will include:

- Standard weather variables such as temperature, cloud cover, wind speed and direction, humidity, rainfall, etc.
- The number of lizards for each species caught using each salvage technique;
- The effort employed per day (e.g., number of trap nights or systematic search effort);
- The number of missed individuals and number of individuals found dead or injured.

Lizard catch data will be live plotted during the pre-works and works periods to visualise progress towards 'cease salvage' parameters. The decline in trapped lizard numbers (depletion rate), where observed, will also be explored using regression. Extending the regression line to its x-axis intercept can provide a crude estimation of the residual population size based on the proportion of un-trapped individuals for each species remaining in the salvage area. This coarse analysis will be useful for validating, or otherwise, both the initial population estimates for each impact area and the estimated proportion of the population that is salvaged.

6 LIZARD MONITORING PROGRAMME

Lizard monitoring is an important component of the project-wide lizard management and will provide information crucial for the evaluation of the success or otherwise of enacted management measures. Importantly, the purpose of the proposed monitoring is not to measure the survival of relocated lizards (individuals) nor the overall success of the salvage-relocation per se. Rather, its purpose is to measure lizard population change over time in response to enacted management (mammalian predator control and habitat enhancement) at MEAA and to track progress towards the biodiversity offsetting targets (see Whirika Consulting 2025).

Relocated lizards will not be permanently marked nor photo identified, and it is assumed that the response of salvaged-relocated and resident lizards to management will be similar (e.g., an increase in resident lizards in response to mammalian pest suppression will similarly be demonstrated by salvaged-relocated lizards at the same site). Acknowledging a level of uncertainty in this assumption, the monitoring programme makes provisions for monitoring the contribution of salvage-relocated lizards to the resident lizard population, and the effect of such contributions on population level response compared to areas where no salvaged lizards are released (see section 6.4. “Monitoring programme design”).

All lizard monitoring activities will be carried out under a valid Wildlife Act Authority (e.g., 98006-FAU).

To measure lizard response to management, population level monitoring needs to occur both before and after management intervention, and monitoring needs to continue over a sufficient period to allow measures of success or failure to be confidently determined.

For this project, three levels of lizard monitoring are proposed, including:

- Baseline monitoring (commenced April 2024);
- Buffer area monitoring (commenced April 2024); and
- Post-release monitoring.

The details of each type of monitoring are described below.

6.1 BASELINE MONITORING

The baseline monitoring programme commenced in April 2024, and sampled select impact sites (e.g., CO6 Pit, GB2 Pit, GBWRS, etc.) and the mitigation (lizard relocation) site (e.g., MEEA and the surrounding buffer area; see Whirika Consulting 2025) (Figure 6.1). Baseline monitoring serves the purpose of providing data on lizard populations (i.e., species diversity and population size) prior to the commencement of impact and prior to enacted management. The baseline data has assisted with refining the population range estimates of species occurring in potentially affected PCs and will establish reference points against which population change or trends (e.g., in response to management) can be measured over time.

Monitoring was also undertaken at the Back Road Waste Rock Stack site (“BRWRS”), even though this site is not required for the MP4 Project. The information gathered from the BRWRS site has provided

both additional data on lizard abundance in the wider surrounding landscape and valuable baseline data on lizard populations should the site be considered for mine development in future.

Two rounds of the baseline monitoring for each select impact site will be implemented to account for temporal variation. That is, two years (e.g., Year 1 [April 2024] and Year 2) of baseline monitoring, and where practicable, repeated monitoring in spring (e.g., October/ November) and late summer (e.g., March/ April) each year would be undertaken to provide robust population data. It is important to highlight that reducing the number of sampling events may reduce the accuracy and robustness of the baseline data.

6.2 PROJECT COMPONENT BUFFER AREA MONITORING

The 100 m PC buffer zones (i.e., areas that may be indirectly affected by activities) surrounding some of the MP4 PCs (e.g., CO6 Pit, GB2 Pit, and GBWRS) will continue to be monitored post-impact. The initial (April 2024) baseline monitoring has already provided pre-impact data on the estimated number of lizards occurring inside the 100 m buffer zones (see section 4.3 “Lizard population size estimates”). Continued monitoring inside the buffer zones post-impact on an annual basis for three subsequent years will allow any in indirect effects on lizard abundance over time to be monitored.

6.3 POST-RELEASE AND ON-GOING MONITORING

Repeated annual monitoring of lizard populations in the MEEA and surrounding buffer pest control area will occur following the release of salvaged lizards and will continue for 10 years. The purpose of this monitoring is not to measure the survival of relocated individuals, nor the overall success of the salvage-relocation itself, but rather measure lizard population change over time in response to enacted management. Baseline lizard abundance estimates at Murphy’s EEA (where mammalian predators will be eradicated) and the wider buffer predator control area (where predators will be suppressed) has been collected in April 2024. Repeat annual monitoring of lizard abundance at these sites once pest control operations are in place will allow lizard population responses to be measured and evaluated against management targets [Whirika Consulting 2025]), ultimately allowing positive ecological outcome (‘no net loss/ net gain’) claims to be validated or to trigger adaptive management where expected outcomes are not met.

