



Macraes Phase 4 Fast-track

Avifauna Monitoring and Management Plan

for: Oceana Gold (New Zealand) Limited



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List of Abbreviations and Terminology

Term	Definition
Accidental Discovery Protocol	Procedure applied where indigenous species not previously identified in this AMMP are found breeding within the Project area.
AMMP	Avifauna Management & Monitoring Plan (this document)
Breeding season	The period spanning initiation of breeding, egg laying, nestling periods, and up to age of independence for fledgling young; varies by species and local conditions.
Buffer zone	A species-specific protection area established around an identified nest — typically 50 m for ground-nesting birds and up to 200 m for Eastern falcon.
EIANZ	Environment Institute of Australia and New Zealand
Fast-track Approvals Act 2024	Legislation under which the Project's approvals and supporting ecological assessment are progressed.
GIS	Geographic Information System
GPS	Global Positioning System
Ground-nesting birds	Species that nest on the ground (e.g. banded dotterel, SIPO, pied stilt).
Initiation of breeding	Early breeding behaviour such as nest building and mating, before eggs are laid (a breeding site is established but no eggs laid).
Kārearea / Eastern falcon	Eastern falcon (<i>Falco novaeseelandiae</i>); managed under a larger buffer regime (Section 6).
LINZ	Land Information New Zealand
MP4	Macraes Phase Four Project
Nest check / pre-works nest survey	Visual inspection of the works area (and surrounding buffer) by a SQEP to detect nesting birds before works commence.
NPS-IB	National Policy Statement for Indigenous Biodiversity 2023
NZTA	New Zealand Transport Agency (Waka Kotahi)
OGNZL	Oceana Gold (New Zealand) Limited
Project Ornithologist	The ornithologist responsible for overseeing nest surveys, monitoring, adaptive management and reporting under this AMMP.
RMA	Resource Management Act 1991
SIPO	South Island pied oystercatcher (<i>Haematopus finschi</i>)
SQEP	Suitably qualified experienced person (e.g. an ornithologist and/or ecologist)
TAR	Threatened or At-Risk (New Zealand Threat Classification status)
Threatened or At-Risk species	Species classified as Threatened or At-Risk under the New Zealand Threat Classification System.
Works Area	Any area where work is occurring or is to occur to enable mining and waste rock stack construction. This includes haul roads, laydown areas, stockpiles and other ancillary mining facilities.

1 EXECUTIVE SUMMARY

This Avifauna Management & Monitoring Plan (AMMP) has been prepared to support the Macraes Phase Four Project (MP4) and outlines measures to manage potential effects on indigenous bird species during construction, operation, and rehabilitation phases. The AMMP forms part of the Project's ecological assessment under the Fast-track Approvals Act 2024.

The Project involves the expansion and continuation of mining activities within an existing, highly modified landscape. Despite this, the site supports a range of indigenous avifauna, including Threatened and At-Risk species such as eastern falcon, banded dotterel, South Island pied oystercatcher (SIPO), and New Zealand pipit. These species are particularly vulnerable to disturbance during breeding, especially ground-nesting birds that utilise open and disturbed habitats.

The primary risk to avifauna is disturbance or destruction of nests, eggs, and chicks during the breeding season. This AMMP adopts a precautionary and adaptive management approach to minimise potential adverse effects of the Project on protected native avifauna. The approach is informed by ongoing survey and monitoring, enabling management measures to be refined as new information becomes available.

Key management measures include:

- Pre-work surveys by a suitably qualified ornithologist;
- Establishment of species-specific buffer zones (typically 50 m for ground-nesting birds and up to 200 m for eastern falcon) for identified nests;
- Temporary cessation or modification of works where nests are present;
- Use of deterrence methods prior to the breeding season, to reduce nesting in active work areas;
- Ongoing monitoring of breeding activity, including weekly inspections and daily checks where required.

Species-specific protocols are provided for ground-nesting birds, eastern falcon, wetland, and tree or shrub-nesting species with the potential to breed on site, as listed in Table 1.1. These protocols include nest surveys, deterrence measures, procedures for nest discovery, and nest management if required. These measures are designed to avoid direct mortality, minimise disturbance, and ensure compliance with the Wildlife Act 1953.

Implementation of this AMMP will enable Project activities to proceed while appropriately managing effects on avifauna in accordance with statutory requirements and current best practice.

Table 1.1. A summary of the avifauna breeding seasons, with potential to breed on site. Indicative breeding months (in blue) are from New Zealand Birds online (nzbirdsonline.org.nz) and include both egg-laying and nestling dates. Nesting location is indicative only and can be used to determine management actions (section 5 to 7). Note that game birds that are partially protected under the Wildlife Act 1953 are indicated as GB.

Common name*	Nesting location	Breeding Season												Management Required	Buffer zone (m)	Section Detailing Management
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Banded dotterel, pohowera	Ground													Nest check prior to works during the breeding season. Nest buffer and monitoring if nest present.	50	Section 5
Eastern falcon	Ground														200	Section 6
South Island pied oystercatcher, Tōrea	Ground														50	Section 5
Black shag, Māpunga	Tree														20	Section 7
New Zealand Fernbird	Shrub/wetland														20	Section 7
New Zealand pipit, Pīhoihoi	Ground														50	Section 5
Silvereye, tauhou	Tree/shrub														20	Section 7
Australasian shoveler, Kuruwheangi (GB)	Ground														50	Section 5
Grey teal, Tētē-moroiti	Ground, Tree														50	Section 5
Grey warbler, riroriro	Tree/shrub														20	Section 7
Kererū, New Zealand pigeon	Tree														20	Section 7
Morepork, ruru	Tree cavity														20	Section 7
New Zealand scaup, Pāpango	Ground														50	Section 5
Paradise shelduck, Pūtangitangi	Tree cavity/ground														20	Section 7
Pied Stilt, Poaka	Ground														50	Section 5
Pūkeko (GB)	Ground														50	Section 5
Sacred kingfisher, Kōtare	Tree cavity														20	Section 7
South Island fantail, Pīwakawaka	Tree/shrub														20	Section 7
Southern black-backed gull, Karoro	Ground													Not required (not protected under wildlife act)		
Spur-winged plover	Ground															
Swamp harrier, Kāhu	Ground/shrub													Nest check prior to works during the breeding season. Nest buffer and monitoring if nest present.	50	Section 5
Tūi	Shrub/tree														20	Section 7
Welcome swallow, warou	Buildings/cliffs														20	Section 7
White-faced heron, Matuku moana	Trees														20	Section 7

Note: *The colour gradient indicates the species conservation status: dark red = Threatened, light red = At-Risk, olive green = Not Threatened.

2 INTRODUCTION

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

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

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

2.1 Site Location and Description

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

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

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

- Numerous open pits (both operational and non-operational);
- Two underground mines (Fraser’s, now closed, and Golden Point, which is actively mined);
- Waste rock stacks at various stages of operation and rehabilitation;
- A network of haul roads and general mine service tracks;
- A Processing Plant;
- Five tailings storage facilities (three inactive, one active but nearing capacity, and one under construction and currently receiving tailings);
- An extensive network of water management infrastructure, including diversion drains, silt ponds, sumps, pit lakes, and freshwater storage reservoirs;
- Two consented but not yet constructed water storage reservoirs (Camp Creek Dam and Coal Creek Dam); and
- Associated infrastructure supporting ongoing operations, including district roads, powerlines, workshops, offices, and associated water and amenity facilities.