In addition, the post-release monitoring will also allow the monitoring of relocated lizard influx (i.e., count or number of individuals of each species rather than unique individuals, which would require permanent marking) into the MEEA, compared to other areas where lizards will not be released.

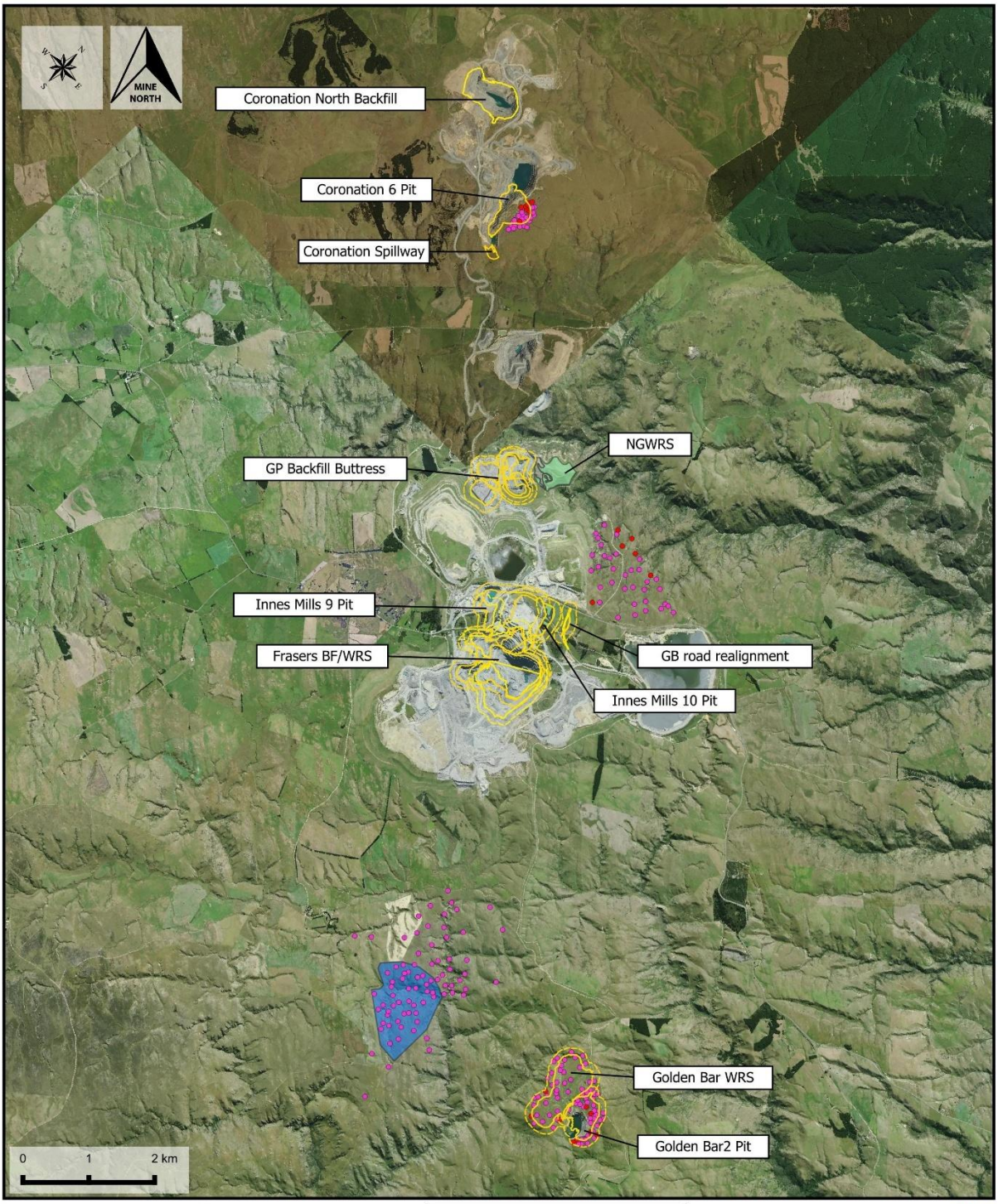

Figure 6.1 MP4 Stage 3: Lizard monitoring sites

CLIENT / PROJECT
OceanaGold Limited

13 February 2025

MAP PROJECTION:
NZGD2000 / New Zealand Transverse Mercator 2000

SOURCES:
LINZ Basemap aerial

SCALE **@ A4 1:75,000**

61130#BEE09

Legend

MP4 Project Components

- Impact footprint
- 100 m buffer
- MEEA (indicative)
- Lizard pitfall trap

Bioresearches
A Babbage Company

6.4 MONITORING PROGRAMME DESIGN

All lizard monitoring undertaken as part of MP4 Project will primarily focus on skink (*versus* kōrero gecko) populations because effective monitoring of geckos in dryland landscapes where geckos use tors, is unreliable or not possible. As both skinks and geckos in the Otago landscape are vulnerable to the same or similar pressures (e.g., habitat degradation and mammalian predators), it is expected that any skink responses will provide a proxy for kōrero gecko response; recognising that gecko response will lag due to the difference in reproductive biology between skinks and geckos.

The monitoring design has been outlined in section 4.3.2 "Modelled population estimates" but is repeated here for convenience. The design employs stratified random sampling to establish a defined number of independent sites[26] across the monitoring areas. Sampling is achieved by overlaying 20 x 20 m grid squares on the monitoring areas and randomly selecting a representative number of grid squares ('sites') that will be subject to monitoring (Figure 4.2). The number of randomly selected sites varies between, and is related to, the size of monitoring areas (Table 4.4).

To discern the effect of relocated lizards on population level response within MEEA, the lizard release will be strategically implemented to ensure that some monitoring sites occur in areas where salvaged lizards will be released while other sites will aim to monitor only resident lizards (i.e., these sites will not receive salvaged lizards).

At each site, a pitfall trap (covered by an *Onduline* ACO) has been installed and will sample lizards at that specific site. Pitfall traps will be activated at least annually, preferably biennially, over a 10-day period during the months of November to April, inclusive, with 'lizard species' and 'count' (*versus* mark-recapture) data recorded.

Models for estimating abundance from repeated counts of a closed population (e.g., Royle (2004) N-mixture model) will be used to generate lizard population estimates for each of the monitoring areas. Population estimates (with confidence intervals) generated from the April 2024 monitoring session provide the baseline reference points for each affected area prior to impact and for the mitigation site (MEEA) prior to pest management and lizard release. The same monitoring sites and data analyses will be used following the release of salvaged lizards to monitor lizard response to management over time. Where appropriate, an open population model (e.g., open population generalization of Royle's (2004) N-mixture model; Dail & Madsen 2011) will be used to explore population trend data across years. Alternatively, a series of closed-population models (Royle (2004) N-mixture model) for each year will be compared[27]. Covariates (e.g., temperature, relative humidity, habitat type, etc.) will be used to account for the influence of an outside variables that may affect the model results.

Lizards captured in pitfall traps will also be temporarily marked with non-toxic (xylene-free) marker pens so that individual capture histories over the period of the monitoring sessions can be recorded. Understanding individual capture histories will assist in testing both the independence of monitoring

[26] Independent sites are considered sites that are sufficiently spatially distributed to eliminate the possibility of the same individual(s) being detected more than once during a sampling period. For this monitoring programme, a minimum distance of 20 m between sites has been set.

[27] Decisions to use closed or open population models will be informed by a biostatistician.

sites (i.e., individual pitfall trap sites) and the closed-population assumptions of each annual monitoring period. Population demographic information will also be collected for all species encountered. Captured lizards will be measured (snout-vent and vent-tail length), weighed, and sexed prior to release.

To provide confidence in the recommended lizard monitoring approach and analytical methods, the monitoring design was reviewed and validated by an experienced biometrician from *Proteus*, an ecological statistical consulting company based in Mosgiel, New Zealand.

6.5 MONITORING LONG-TERM MANAGEMENT BENEFITS

Introduced mammalian predators (especially rodents, hedgehogs, mustelids, and cats) are a driving factor in the population decline of native lizards. Where these predators are supressed or eliminated, positive lizard response occurs (Reardon *et al.* 2012; Romijn 2013; Norbury *et al.* 2022).

Quantitative information on the degree of lizard population response to release from mammalian predators is limited to a few studies, but published information indicates fourfold increases in lizard abundance can be achieved where predators are suppressed to ≤ 5–10% residual catch rates (i.e., 5–10% of the predator population remains in the landscape) and even higher (e.g., sixfold) where mammalian predators are eradicated (Reardon *et al.* 2012; Norbury *et al.* 2022).

For the MP4 Project, a no net loss target (to be refined/ confirmed following consultation) inside MEEA over a predefined timeframe (to be refined/ confirmed following consultation) has be set (Whirika Consulting 2025). The baseline and on-going monitoring will provide data that will be used to measure and track lizard response against the target. Where this target is achieved, positive ecological benefit claims for native lizards, as outlined in the Impact Management Plan (Whirika Consulting 2025) will be realised. It should be emphasised that meeting the target will not result in reductions to management (e.g., mammalian pest suppression) efforts and effort will remain constant for the duration of the timeframe set out in the Impact Management Plan.

In instances where population growth trajectories are not tracking towards desired targets, adaptive management will be applied (e.g., increased level of mammalian predator control) in an attempt to bolster lizard population size back to the desired level to meet targets.

6.6 REPORTING

Following each annual monitoring period (post-lizard release), a report detailing the results of the monitoring will be prepared and copies provided to OceanaGold Ltd., the Department of Conservation, Otago Regional Council, iwi, and other relevant stakeholders. The results reported will include but not be limited to survey conditions, estimated population abundances, population demographics, and measures against management targets. Any recommendations for adaptive management would also be provided.

All records of lizards encountered would be compiled and submitted to the Department of Conservation, for inclusion in the Amphibian and Reptile Distribution Scheme (ARDS) database (*BIOWEB Herpetofauna database*).