Macraes Phase 4 Fast-track

Avifauna Monitoring and Management Plan

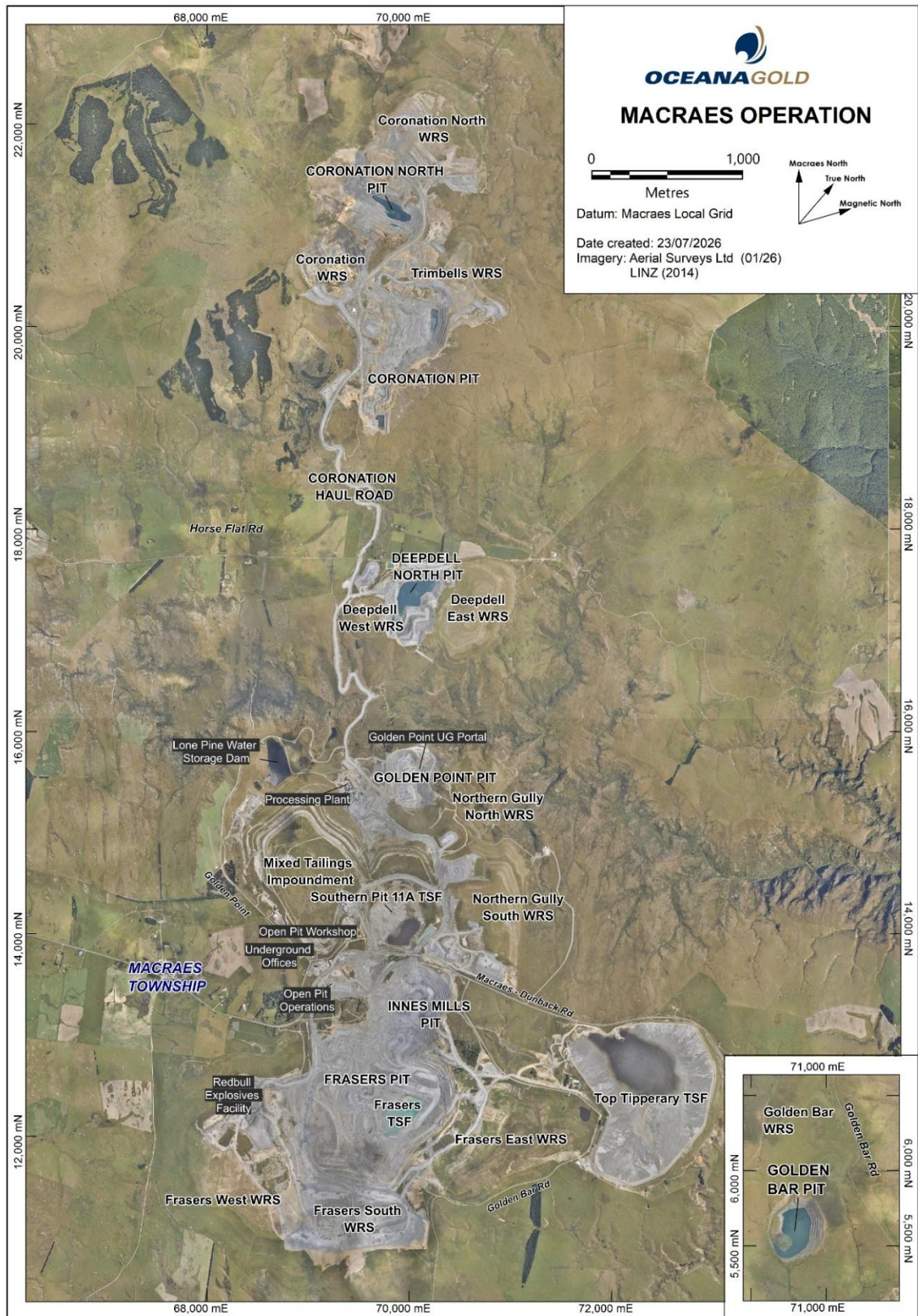


Figure 2.1. Existing site layout at the Macraes Operation (as of July 2026)

2.2 Project Overview

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

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

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

Project works will involve vegetation clearance, earthworks, heavy machinery operation, and ongoing disturbance over an extended timeframe. These activities have the potential to disturb native avifauna, particularly during the breeding season, and may result in the loss of nests and/or breeding success if not appropriately managed. Project components relevant for this AMMP are shown in Figure 2.3.

Macraes Phase 4 Fast-track

Avifauna Monitoring and Management Plan

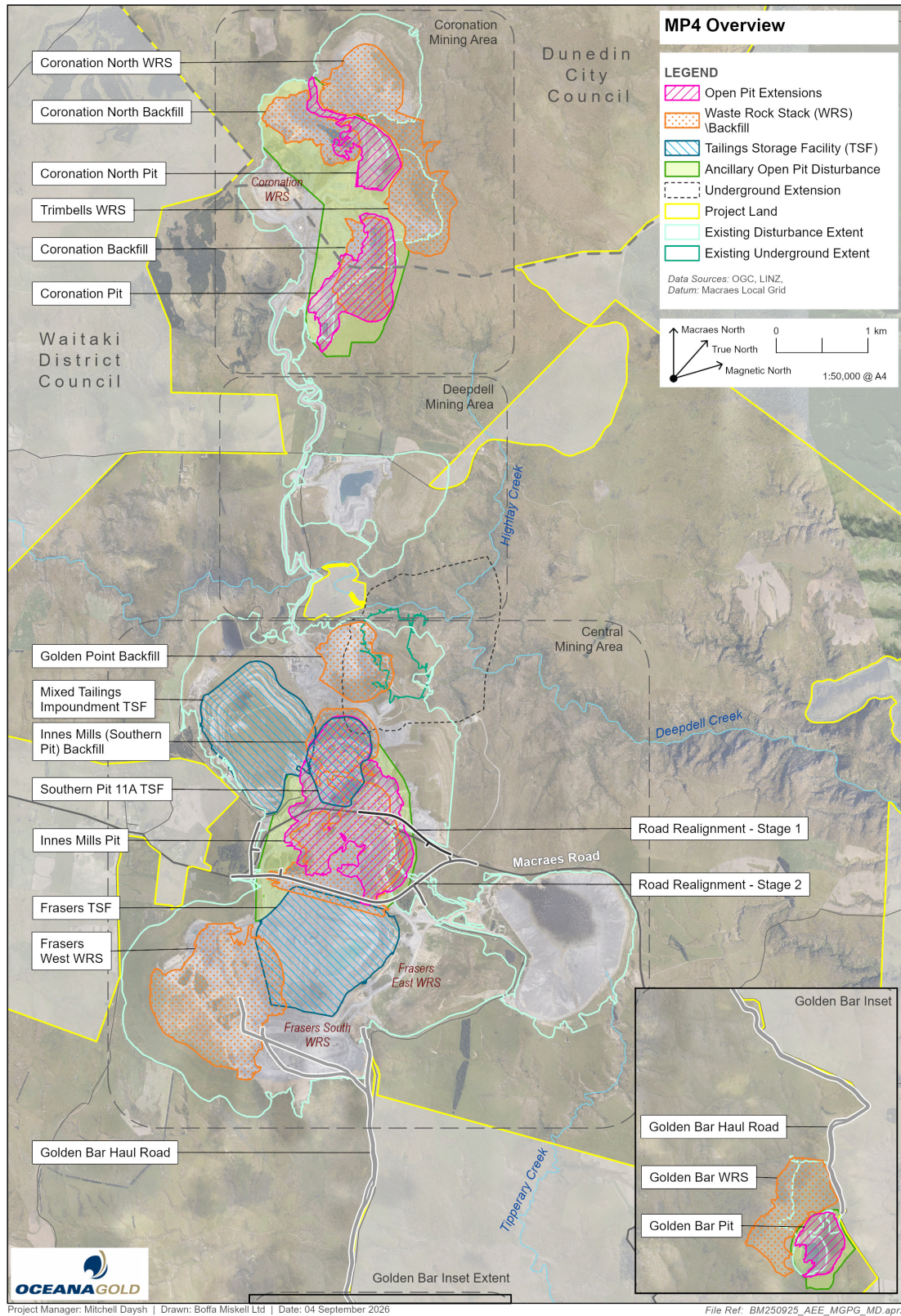
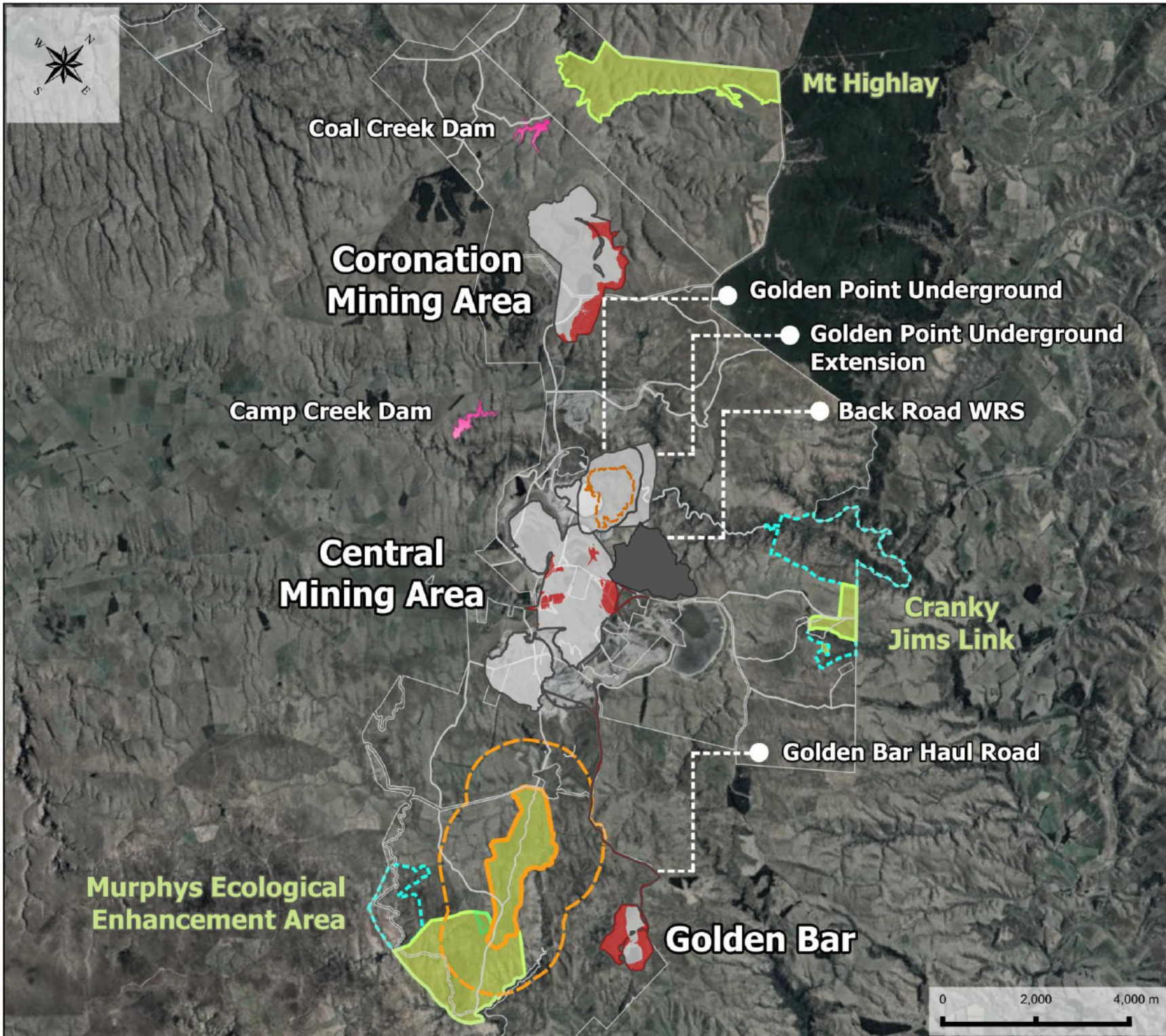