6.7 WILDLIFE ACT AUTHORITY AND COMPLIANCE REPORTING

Reporting requirements outlined in the Wildlife Act Authority and resource consent will be adhered to.

Lizard capture and relocation data will also be compiled, summarised, and submitted to the Department's national data repository for herpetofauna records (Bioweb ARDS Herpetofauna database) annually. As a minimum, the report will include the following information:

- DOC Wildlife Act Authority number and Project name and location;
- A summary of the species, numbers and age/ sex classes of lizard captured;
- Locations of lizards captured; and
- Summary of salvage method, effort, and success.

7 COMPENSATORY/ CONTINGENCY ACTIONS

Compensatory actions are provided for as contingency measures for unanticipated adverse effects on lizards resulting from the MP4 Project.

These include:

1. If any individual(s) of the larger, rarer lizard species (Otago green skink, Otago skink, grand skink) are found during the salvage operation, the following actions will occur:
    a. Salvage effort will be targeted at sites where rarer or threatened lizard species are detected. The degree and duration of salvage effort will be determined by the Project herpetologist, in consultation with OGL and the DOC, but will be maintained until there is a high level of confidence that all rare or threatened lizards have been removed from the affected area(s).
    b. The lizard(s) will be released into suitable habitat within the fenced and intensively predator-controlled area of MEEA; and
    c. A dedicated and localised monitoring programme will be developed and implemented by the Project herpetologist to monitor the survival of the individual(s) over time (e.g., photo-sight-resight) at and near their point(s) of release.
2. If the overall lizard salvage numbers are unexpectedly exceeded by more than 5% of the anticipated number, during any one of the staged salvage operations[28], all 'excess' individuals will be released into the existing Island Block Covenant site and/ or other suitable area, without any habitat enhancement or follow up monitoring requirements. While high numbers of 'excess' lizards are not expected from the salvage programme[29], an upper limit of no more

[28] Such a situation may arise if large numbers of lizards are captured in the final day of the salvage or where more individuals are captured during the dismantling of targeted rock tors.
[29] The salvage programme has been designed with 'stopping rules' (see Section 4.2) to reduce the likelihood of ending up with high numbers of excess lizards.

than 20 lizards/ ha (of any species) would be released into the Island Block Covenant[30] and/ or other suitable area. Where excess lizards are salvaged, the species and number of individuals will be clearly reported to the Department of Conservation.

3. If any individual(s) of a threatened species (Otago or grand skink) is killed as a direct result of the project activities, compensation could be provided through a contribution to a lizard conservation project focussed on protecting threatened native lizards. The type or value of the contribution will be determined through conversations between OGL, the Project herpetologist, Department of Conservation, and any other relevant stakeholders. The contribution will be commensurate to the effects and sufficient to ensure that tangible benefits for threatened lizard conservation are being realised.

4. Where the post-impact buffer monitoring detects declines in one or more lizard species at rates greater than expected for a species across their national range (i.e., decline rates assigned to species under the NZTCS framework), then more intensive monitoring and investigation into the cause of decline would be carried out. Where necessary, mitigative or compensatory actions would be explored in consultation with relevant stakeholders, including but not limited to OceanaGold and the Department of Conservation.

[30] 20 lizards/ ha is significantly lower than the expected density of lizards already present in Island Block Covenant, as inferred by the abundance of high-quality lizard habitat present at the site and the author's experience with lizard densities in the wider surrounding landscape.

Lizard Management Plan (LMP) Checklist. OceanaGold Limited = OGL, Otago Regional Council = ORC, Department of Conservation = DOC.

Project start-up	Required of:	Completed
Lizard Management Plan approval	OGL, ORC, DOC, mana whenua.	
Approved lizard release sites	DOC, ORC, mana whenua.	
Pre-start meeting	OGL, ORC, Project herpetologist, salvage team, relevant contractors.	
Demarcation of works footprint	OGL surveyors & engineers, vegetation clearance personnel.	
Pre-works management (prior to vegetation clearance and earthworks)		
Pre-works lizard capture and site preparation	Project herpetologist, salvage team, mana whenua.	
Works lizard management		
Machine assisted lizard capture	Project herpetologist, salvage team, mana whenua, contractor, clearance personnel.	
Lizard relocation	Project herpetologist, salvage team, mana whenua.	
Post-works		
Works completion report and lizard records to OGL, ORC, DOC, and relevant stakeholders.	Project herpetologist.	
Mitigation site management (protection, pest control, revegetation)	OGL, ORC, DOC, Project ecologists.	
Habitat creation at lizard relocation site	Project herpetologist, salvage team, mana whenua, contractor, clearance personnel.	
Post-release monitoring (annually)	Project herpetologist and ecologists.	

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9 APPENDICES

APPENDIX I. LESSONS FROM THE DDNIII SALVAGE AND RECOMMENDATIONS (LIZARDEXPERTNZ, 2021)

The extent and duration of the DDNIII Project Impact Area ("PIA") lizard salvage resulted in several lessons for future large-scale salvage operations:

- Based on the predicted number of lizards in the LMP, versus actual numbers of lizards salvaged, a significant upward calibration is required when estimating lizard populations over a similar range of habitats at Macraes Flat. The exact nature of the upward scaling will become clearer once expert index counts over sixteen stage 3 salvage rock tors are compared with actual captures (see Section 3 "Calibration over Sixteen Rock Tors").
- Salvage stopping rules in LMPs need to be flexible, with a feed-back process established between DOC/OGL when the Wildlife Act permit is issued. Salvages of the scale carried out over DDNIII PIA are rare in New Zealand, and as such, stopping rules are still being developed and require real-time adjustment as the salvage progresses.
- Salvage of tussock skinks, at least in the Macraes Ecological District, is best carried out in spring when ground temperatures are relatively low, and skinks are still living in and around overwintering sites. As the season progresses skinks and in particular females, apparently become less catchable. This observation was not relevant to kōrero geckos that were present and catchable year around in most habitats.
- The salvage team were unable to keep ahead of mining works over stage 2 & 3 salvage, highlighting a need to ensure better coordination of OGL mining works schedules with lizard management tasks over any future projects involving salvage.
- Any future LMPs at Macraes Flat, or indeed anywhere in New Zealand where a large-scale lizard salvage project is permitted, need to explicitly provide for any lizards salvaged above and beyond numbers anticipated.

APPENDIX II. SUMMARY OF THE MP4 IMPACT MANAGEMENT STRATEGIES FOR NATIVE LIZARDS (EXTRACTED AND SUMMARISED FROM WHIRIKA 2025).

Compensation

Due to uncertainty in the affected lizard population estimate, compensation is planned for the effects on reptile populations.

Predator control

The focus of the proposed predator control will be using predator removal within an Xcluder predator proof fence in the Murphys EEA. The predator removal /intensive control area will extend over at least 45 ha in Murphy's EEA within which the populations of all target pests will be eradicated and maintained as close to zero as possible (this may require episodic control of mice within the area). Potential breach points of the predator fence (particularly where the fence crosses streams) will be reinforced using 1 ha blocks of permanently set Ka Mate traps paired with permanent bait stations restocked 6-monthly on a 10 m spacing to keep mice at very low densities in these vulnerable areas. Once constructed, the length of the fence will not be re-scaled if lizard population targets are not being met, however, any significant surplus lizard holding capacity may be reserved for mitigating future Macraes Gold Project ecological effects.

All predator control activities, including their eradication within the fence, will be directed by a Predator Control Plan (to be developed).

Lizard Enhancement Project

The effect of the MP4 project on lizards will be addressed under an offset framework of removal of predators from within a predator-proof fence to address the effect on lizard populations. This work is undertaken on the assumption that managing the effect on skink populations will also benefit gecko populations to a similar level, but as gecko populations are notoriously difficult to accurately monitor this population response is taken as given. A similar approach to that used in an offset will be employed in designing the Lizard Enhancement Project which will consist of the predator removal described above to achieve a target lizard population size of net gain.

Rock tor replacement

While the effectiveness of rock tor creation is unknown, it is currently the only technique available to address the loss of rock tor habitat of lizards (and also invertebrates and birds to a degree). At least two rock tor designs are currently being trialled at Macraes (Camp Creek and Deepdell North). The initial results of these trials will be used to inform the best design for replacement rock tors. It is proposed to use locally sourced plate schist to create ~35 replacement rock tors to the agreed design at Murphys EEA along the existing access road (to minimise impact of rock transport).

Site selection for Offsets and Compensation

Murphys EEA has been selected on the basis of its proximity to the Golden Bar and Innes Mills pits, the similarity of vegetation to that being affected, and also best fulfils site selection criteria for lizard salvage or translocation activities[31]. It is an area of farmland that retains areas of semi-natural vegetation that is degraded by ongoing grazing, weed invasion (particularly by gorse), and a recent fire that has severely damaged the shrublands and tussock grassland. The tussocks have recovered to about 50% of their probable pre-burn stature and there has been some loss in extent. The site is comparable in elevation (except to the higher elevation Coronation 6 area) and general ecological character to the sites within the project area, though there is a greater predominance and greater size of rock outcrops and tors (viewed as a positive attribute). The site is nearby to a site that was known to recently harbour Otago skinks at two sites and these may still be present[32]. A number of other ecological features are present in the site (depending on its final boundary) including populations of other rare plants. The boundary of the EEA is located to give at least 200 m clearance of a nearby area of potential mining interest.

The site will be covenanted, with stock-proof fencing erected around the perimeter, and a smaller (~45 ha) area within will be predator-proof fenced.. The predator removal/ intensive control will occur inside the fence and populations of all target pests will be eradicated and maintained at zero (this will require episodic control of mice within the area).

The specific location of the ~45 ha fence is yet to be finalised and will be defined based on further engagement with DOC, Iwi, and construction contractors. In the interim, an indicative 91 ha area of the Murphys Creek catchment has been selected, within which the 45 ha predator exclusion fence can be constructed.

[31] NZ Lizard Taxon Advisory Group, 2019

[32] Knox, C. 2015. Survey for green skink (*Oligosoma chloronoton* Clade 3b) on the Oceana Gold (NZ) Limited estate at Macraes Flat, Otago. Unpub. Report. EcoGecko Consultants.