Figure 2.2. MP4 Overview Plan

Figure 2.3. (following page): Overview of Macraes MP4 areas



MP4 Project Areas

Date: 05/08/2026

Drawn By: MS

Client: OceanaGold New Zealand Ltd

Scale: 1:110,000

Legend

OGL landholdings

Mining Areas

- Mp4 Project Components
- Areas of habitat/vegetation loss within the MP4 Project
- Camp and Coal Creek Dams
- Backroad Waste Rock Stack
- GPUG Consented Boundary

Offset/Compensation Sites

- Sites of Protection/Restoration for Compensation Package
- Predator exclusion fence
- Predator exclusion fence buffer
- Existing Ecology Covenants
- OGL landholdings

SOURCES
LINZ Basemap aerial

MAP PROJECTION
NZGD2000 / New Zealand Transverse
Mercator 2000

Bioresearches
A Babbage Company

2.3 Sequencing of Activities and Proposed Work Dates

The project is not being progressed in stages. Rather, all activities that comprise the MP4 project are included in this substantive application. Those activities are anticipated to occur across a period of 13 years, with OGNZL proposing to commence the MP4 project as soon as the necessary approvals are obtained.

The activities described herein are expected to be generally sequenced as follows:

- The continuation of Innes Mills Pit mining from Year 2 to Year 12;
- The continuation of Coronation Pit mining from Year 2 to Year 6;
- Relocation of tailings from Southern Pit TSF and MTI from Year 2 to Year 12 to facilitate mining of Innes Mills Stage 13 (IM13);
- The continuation of Golden Bar Pit mining mostly in Year 3 and in Year 7;
- The continuation of GPUG mining from Year 1 to Year 10;
- The continuation of Coronation North mining from Year 1 to Year 2 and then from Year 7 to Year 10;
- Associated replenishment of stockpiles throughout the MP4 mine life; and
- Full site rehabilitation to commence in Year 11 and be completed by approximately end of Year 13.

Mine planning is fluid at complex multi-pit operations such as the Macraes Operation. Precise timing of activities depends on a range of factors and operational requirements may facilitate changes to the sequencing of some activities.

Table 2.1 shows the anticipated sequencing of the proposed MP4 activities across the life of the project.

Table 2.1: Anticipated sequencing of MP4 activities

Pit	Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Innes Mills	IM8													
	IM9													
	IM10													
	IM11													
	IM12													
	IM13													
Coronation North	CN5													
	CN6													
Coronation	C06													
	C07													
	C08													
Golden Bar	GB2													
	GB3													
Underground	GPUG													
Stockpiles														

2.4 Purpose and Scope

The purpose of this AMMP is to provide a structured framework for managing potential adverse effects of the MP4 Project on avifauna. The AMMP identifies key risks to indigenous bird species associated with Project activities and sets out measures to avoid, minimise, and manage those effects in accordance with best practice and relevant statutory requirements.

This AMMP applies to all stages of the Project that have the potential to affect avifauna, including site preparation, construction, operation, and rehabilitation activities. It covers all areas within the Project Footprint and the associated Zone of Influence, recognising that effects on mobile species such as birds may extend beyond the immediate works area.

Indirect effects on avifauna associated with the wider operation of the Project, including noise, vibration, lighting, dust, vehicle movements and other operational disturbance, are assessed in the Ecological Impact Assessment (E7; Bioresearches, 2026f). These effects are not managed through this AMMP unless they relate directly to the nest and breeding management measures specified herein. Project-wide management of indirect effects will be implemented through the relevant operational, environmental and other management measures applying to MP4.

This scope of this report is to:

- Give effect to the proposed consent conditions for MP4 (see Table 2.4 for relevant consent numbers);
- Managing effects on indigenous bird species, with a focus on Threatened and At-Risk species identified through site surveys and ecological assessments;
- Procedures for pre-works surveys to identify bird presence, nesting activity, and habitat use;
- Implementation of species-specific and general management measures to address disturbance, habitat loss, and direct mortality risk; and
- Monitoring and reporting requirements to support compliance and inform adaptive management.

This AMMP is informed by available ecological information, including the findings of the Avifauna Values Assessment (E5), Ecological Impact Assessment (E7) and the Residual Effects Analysis Report (E13) which provide information regarding species presence, distribution, and breeding activity within the Project area and the surrounding landscape. These documents are referenced to in Table 2.2.

Table 2.2. Ecology Documents prepared for the proposed Macraes Phase 4 Project. Current document highlighted.

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

2.5 Objectives

The objectives of this AMMP are to:

- Avoid injury and mortality of indigenous bird species during Project works;
- Avoid and minimise disturbance to breeding birds, particularly Threatened and At-Risk species;

- Provide clear protocols for pre-works surveys and management of nests, eggs, and chicks;
- Establish monitoring and reporting procedures to support compliance and adaptive management; and
- Ensure that all works are undertaken in accordance with relevant statutory requirements.

2.6 Statutory Context

Management of avifauna for the MP4 Project is informed by a range of statutory and policy instruments, that provide for the protection of indigenous biodiversity and regulate activities that may affect bird species and their habitats. The following provisions are of particular relevance to the AMMP.

2.6.1 Wildlife Act 1953

With the exception of game birds, which are partially protected, and two unprotected indigenous species: the southern black-backed gull (*Larus dominicanus*) and spur-winged plover (*Vanellus miles*), all other indigenous bird species in New Zealand are fully protected under the Wildlife Act 1953. The Act makes it an offence to hunt, kill, or possess protected wildlife, or to disturb or destroy nests or eggs, without appropriate authorisation from the Department of Conservation.

Accordingly, all Project works must be undertaken in a manner that avoids direct harm to protected, indigenous birds, as well as disturbance to active nests, eggs, and chicks. This AMMP establishes procedures for pre-works surveys, identification of breeding activity, and implementation of appropriate management responses to ensure compliance with the Act.

2.6.2 Resource Management Act 1991

The Resource Management Act 1991 (RMA) provides the overarching framework for managing the environmental effects of activities in New Zealand. Under sections 5 and 17 of the RMA, adverse effects on the environment, including effects on indigenous biodiversity, must be avoided, remedied, or mitigated.

Assessment of ecological effects, including those on avifauna, is required under section 88 and Schedule 4 of the RMA, which set out the information requirements for an Assessment of Environmental Effects. This AMMP supports this process by identifying potential effects on avifauna and specifying measures to manage those effects in accordance with the effects management hierarchy (Roper-Lindsay et al., 2018).

2.6.3 National Policy Statement for Indigenous Biodiversity 2023

The National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB) requires the maintenance and, where possible, enhancement of indigenous biodiversity. It places particular emphasis on protecting habitats of indigenous species and managing adverse effects on biodiversity values.

Although detailed provisions are implemented through regional and district plans, the NPS-IB is relevant to this AMMP in that it reinforces the need to:

- Avoid significant adverse effects on indigenous biodiversity;
- Manage effects on habitats of Threatened and At-Risk species; and
- Apply the effects management hierarchy, including avoidance and minimisation as primary responses.

This AMMP contributes to achieving these outcomes by providing the avifauna values (as identified within the Avifauna Values Assessment; Bioresearches, 2026d) within the Project area and setting out measures to manage risks to those values.

2.6.4 Otago Regional Policy and Planning Framework

The Otago Regional Policy Statement and relevant regional plans provide direction on the management of natural resources, including indigenous biodiversity and habitats of indigenous fauna. These documents recognise the importance of protecting significant indigenous vegetation and habitats and managing adverse effects on ecological values.

While the AMMP is not a regulatory document, it has been prepared to align with these regional provisions by identifying avifauna values and implementing measures to avoid or minimise adverse effects where practicable.

2.6.5 Waitaki and Dunedin District Plans

The Project area spans areas administered by both the Waitaki District Council and the Dunedin City Council. The respective district plans include objectives, policies, and rules relating to indigenous biodiversity, including the protection of significant natural areas and habitats of indigenous fauna.

These plans generally seek to:

- Protect habitats that support indigenous species, particularly those that are Threatened or At-Risk;
- Avoid or mitigate adverse effects of land use and development on biodiversity values; and
- Recognise the ecological importance of modified landscapes where they provide habitat for indigenous fauna.

This AMMP has been developed to support consistency with these provisions by identifying avifauna habitat within the Project area (Figure 2.3) and outlining management measures to reduce adverse effects associated with Project works.

2.7 Overview of the Avifauna Management & Monitoring Plan

This AMMP requires actions to avoid adverse effects on native birds by way of breeding surveys and nest monitoring as required. The credentials and contact details of the Project Ornithologist are provided in Table 2.3. A summary of the proposed AMMP activities has been provided as a checklist in

Table 2.3. For details on each of these elements, refer to the appropriate section within the AMMP body text.

2.8 Responsibilities and competencies

The roles and responsibilities for implementation of the AMMP are set out as follows. OGNZL hold overall accountability, and the Macraes environmental team and nominated project manager will be responsible for implementation and compliance with the AMMP, and any conditions listed as part of a resource consent issued to OGNZL.

The project ecologist (Michael Anderson) takes the technical lead and will liaise with the other roles through OGNZL's Project Manager. Supporting ecologists and/ or sub-contractors that will contribute to the AMMP protocols required before, during, and after mine development will act under the supervision of the lead project ecologist.

Table 2.3. Details of Project Ornithologist (at time of writing)

Credentials and Contact Details of Project Ornithologist	
Project Ecologist/Ornithologist	Dr. Michael Anderson
Credentials	PhD, 23 years of ornithology experience
Email	[REDACTED]

Table 2.4. Avifauna Management & Monitoring Plan (AMMP) Checklist

Project start-up	Required of:	Relevant section of AMMP	Completed	Relevant consent conditions
Avifauna Management & Monitoring Plan	Contractor			
Timing of the implementation of the AMMP		Table 1.1; throughout		
Summary of affected habitats and species		Sections 3 and 4		
Works management				
Pre-work survey for the presence of birds and breeding status/nest presence.	Ornithologist, project contractor or delegated SQEP*	Sections 5.2, 6.1.1 and 7		
Protocols to deter ground-nesting avifauna from nesting on the site		Section 5.1		
Protocols for eggs detected on-site (ground nesting species)		Section 5.3		
Protocols for chicks detected on-site (ground nesting species)		Section 5.4		
Ongoing monitoring		Section 8		

Demarcating active nests with a buffer boundary (20 or 50 m; e.g. tape and posts) and a no-go zone (20 or 50 m).	Ornithologist, project contractor or delegated SQEP*	Section 5.3 and 7		
Daily checks for chick locations once chicks mobile	Ornithologist, project contractor or delegated SQEP*	Section 5.4		
Monitoring and Completion report	Ornithologist	Section 8		
Works nest management (Eastern Falcon)				
Demarcating active nests with a 200 m boundary (e.g. tape and posts). Exceptions can be made in certain circumstances as described in Section 6.3	Ornithologist, project contractor or delegated SQEP*	Section 6.2		
Monitoring and Completion report	Ornithologist	Section 8		

*Suitably qualified or experienced person

2.9 Categories of Work Requiring Nest Checks

MP4 Project works do not represent a single, uniform 'construction' phase but a sequence of activities with differing levels of ground disturbance, operating hours and duration: non-invasive ecological assessment work, vegetation clearance linked to lizard salvage (undertaken in daylight hours only), topsoil stripping and earthworks establishing new mining footprint, and active mining and blasting within already-disturbed areas (typically continuous, 24 hours a day). Table 2.5 clarifies which of these categories trigger a pre-works nest check, and the timing that applies. Where clearance and mining preparation for a given work area are separated by an extended period, or where a work area is left inactive, the check is retriggered in accordance with Section 8.1.4.

Table 2.5. Categories of work at MP4 and associated nest check requirements.

Category of work	Example activities	Nest check required?	Timing / trigger
Non-invasive ecological assessment	Site walkovers, ecological surveys, lizard pitfall trap installation and monitoring	No	No vegetation or ground disturbance occurs; any incidental nest observation is managed under the Accidental Discovery Protocol (Section 8.1.5).
Vegetation clearance (including clearance associated with lizard salvage)	Tussock/shrubland clearance ahead of lizard salvage; tree and shrub felling	Yes	Pre-clearance check within 24 hours of clearance commencing, where undertaken during the bird breeding season (August–March) (Sections 5.2, 7).

Topsoil stripping and earthworks establishing new mining footprint	New pit benches, waste rock stack lifts, haul road formation	Yes	Pre-works check within 24 hours unless the area has already been cleared/checked under the previous category (Sections 5.2, 6.1).
Active mining and blasting within an established, previously checked footprint	Ongoing extraction, blasting and haulage within existing/active pit and waste rock stack areas	No	Area is continuously disturbed and does not constitute suitable nesting habitat.
Resumption of work after a gap	Inclement weather stand-down, seasonal shutdown, or a delay between vegetation clearance/lizard salvage and the start of mining preparation works	Yes	Repeat check required where a work area has been inactive for more than 72 hours (Section 8.1.4). For longer gaps (weeks to months) between a second nest check will be required.
Rehabilitation, rehandling or renewed disturbance of previously inactive mine surfaces	Rehandling or removal of waste rock or stockpiled material; reshaping of waste rock stacks; rehabilitation earthworks; disturbance of previously rehabilitated or inactive mine surfaces.	Yes	A pre-works nest check is required where works are proposed during the breeding season, and the area has been inactive for more than 72 hours, or where the Project Ornithologist considers that the area has become suitable for nesting birds. Any active nest identified will be managed in accordance with Sections 5 to 8 of this AMMP.

3 AVIFAUNA SPECIES PRESENT OR POTENTIALLY PRESENT

This section summarises avifauna species recorded or considered likely to be present within the MP4 Project area (Figure 2.3), based on the Avifauna Values Assessment (Bioresearches 2026d).

3.1 Threatened or At Risk Species

The following Threatened or At-Risk species have been identified as present or potentially present within the Project area based on survey data and habitat suitability:

- Eastern falcon (*Falco novaeseelandiae*) – Threatened (Nationally Vulnerable)¹, Regionally Vulnerable²
- Banded dotterel (*Charadrius bicinctus*) – At-Risk (Declining), Regionally Vulnerable
- SIPO (*Haematopus finschi*) – At-Risk (Declining), Regionally Vulnerable
- New Zealand pipit (*Anthus novaeseelandiae*) – At-Risk (Declining), Regionally Not Threatened
- Fernbird (*Poodytes punctatus*) – At-Risk (Declining), Regionally Declining
- Silveryeye (*Zosterops lateralis*) – Not Threatened, Regionally Declining

The majority of these Threatened or At-Risk species are typically associated with open and modified habitats, which includes sparsely vegetated ground, grassland, and disturbed landscapes. Such habitats are characteristic of mining environments and may provide suitable foraging habitat and, in some cases, opportunities for nesting and breeding.

Eastern falcon may utilise elevated or undisturbed areas for nesting and are particularly sensitive to disturbance during the breeding season. Banded dotterel and SIPO are ground-nesting species that may breed in open, gravelly, or sparsely vegetated areas, including disturbed substrates. New Zealand pipit commonly nests on the ground within grassland and open habitats and may be susceptible to disturbance during vegetation clearance and earthworks.

Two Threatened or At-Risk species potentially present within the Project area, fernbird and silveryeye, favour habitats that provide dense vegetation and cover for nesting. Fernbirds require dense, low vegetation that provides effective concealment, most commonly within or adjacent to wetlands. In contrast, silveryeyes favour dense shrubs and small trees that provide sheltered nesting sites rather than open ground. As these habitat types occur within the MP4 Project area, there is potential for these species to be disturbed by vegetation clearance and other Project works during the breeding season.

In addition to species recorded or considered likely within the footprint, the Avifauna Values Assessment identifies several Threatened or At-Risk species that have been observed in the wider surrounding environment but are not currently confirmed within the Project area. Black shag (*Phalacrocorax carbo*) may utilise aquatic habitats within the broader landscape for foraging; however, the Project area does not provide suitable breeding habitat for this species. Black-fronted dotterel (*Elseyornis melanops*) are also identified as potentially present based on regional records and habitat suitability; however, their presence has not been confirmed during surveys to date. Given their use of open, sparsely vegetated ground near water, there remains some potential for occurrence within or adjacent to disturbed areas, and this species is therefore considered in a precautionary context.

Given the mobility of these species and the dynamic nature of mining landscapes, their presence and breeding activity may vary between seasons and years.

Conservation status classifications may change during the life of the Project. If an indigenous bird species is recorded or is reasonably expected to occur within the Project Area and is reclassified to a

¹ Robertson et al., 2021

² Jarvie et al., 2025

higher national or regional conservation category, the Project Ornithologist will review the implications of that change for this AMMP. The review will consider whether existing survey requirements, seasonal controls, nest buffers, monitoring or other management measures remain appropriate. Where a material change to management is warranted, the AMMP will be updated through the applicable plan review process.

3.2 Non-threatened native species

A range of indigenous bird species not currently classified as Threatened or At-Risk have also been recorded or are likely to be present from time to time, within the Project area. These species are generally more widespread and adaptable to modified environments but remain protected under the Wildlife Act 1953.