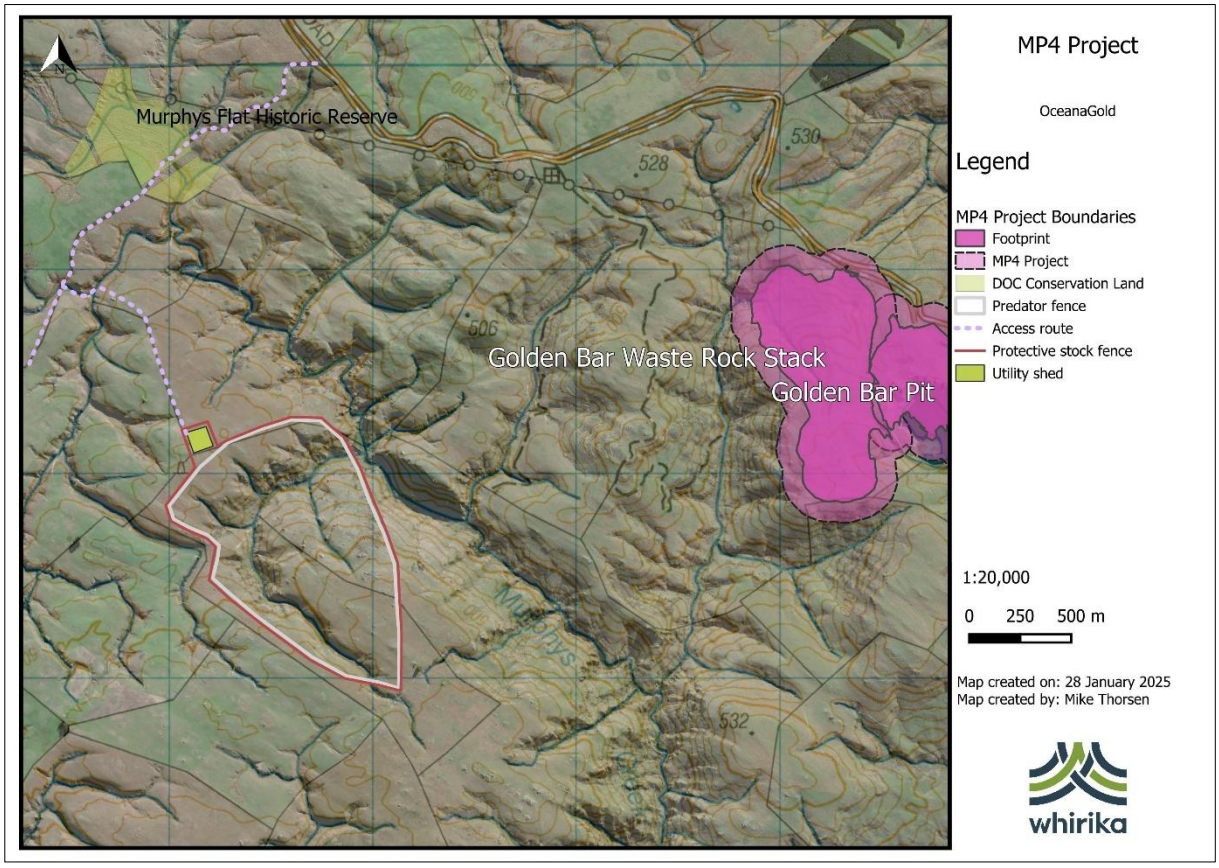

Figure 1. Indicative location of Murphys EEA (white outline). Murphys Historic Reserve shaded green. Golden Bar Road at top of figure and Golden Bar project components shaded pink. Note: the white outline indicates the practicable fence line of a predator-proof Xcluder fence. Specific location of the ~45 ha fence is yet to be finalised but will be within the indicative Murphys EEA location (white outline).

Overview of Murphys EEA looking SE down valley to Murphys Creek showing habitat variation. Tussock in foreground recovering after a fire.

Fence detail

A feasibility assessment for the pest-proof fence is provided by Xcluder® in Appendix III. This provides detail on and images of the proposed design, fence and material specifications and construction.

Fence design

The fence design proposed by Xcluder® to meet the needs of the Macraes project is the Xcluder® "All-Pest" fence. This fence is designed to exclude all mammalian pests known to be present at the site.

The basic configuration and dimensions of this fence has proven to be very successful at exclusion of all target pests over several years.

The design has evolved over the last 25 years to improve several historical design elements, and has now been in successful practical service. Xcluder® have significant experience in designing and building pest-proof fences at sites where water management and erosion protection are critical for successful pest exclusion.

Construction

The fence should be constructed on a stable 5 m-wide platform that controls the movement of water through the base of the fence. The platform will accommodate the fence, provide room on the outside of the fence for a vehicle to pass for fence inspections and maintenance, and room on the uphill side for the construction of a water table to entrap and channel all runoff. Formation typically involves earthworks to create a fence line track, similar to a high-quality farm track or rural road, with water tables and culverts used to pass water under the fence (Figure 9.3).