Species recorded or potentially present are listed in full in Table 3.1. These species utilise a range of habitats within the wider landscape, including grassland, shrubland, waterbodies, and remnant vegetation. While generally less sensitive to disturbance than Threatened or At-Risk species, they may still be affected by vegetation clearance, habitat modification, and mining activities, particularly during nesting periods.

3.2.1 Southern Black-Backed Gull / Karoro

A breeding colony of southern black-backed gull/karoro is present at the existing Golden Bar pit lake. The colony will be displaced by the Golden Bar pit expansion. Karoro is classified as nationally and regionally Not Threatened and has been assigned Low ecological value. Although karoro is a taoka species, it is listed as unprotected wildlife under Schedule 5 of the Wildlife Act 1953. The species is widespread, highly mobile and able to use a broad range of natural and modified nesting, roosting and foraging habitats. Comparable habitat occurs elsewhere within the wider Macraes landscape and, based on the Golden Bar colony only recently establishing after being displaced from another site (Deepdell South in 2020/2021), the displaced birds are expected to establish at another suitable location. The activity affecting the colony will be undertaken outside the main breeding period, so that active nests, eggs and dependent chicks will not be affected. Given the species' Low ecological value, the availability of alternative habitat, the timing of works outside the breeding period, no colony-specific management, monitoring, relocation, deterrence or pre-works breeding checks are proposed

Table 3.1. National and regional threat status, taoka status and overall ecological value for native species that have been confirmed to be within the Project area. Species value has been assigned according to the EIANZ guidelines and assigned based on either the National or Regional threat status, depending on whichever was higher.

Common Name	Scientific Name	National Threat Status ³	Regional Threat status ⁴	Taoka Species ⁵	Species Value
Eastern falcon	<i>Falco novaeseelandiae</i>	Nationally Vulnerable	Regionally Vulnerable	Y	Very High
Banded dotterel	<i>Charadrius bicinctus</i>	Declining	Regionally Vulnerable		Very High
South Island pied oystercatcher	<i>Haematopus finschi</i>	Declining	Regionally Vulnerable		Very High
Black shag	<i>Phalacrocorax carbo</i>	Relict	Regionally Endangered	Y	Very High
New Zealand fernbird	<i>Poodytes punctatus</i>	Declining	Regionally Declining	Y	High
New Zealand pipit	<i>Anthus novaeseelandiae</i>	Declining	Regionally Not Threatened	Y	High
Silvereye	<i>Zosterops lateralis</i>	Not Threatened	Regionally Declining		High
Australasian shoveler	<i>Spatula rhynchotis</i>	Not Threatened	Regionally Not Threatened	Y	Low
Grey teal	<i>Anas gracilis</i>	Not Threatened	Regionally Not Threatened	Y	Low
Grey warbler	<i>Gerygone igata</i>	Not Threatened	Regionally Not Threatened	Y	Low
Kererū	<i>Hemiphaga novaeseelandiae</i>	Not Threatened	Regionally Not Threatened	Y	Low
New Zealand scaup	<i>Aythya novaeseelandiae</i>	Not Threatened	Regionally Not Threatened		Low
Paradise shelduck	<i>Tadorna variegata</i>	Not Threatened	Regionally Not Threatened	Y	Low
Pied stilt	<i>Himantopus leucocephalus</i>	Not Threatened	Regionally Not Threatened	Y	Low
Pūkeko	<i>Porphyrio melanotus</i>	Not Threatened	Regionally Not Threatened	Y	Low
Sacred kingfisher	<i>Todiramphus sanctus</i>	Not Threatened	Regionally Not Threatened	Y	Low
South Island fantail	<i>Rhipidura fuliginosa</i>	Not Threatened	Regionally Not Threatened	Y	Low
*Southern black-backed gull	<i>Larus dominicanus</i>	Not Threatened	Regionally Not Threatened	Y	Low
*Spur-winged plover	<i>Vanellus miles</i>	Not Threatened	Regionally Not Threatened		Low

³ Robertson *et al.*, 2021

⁴ Jarvie *et al.*, 2025

⁵ Ngāi Tahu Claims Settlement Act 1998, 1998 No 97 New Zealand Public Act (1998), <https://www.legislation.govt.nz/act/public/1998/0097/latest/whole.html>

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Swamp harrier	<i>Circus approximans</i>	Not Threatened	Regionally Not Threatened	Y	Low
Tūi	<i>Prosthemadera novaeseelandiae</i>	Not Threatened	Regionally Not Threatened	Y	Low
Welcome swallow	<i>Hirundo neoxena</i>	Not Threatened	Regionally Not Threatened		Low
White-faced heron	<i>Egretta novaehollandiae</i>	Not Threatened	Regionally Not Threatened		Low

Note: Species common names italicised are partially protected under the Wildlife Act 1953, listed as game-birds⁶ or 'partially protected wildlife'⁷. * =native species which are not protected under the Wildlife Act 1953.

⁶ [1] Schedule 1 of the Wildlife Act 1953, <https://www.legislation.govt.nz/act/public/1953/0031/4.0/DLM278547.html>

⁷ [2] Schedule 2 of the Wildlife Act 1953, <https://www.legislation.govt.nz/act/public/1953/0031/4.0/DLM278553.html>

3.3 Breeding Seasons Summary

The timing of breeding seasons is a critical consideration for avifauna management, as birds are most vulnerable to disturbance during nesting, incubation, and chick-rearing periods. Indicative breeding seasons for indigenous species identified within the Project area are summarised in Table 3.2, based on available literature and summarised data from New Zealand Birds Online (nzbirdsonline.org.nz). Note that breeding season includes initiation of breeding (e.g. nest building), egg laying, nestling periods and up to age of independence for fledgling young. These periods may vary depending on local environmental conditions and annual variability. Ground-nesting species such as banded dotterel, SIPO, and pipit are particularly vulnerable during this time, as nests are often inconspicuous and located within open or sparsely vegetated areas. Eastern falcon are also ground nesting, but tend to have nests located in steeper gullies and rock tors.

Given that survey effort is ongoing and breeding activity may not yet be fully characterised, this AMMP adopts a precautionary approach. Pre-construction surveys will be required prior to works undertaken during the breeding season to confirm the presence or absence of active nests and to inform appropriate management responses.

Table 3.2. A summary of the avifauna breeding seasons, with potential to breed on site. Indicative breeding months (in blue) are from New Zealand Birds online (nzbirdsonline.org.nz) and include both egg-laying and nestling dates. Breeding location is indicative only and can be used to determine management actions (section 5 to 7)

Common name*	Breeding location	Breeding Season											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Banded dotterel, pohowera	Ground												
Eastern falcon	Ground/Tor												
South Island pied oystercatcher, Tōrea	Ground												
Black shag, Māpunga	Tree												
New Zealand Fernbird	Shrub/wetland												
New Zealand pipit, Pīhoihoi	Ground/grasses												
Silvereye, tauhou	Tree/shrub												
Australasian shoveler, Kuruwhengi	Ground												
Grey teal, Tētē-moroiti	Ground/Tree												
Grey warbler, riroriro	Tree/shrub												
Kererū, New Zealand pigeon	Tree												
Morepork, ruru	Tree cavity												
New Zealand scaup, Pāpango	Ground												
Paradise shelduck, Pūtangitangi	Ground/Tree												
Pied Stilt, Poaka	Ground												
Pūkeko	Ground												
Sacred kingfisher, Kōtare	Tree cavity/earthen cavity/cliff												
South Island fantail, Pīwakawaka	Tree/shrub												
Southern black-backed gull, Karoro	Ground												

Note: *The colour gradient indicates the species conservation status': dark red= Threatened, light red =At-Risk; olive green = Not Threatened.

4 SITE CHARACTERISTICS

4.1 Ecological Context

The MP4 Project area is located within the existing Macraes Operation in Otago, within a landscape that has been subject to extensive historical land use modification associated with mining, pastoral farming, and infrastructure development. The ecological context of the Project area is therefore characterised by a predominance of modified habitats, interspersed with remnant or regenerating indigenous vegetation and constructed or managed landforms.

Despite this modification, the wider Macraes landscape continues to support a range of indigenous avifauna, including species adapted to open environments. The presence of tussock grassland (AL1), sparsely vegetated areas of grey scrub (VS6), exposed substrates (e.g. rock tors), and artificial landforms associated with mining operations can provide suitable foraging and, in some cases, breeding habitat for ground-nesting species such as banded dotterel, SIPO, and New Zealand pipit. Elevated or less disturbed areas may also provide nesting opportunities for eastern falcon.

Water management infrastructure, including ponds, drains, and treatment systems, may provide habitat for some water-associated species within the broader area, although the extent to which these features support regular avifauna use varies and is subject to ongoing assessment.

The ecological context is dynamic, reflecting both ongoing mining activities and progressive rehabilitation. Habitat availability and suitability for avifauna may change over time as areas are disturbed, recontoured, and revegetated. As such, avifauna use of the Project area is expected to be variable, both spatially and temporally.

4.2 Site description

The MP4 Project area comprises a series of existing and proposed mining areas within the wider Macraes Operation (Figure 2.3). The landscape is highly modified, with a substantial proportion of the Project area comprising active mine workings, rehabilitated landforms, and associated infrastructure. Within the Zone of Influence, land cover includes active mine surfaces, rehabilitated waste rock stacks, improved and rough pasture, pine forest (standing and felled), ephemeral wetlands, riparian vegetation, shrubland, and narrow-leaved tussock grassland.

Approximately 70 per cent of the Project area is associated with existing or recent mining disturbances, with semi-natural and indigenous-dominated habitats forming a smaller but locally important component.

Across the Project area, the dominant ecological pattern is a mosaic of:

- Highly disturbed or engineered substrates (active pits, waste rock stacks, haul roads);
- Exotic grassland and pasture; and
- Indigenous or semi-indigenous habitats including tussock grassland, shrubland, and riparian/wetland features.

These habitat types vary in extent across the different mining areas, as outlined below.

4.2.1 Coronation Mining Area

The Coronation Mining Area is dominated by active and historic mining disturbance associated with open-pit development and waste rock management. Built and disturbed landforms are a defining feature, with additional areas of mine substrate and recently reworked ground.

Vegetation within this area is patchy and reflects a gradient from bare or sparsely vegetated substrates through to regenerating communities. The most extensive semi-natural vegetation comprises dense and moderately dense narrow-leaved tussock grassland, with smaller areas of shrubland.

Exotic grassland is present but relatively limited compared to other Project areas. Minor habitat components include ephemeral wetlands, riparian herbaceous vegetation, and a small area of pine (including felled stands).

Overall, the Coronation Mining Area represents a highly modified environment with localised pockets of regenerating indigenous vegetation, particularly tussock grassland.

4.2.2 Central Mining Area

The Central Mining Area comprises a mix of active mining infrastructure, tailings storage facilities, and previously disturbed land undergoing rehabilitation.

Vegetation is dominated by exotic grassland, which represents the largest single habitat type in this area. Smaller areas of tussock grassland, shrubland, and pine (both standing and felled) are present, reflecting both historical land use and rehabilitation efforts.

This area also contains a greater representation of aquatic and semi-aquatic habitats relative to other mining areas, including ephemeral wetlands, ponds, and riparian vegetation (including herbaceous and shrubland components).

Overall, the Central Mining Area supports a diverse but highly modified assemblage of habitat types, with a strong dominance of exotic vegetation and engineered landforms, interspersed with smaller areas of semi-natural vegetation and aquatic features.

4.2.3 Golden Bar Mining Area

The Golden Bar Mining Area comprises extensions to an existing open pit and associated waste rock storage areas. Much of the footprint occurs over rehabilitated land from earlier mining phases, with additional disturbance affecting areas of tussock grassland.

Vegetation is strongly dominated by exotic grassland, which forms the primary land cover across this area. Indigenous vegetation is present mainly as dense and moderately dense tussock grassland, with smaller areas of shrubland.

Other habitat components include ephemeral wetlands, ponds, and limited riparian vegetation, including sedgeland and minor shrubland associations.

The Golden Bar Mining Area therefore represents a rehabilitated mining landscape with extensive exotic grassland and notable, though fragmented, areas of indigenous tussock vegetation.

4.2.4 Golden Bar Haul Road

The Golden Bar Haul Road corridor comprises a linear infrastructure feature traversing previously disturbed and rehabilitated mining landforms. Works in this area involve realignment across modified terrain, including earthworks and vegetation clearance.

Vegetation is predominantly exotic grassland, with very limited areas of indigenous vegetation. Small, discontinuous patches of tussock grassland occur, along with highly modified habitats such as road margins and disturbed ground.

Other habitat types within the corridor include minor areas of ephemeral wetland and road-associated features, reflecting local drainage patterns and engineered stormwater controls.

Overall, this area is highly modified and fragmented, with low structural complexity and limited ecological connectivity compared to other parts of the Project area.

5 GROUND-NESTING BIRD BREEDING MANAGEMENT

Several ground-nesting bird species have the potential to breed seasonally within the MP4 Project area, particularly within open habitats such as tussock grassland, exotic grassland, rehabilitated mine surfaces, and sparsely vegetated areas. These species include:

- Open-habitat shorebirds, such as banded dotterel, SIPO, and pied stilt, construct simple scrape nests on the ground and are highly adaptable, capable of nesting within a range of disturbed environments;
- Terrestrial passerines such as the New Zealand pipit (*Anthus novaeseelandiae*), which are known to nest in low vegetation and open ground;
- Wetland-associated species such as pūkeko (*Porphyrio melanotus*) and fernbird (*Poodytes punctatus*), particularly in proximity to ephemeral wetlands and riparian margins;
- Waterfowl, including paradise shelduck (*Tadorna variegata*), grey teal (*Anas gracilis*), utilise the ground and trees for nesting, while the Australasian shoveler (*Spatula rhynchotis*) nests commonly on the ground.

The likelihood of breeding sites being present varies spatially across the Project area, with the highest potential associated with less intensively disturbed habitats, including tussock grassland, shrubland margins, ephemeral wetlands, and rehabilitated areas. Conversely, active mining areas and frequently disturbed infrastructure corridors are less likely to support successful breeding, although opportunistic nesting by species such as banded dotterel can occur in recently disturbed or sparsely vegetated substrates.

While some species have not been confirmed to breed within the Project area, they are included as a precautionary measure due to the presence of suitable habitat and their known use of habitats present on site. Management approaches are therefore designed to address a suite of ground-nesting species with broadly similar ecological requirements, with provision for species-specific responses where required.

Management of ground-nesting birds in active works areas and mining environments is well established in New Zealand, particularly for species such as banded dotterel that are known to utilise disturbed substrates (Dowding & Murphy, 2001; Pierce, 2013). The approach adopted in this plan draws on established mitigation frameworks applied in infrastructure and extractive industry projects, adapted to the specific conditions and habitat mosaic present within the MP4 Project area.

The following section outlines management measures to avoid or minimise adverse effects associated with vegetation clearance, earthworks, and ongoing mining activities. These measures are focused on reducing direct impacts such as nest destruction and indirect effects, including disturbance and habitat modification during the project establishment and operational phases, rather than providing long-term species management.

5.1 Deterrence of birds prior to nesting

For some ground-nesting shorebird species, such as banded dotterels, early intervention to prevent territory establishment and nesting is the most effective way to avoid project delays. This can be done at the start of the breeding season when birds typically establish territories (see Table 3.2), which can vary from June (pied stilt) to August (SIPO).

Table 5.1 summarises the methods which can be used to discourage prospecting pairs and nest establishment on site. Site specific recommendations are discussed below:

- Establish works areas between March and July (outside of the main breeding season) and implement deterrence measures during this period (see Table 5.1). Ongoing works activity will further reduce site attractiveness.
 - The most effective deterrence measure that can be implemented prior to Project works starting is to obstruct the birds' line of sight by erecting silt fencing, concrete barriers, or constructing rockpiles which reduces the ability for incubating parents to detect threats while nesting.
 - Other deterrence measures have low–moderate effectiveness as birds may acclimatise to these methods.

Permanent deterrence can be achieved by converting suitable habitat to unsuitable, typically by making the surface impenetrable. This permanently prevents ground-nesting species from creating a scrape nest in the ground.

Multiple nesting attempts will occur throughout the breeding season, and therefore periods of reduced works activity, such as long weekends, may increase nesting risk. Continuous deterrence measures such as human presence, active works, or rock piles, should be undertaken alongside regular avifauna surveys to detect prospecting pairs and inform management measures as needed. Frequency of avifauna surveys is discussed in Section 5.2.

Table 5.1. Methods previously used for deterring prospecting ground-nesting birds, such as banded dotterels (modified from Bannock, 2012).

Method	Likelihood of success	Comments
Human activity	Low	Introducing increasing human activity, such as dog walking and the regular use of the area by people may deter dotterels.
Site activity	Low	Use of machinery may temporarily deter dotterels.
Metallic tape	Low	Use of tape/streamers that flutter in the wind. Can be effective until birds acclimatise (~3 weeks).
Silt fences	Moderate	Erecting shade cloth at knee height, place in rows, spaced 5-10 metres apart, may block the birds' view.
Rock piles/concrete barriers	Moderate	Positioning piles of rocks or other large materials (i.e., concrete barriers, bricks, wood) in areas with open vantage, will block the birds' view and deter nesting. This method is recommended in areas less suitable for silt fencing, such as areas with high winds, narrow areas on site, or areas where poles can't be securely fixed to the ground. Any small materials such as gravel and sand should be avoided as dotterels can create nests in these materials. Additionally, the creation of new elevated flat platforms should be avoided, as this can create a new nesting location too.
Machinery	Moderate	Park large machinery close to where dotterels are showing an interest. Start machinery periodically (at least daily) as banded dotterels can habituate to inoperative machinery left for extended periods of time.
Impenetrable surface	High	Convert suitable nesting habitat to unsuitable by making surfaces impenetrable (i.e., paved surface), as banded dotterel will not be able to excavate small scrapes in the ground to construct nests.

5.2 Pre-works nest surveys

No more than 24 hours prior to the initiation of works, a suitably qualified experienced person (SQEP) such as an ornithologist and/or ecologist must carry out a visual inspection of the site to identify if ground nesting species such as banded dotterels or SIPO are nesting during the breeding season.