Culverts

One square box culvert 1.5–2 m in diameter (or equivalent volume) and a water gate will be needed at the tributary mouth. Up to 10 small under-fence water management culverts will pass though the fence at various places.

Pest proofing

For pest proofing, the fence employs 6 mm x 25 mm ss316 stainless steel welded mesh and a mesh skirt is pinned into the substrate with stainless steel geotextile pins (typically galvanised), is covered with earth or metal and then re-grassed.

Gates

Secure, vehicle and ATV/pedestrian gates will be built into the fence perimeter for maintenance and monitoring access.

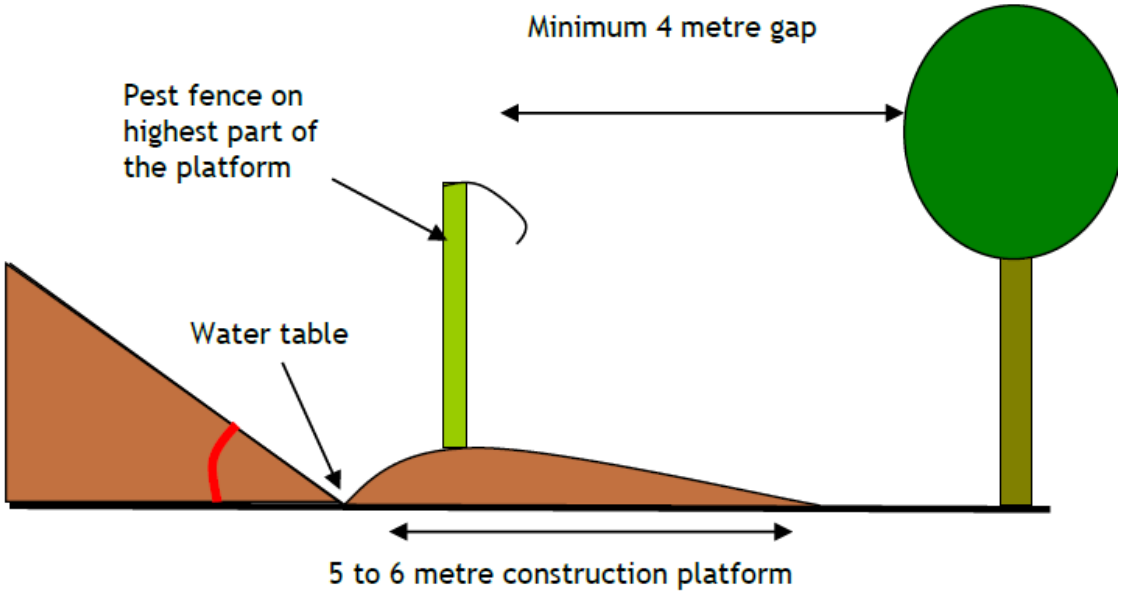

Figure 9.3. Standard fence platform used on steeper sections of the fence

Biosecurity and monitoring

Potential breach points of the predator fence (particularly where the fence crosses ephemeral stream channels) will be reinforced using 1 ha blocks of permanently set Ka Mate traps paired with permanent bait stations restocked 6-monthly on a 10 m spacing to keep mice at very low densities in these vulnerable areas.

An annual inspection and monitoring programme will be developed for the life of the Murphys EEA as part of the Ecological management Plan. It will monitor ecology and habitats covering lizard, bird, invertebrate, and vegetation responses, as well as weed and predator incursions and their removal.

Monitoring

A monitoring programme will be a key part of the project Impact Management Plan. Monitoring will cover the following:

1. Documenting long-term changes in lizard populations within the Murphys EEA, particularly in areas where salvaged lizards have been released.
2. Documenting long-term changes in bird populations, particularly of uncommon or taoka species, in the Murphys EEA.
3. Long-term monitoring of invertebrate communities in the Murphys EEA and Golden Bar WRS tussock rehabilitation in comparison with un-managed site(s) utilising pitfall trapping and light trapping.
4. Monitoring the quality and type of vegetation (community composition, ground cover, structure, weediness, pest damage) in the Murphys EEA, wetland and ephemeral wetland offset sites in comparison with un-managed site(s) (where possible) using permanent plots.
5. Monitoring of establishment and survival of rescued plants.

6. Monitoring of re-establishment of tussock grassland at Golden Bar WRS measuring community composition, ground cover, structure, weediness, pest damage.
7. Environmental weed survey and monitoring.
8. Annual inspections of Murphys EEA to increase knowledge of the biodiversity at the site.
9. Pest animal removal effectiveness.

Long term MEEA management and maintenance

Important components of the Murphys EEA site over the long term include the following:

- Legal protection of site and provision in perpetuity (via a covenant)
- Be of sufficient size to compensate for uncertainties in ecological outcomes
- Will have ecological oversight
- Will have funding to support the Murphys EEA over the term of the offset (35 years)
- Development of a Murphys EEA management plan
- The Murphys EEA will be maintained by dedicated personnel, and the facility will include site buildings to house personnel and equipment

Initial Intensive Predator Control

A preliminary stage of intensive predator control ("IPC") will occur during Q4 2025-Q1 2026 in the northern part of Murphys EEA to facilitate salvaging of IM9-10 lizards in Q1 2026. IPC will be undertaken prior to and/ during fence construction. Fence construction will follow during Q2-Q3 2026. Predator removal within the fenced perimeter will be completed once all consents are obtained. The planned IPC is outlined in Appendix IV.