The initial inspection will be undertaken through a systematic survey of the site using binoculars from a high vantage point, preferably near the site perimeter, combined with an aural survey for bird calls. Inspecting from outside the site aims to minimise disturbance to any potentially nesting bird/s during the initial assessment. If no ground-nesting species are identified, a systematic walk-through of the entire works area may then be undertaken at a slow and deliberate pace, scanning the ground carefully for eggs. This includes within the nest buffer distance of the edge of the works area, i.e. if ground-nesting bird habitat is on the works edge, areas within 50 metres of the edge should be searched too.

As many ground-nesting species nests and eggs are highly camouflaged within their surroundings, there is a risk that individuals or nests may be missed during the initial vantage survey, so care should be taken whilst walking through the site. If any indigenous ground-nesting species are discovered on site during the walk through, and exhibit alert behaviours towards the SQEP, such as a broken-wing display (Photo 3), this likely indicates the presence of a nearby nest or breeding birds. In these circumstances, the SQEP should withdraw from the area and observe the birds from a sufficient distance to avoid further disturbance. This allows the birds to resume normal behaviour and if nesting, return to their nest. If nests with eggs are detected on site, the protocol in Section 5.3 below should be adhered to.

Should birds be present, but not have nests, weekly inspections should be conducted during works to monitor for the presence of breeding pairs, breeding territories and potential new nests. Deterrence measures in Table 5.1 can be used if birds are detected but are not found to be breeding.

An additional site inspection may be necessary if there is no activity at the site for more than 3 days.

5.3 Eggs detected on site

If eggs are found on site (i.e. eggs laid in a nest) within the Project works areas or outside of the Project works area, but where the nest buffer overlaps (i.e. nest within 50 m of the edge of the works area), the following steps apply:

- All activities within 50 metres of the nest should stop immediately, and people are to leave the area.
- A 50 m buffer around a nest is required, as this was recommended by McVeagh and John (2020), who concluded that a 50 m buffer was necessary around nesting banded dotterels because trials showed nests were not disturbed by machinery until vehicles were as close as 40 m, while the 50 m distance from chicks needed to be maintained due to their greater vulnerability and difficulty of detection.
- This same distance is also used for New Zealand dotterels in construction sites (Bannock, 2012).
- This level of detail around buffer distances is not known for all ground-nesting species that may be present at the site. The 50 m buffer distance should be considered a guideline, and may need to be increased should it be observed that breeding birds are being disturbed by activity from a distance greater than 50 m.
- Do not directly mark the nest location. If needed, a marker can be placed at least 10 metres from the nest as an indicator, or two markers either side >10 m from the nest.

- Where an active nest is identified, the extent of the exclusion zone will be clearly communicated to site personnel and, where practicable, visibly demarcated using temporary markers, flagging, posts, fencing, signage or other suitable means. The nest itself will not be marked in a manner that increases the risk of disturbance or predation. The method of demarcation will be determined by the Project Ornithologist having regard to site conditions, access requirements and the need to avoid drawing unnecessary attention to the nest.
- Notify the Project Ornithologist (refer to Table 2.2).
- The 50 m buffer is to be treated as a no-work exclusion zone while the nest remains active. No personnel, vehicles, machinery or other Project activities are to enter or operate within the buffer unless specifically approved by the Project Ornithologist.
- The Project Ornithologist may approve a specific activity within the buffer where, having regard to the nature and duration of the activity, weather conditions, nest location, surrounding topography and observed behaviour of the breeding birds, the activity can be undertaken without causing material disturbance to the nest, eggs, chicks or attending adults. Any such approval will be documented and may include additional conditions, monitoring or limits on the timing or duration of the activity.
- Weather is a key factor, as adverse weather may affect exposed eggs when parents are disturbed and off the nest. Because of this, decisions on whether to proceed are to be made the day work is to be carried out. This reduces the risk of unexpected bad weather negatively impacting dotterel eggs or chicks.
- Limit the time that a pair of breeding birds is disturbed (i.e. any activity that causes alarm in the birds, including incubating birds leaving their nest) to 30 minutes in normal conditions, 10 minutes at the most in cold and hot conditions. Rain is particularly dangerous to eggs and young chicks. If it is raining, postpone the monitoring or nearby activity until conditions are more suitable.
- If the nest is in an area that will not be directly affected by works (e.g. impact buffer area, disturbed area not currently active), then the area can be cordoned off using tape and markers.
- The area should be at least 10 m x 10 m in size, with the nest situated in the middle. Make it clear that no person or machine is to enter the marked-out site.
- No work is to occur within 50 m of the nest unless it has been discussed with an ecologist and approval given.
- If there is a risk of chicks entering into construction areas after they hatch, chick fences (i.e. waratahs and shade cloth or other material) can be constructed (50+ metre radius from the nest), as a precautionary separation measure between birds/chicks and construction and roading areas.
- Monitoring equipment (i.e. trail cameras) will be used to monitor nests of Threatened or At-Risk species (e.g. banded dotterel or SIPO) nest sites that occur within the active works area to monitor for any potential adverse effects, and to ensure compliance with the above requirements. This footage will be reviewed by the Project Ornithologist/delegated ecologist weekly.

5.4 Chicks Found in the Work Area

If chicks are found in a work area and are at risk (i.e., disturbance, harm or mortality from Project works), there are a few potential options which can be implemented to avoid impacts. One of the following options will be implemented, in consultation with the Project Ornithologist:

- Delay work until the chicks have fledged (5-6 weeks for banded dotterels and 4-6 weeks for SIPO, post-hatching).
- Delay work until the parents move the chicks from the work area.
 - Many ground-nesting birds have precocial chicks (i.e. mobile from a young age), such as shorebirds (1-2 days after hatching), pūkeko (4-6 days) and ducks (1 day). Parents may move from the nesting area at night following disturbance. Ensure chicks are not trapped or boxed in an area.
 - Chicks of ground-nesting passerines (i.e. pipit) are altricial (i.e. remain in the nest until fully developed and can fly). Pipit chicks will remain in the nest for 14 days and will not be mobile.
- For precocial (mobile) chicks, monitor chick location each day during construction to reduce the risk of chick injury or mortality. Young chicks (2-10 days) of banded dotterel will tend to hide when disturbed, whereas older chicks will tend to flee.
- Where mobile chicks are present within an active works area, works will cease or be modified where practicable to allow the chicks to move away independently. Deliberate movement or herding of chicks will only be undertaken where directed by the Project Ornithologist and where the immediate risk to the chicks from remaining within the works area is considered greater than the disturbance associated with moving them. Any such intervention will be undertaken using the least-disturbance method practicable and only to the minimum extent necessary to remove the chicks from immediate risk.
- Mobile chicks can be herded to a safe area, i.e. outside the work area, where they won't be trampled or run over/disturbed by machinery. This is the least preferred option and should only be done if chicks will not leave the area on their own accord. An experienced ecologist should conduct the herding, and it should always be done in full view of the parents. Herding is also age (>10 days) and weather dependent. Regular checks for chicks prior to works should be conducted each morning in affected areas.

6 EASTERN FALCON | KĀREAREA BREEDING MANAGEMENT

Eastern falcon / kārearea typically nest in simple ground scrapes or on ledges, often utilising elevated sites such as rocky outcrops, bluffs, or steep slopes, as well as areas with vegetation or debris coverage (e.g. tussock, shrubs, or woody material). Within the MP4 Project area, suitable nesting habitat is present in association with elevated landforms, including pit margins, waste rock stacks, and undisturbed or rehabilitated slopes, as well as in adjacent areas of tussock grassland, rock tors and shrubland.

Management measures are required to avoid both direct and indirect disturbance to nesting eastern falcons during Project works. Eastern falcon are highly territorial and exhibit aggressive defensive behaviour near nests, including dive-bombing perceived threats. Such behaviour is a reliable indicator of a nearby nest, typically within approximately 50–100 m and should trigger immediate cessation of works and withdrawal from the area to reduce the risk of injury to personnel and disturbance to the birds.

The *New Zealand Falcon Management Guide for Plantation Forestry* (Wingspan, n.d.) recommends a precautionary exclusion zone of 200 m around active nests, reflecting the species' sensitivity to disturbance during the breeding season. In the context of the MP4 Project, where eastern falcons may occur within a working landscape with ongoing disturbance, a site-specific approach to setback distances is appropriate. An initial exclusion zone of up to 200 m should be adopted, with refinement based on site conditions, observed behaviour, and advice from a suitably qualified and experienced ornithologist.

Given variability in nesting locations and limited site-specific data on breeding eastern falcon within the Project area, an adaptive management approach is required. Management measures should be informed by pre-construction surveys and ongoing monitoring, with buffer distances and controls adjusted as necessary to ensure that disturbance effects are avoided or minimised.

Detailed management protocols for eastern falcon are provided in the following sections.

6.1 Pre-Works Nest Survey

Should works occur during the breeding season (August-March inclusive), a nest survey should be conducted by an experienced ecologist or ornithologist within 24 hours before work commences to determine if eastern falcons are nesting within 200 m of the boundary of any Project works. Once the works area is in place and any vegetation is cleared, works are likely to disrupt eastern falcon in subsequent years, therefore minimising the likelihood of territory establishment and nest building.

If no birds are present or showing breeding signs, ongoing operations can proceed as normal. Any notable activity, such as regular sightings or dive-bombing, between August and March must be reported to the Project Ornithologist within 24 hours.