APPENDIX III. FEASIBILITY ASSESSMENT FOR XCLUDER® PEST-PROOF FENCE AT MACRAES, OTAGO.

APPENDIX IV. PROPOSED INTERIM PEST CONTROL FOR LIZARD-TRANSFER SITE – MURPHY'S CREEK 2024-2025 (OCEANA GOLD), OTAGO (BIODIVERSITY RESTORATION SPECIALISTS, 29 JULY 2024)

APPENDIX V. CERTIFICATE VITAE: DYLAN VAN WINKEL

Dylan van Winkel

Technical Director –

Terrestrial ecology/ Herpetology

M.Sc. (Hons) Conservation Biology

B.Sc. Zoology & Physiology

dylan.vanwinkel@bioresearches.co.nz

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Personal profile

Dylan has over 15 years of experience in the fields of ecology, herpetology, and conservation. More specifically, his focus has been on herpetofauna survey and monitoring, translocation, threatened species management, in situ conservation, and invasive herpetofauna eradication. Dylan is a consultant herpetologist to the Ministry for Primary Industries (Biosecurity New Zealand), a member of the IUCN Skink Specialist Group (SSG), council member of the Society for Research of Amphibians and Reptiles of New Zealand (SRARNZ), a herpetological advisor to the Endangered Species Foundation, and an external member of the New Zealand Lizard Technical Advisory Group. He is also an assessor for both the National and Tāmaki Makaurau/ Auckland regional reptile threat conservation status assessments and reptile assessments for IUCN Red List.

Career summary

2009–present	Senior ecologist/Herpetologist: Bioresearches (Babbage Consultants)
2006 – 2009	Independent ecologist.

Current Wildlife Act Authorities

- 37604-FAU: National herpetofauna capture, handling and holding in temporary captivity, & small-scale relocations.
- 98006-FAU: Auckland capture, handling and holding in temporary captivity, & small-scale relocations.
- 102041-CAP: Holding protected lizards in captivity.

Featured herpetofauna experience

- **Department of Conservation: Lizard monitoring programme for Rangitoto and Motutapu Islands (2008/2009):** Implementation of monitoring programme for Department of Conservation. Management and delivery of pre-eradication assessment of lizard diversity, spatial distribution, and abundance.
- **Waka Kotahi/NZTA: Ara Tūhono Pūhoi to Wellsford RoNS (2012–2015) & Northland Bridges Kaeo (2019–2020):** Native lizard surveys and provision of management recommendations to mitigate potential adverse effects.
- **Auckland Council: Gecko monitoring programme for Regional Parks (2010–2017):** Collaborative development and implementation of a long-term region-wide monitoring to determine the spatial and temporal distribution and abundance of indigenous geckos.
- **Auckland Council: Muriwai gecko monitoring (2020–2024):** Development and implementation of a long-term population monitoring to determine the spatial and temporal distribution and abundance of Muriwai gecko and tātahi skink.
- **Tonkin & Taylor: Technical herpetofauna field assistance Mt Messenger & Ara Tūhono Pūhoi to Wellsford RoNS (2017–2018):** Provided technical field expertise to assist survey identification of lizard species and spatial distribution at Mt. Messenger. Provided technical field and logistical expertise to capture for relocation, native geckos from the Puhoi to Warkworth motorway Project.
- **Royal Forest & Bird Society: Reptile survey and monitoring programme (2021–ongoing):** Reptile survey of the Hibiscus Coast and design and management of a long-term reptile monitoring programme across the Whangaparaoa Peninsula.
- **Rotoroa Island Trust: Rotoroa Island lizard translocations (2014–2015):** Preparation of translocation proposals, stakeholder liaison, logistics and release-site management advice, and collection of moko skinks.
- **Tonga Power: Tongatapu wind generation feasibility study (2014–2015):** Assessments of reptiles for an Environmental Impact Assessment.
- **Biosecurity New Zealand (MPI): Alpine newt and plague skink eradications (2013 to present):** Technical herpetological advice on the trapping, monitoring and eradication of an exotic amphibian and skink in New Zealand.
- Biosecurity New Zealand (MPI): Foreign herpetofauna determinations (2014 to present): Primary herpetologist: Species determinations and risk-assessments on foreign reptiles and amphibians detected at, or post-, New Zealand border. Provision of expert advice on amphibian incursion programmes and legal compliance issues.
- General herpetofauna survey & salvage: Managed or coordinated over 75 herpetofauna surveys and salvage relocation programmes across New Zealand.

APPENDIX VI. ANALYSIS OF MACRAES FLAT LIZARD MONITORING DATA (MACKENZIE & BRATT 2024).

APPENDIX VII. LIZARD POPULATION ESTIMATES AND DENSITY (SKINKS/ HA) FOR MP4 IMPACT AREA.