Breeding indicators include:

- Courtship in early spring, with aerial displays and food transfers from male to female.
- Loud defensive *kek-kek-kek* calls within a few hundred metres of a nest.
- Dive-bombing behaviour, typically indicating a nest within 50–100 m.

If a nest is confirmed within 200 m of the boundary of any works area, the nest management protocols in the following section will apply.

6.2 Nest Management Protocols

- **Establish a buffer zone:** A 200 m (line of sight) buffer zone should be implemented from the eastern falcon nest for the whole time that the eggs and chicks are in the nest (approx. 75 days) (see Figure 6.1. and Figure 6.2). This applies to the establishment of all new works areas (e.g. expansion of pits, waste rock stacks, ancillary sites) and ongoing operations. The buffer area and distances can be measured by marking the location of the nest using a GPS, and measuring the distance from the nest outward.
- No additional work is to occur within the constraints area unless it has been discussed with the Project Ornithologist and approval given.
- **Demarcate Nest:** A buffer of 200 m (or a smaller buffer determined as per the above process) from the nest should be demarcated using tape and markers, or other practical means.
- **Monitor Nest:** Monitoring of eastern falcon will be undertaken by an ornithologist and/or ecologist for 1-3 days at the beginning of works to assess activities on Site and any potential disturbances.
- **Weekly monitoring inspections** of any nest and/or chicks on site, or within buffer areas, by a SQEP should be undertaken during the Project works until the completion of nesting and fledging, as further described in Section 8.1.1.
- **Monitoring equipment** will be installed to monitor the nest and observe any potential disturbances to the parents, and to ensure compliance with the Wildlife Act 1953. The protocols are discussed in Section 8.1.1.
- The nest should remain undisturbed and monitored until fledging or nest abandonment is confirmed.

6.3 Adaptive Management

- Where operational constraints make a 200 m buffer unworkable, the buffer can be reduced to a minimum of 50 m at the discretion of the Project Ornithologist and only where there is no disturbance observed or impact (i.e., prolonged absence from the nest while incubating, repeated dive-bombing) to eastern falcon, eggs or chicks.
- Any modification of the initial 200 m buffer will be determined by the Project Ornithologist based on the location of the nest, topography, screening, nature and intensity of the proposed activity, observed behavioural response of the birds, and the stage of the breeding cycle. The basis for any material reduction in the buffer will be documented. Where a proposed reduction may materially increase the risk of disturbance to an active nest, or where there is substantive uncertainty regarding the appropriate buffer, the proposed approach will be discussed with the Department of Conservation before implementation, where practicable and consistent with any applicable Wildlife Act Authority requirements.
- Additional activities may be permitted where disturbance is not observed. This will be at the discretion of the Project Ornithologist after monitoring and review of breeding eastern falcon during such activities.
- If disturbance to eastern falcon is observed (i.e. leaving the nest for extended periods, dive-bombing, screeching), activities and buffer distances will be reviewed by the Project Ornithologist and may be adapted to minimise disturbances to eastern falcon.

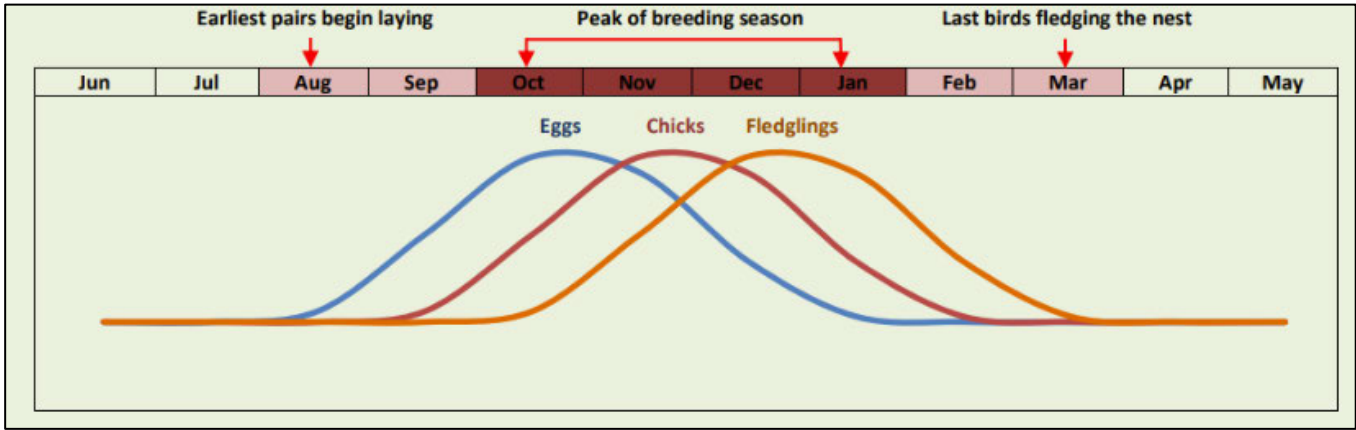


Figure 6.1. The eastern falcon breeding season, with details about the occurrence of egg laying, chicks and fledglings⁸.

⁸ Figure sourced from New Zealand Falcon Management Guide: Plantation Forestry, <https://www.wingspan.co.nz/PDF/Forestry-Management-Protocols-final.pdf>

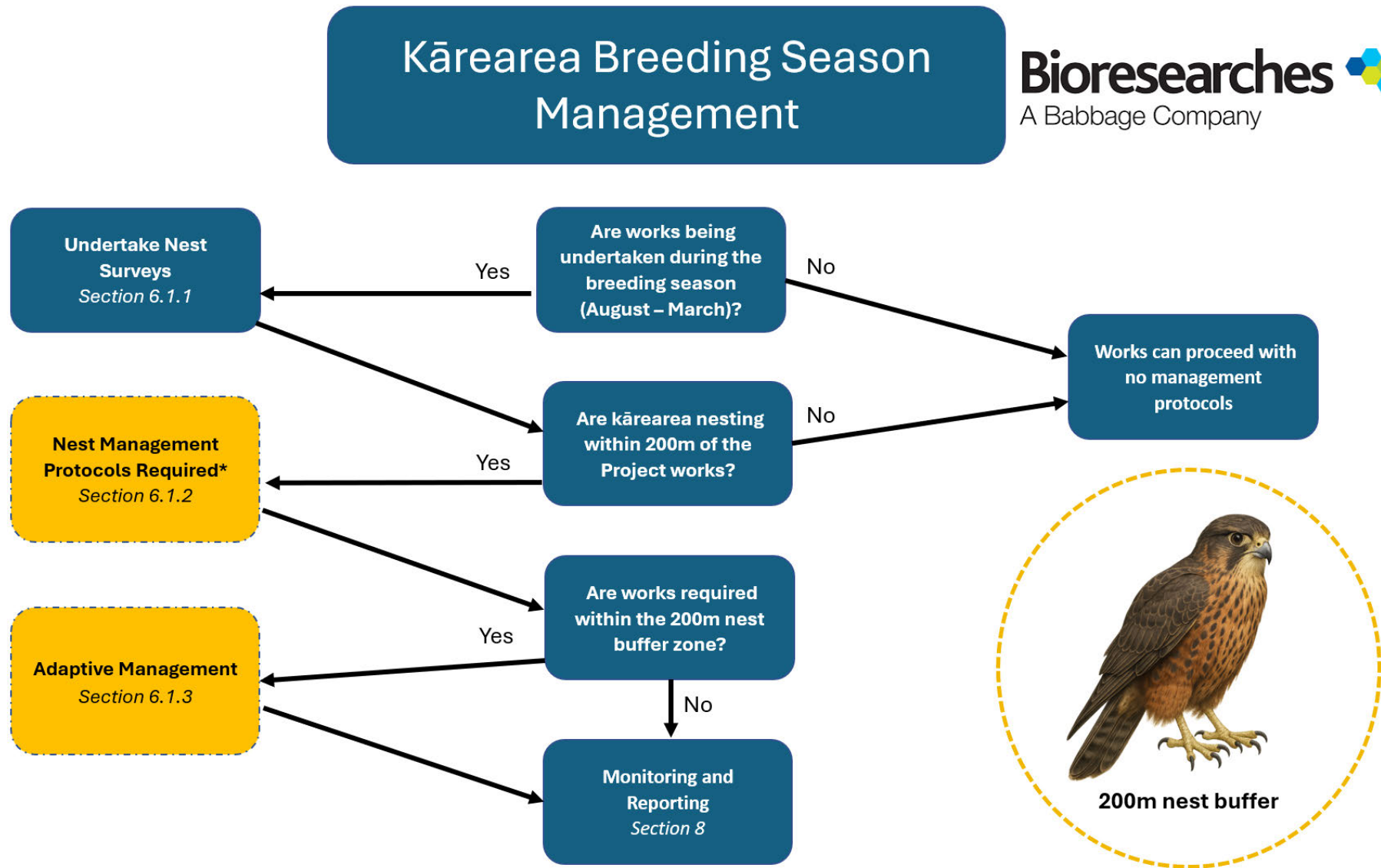


Figure 6.2. Eastern falcon breeding season management protocols

7 TREE/SHRUB NESTING BIRDS

To avoid potential delays to the Project works, vegetation clearance and tree felling are recommended to be undertaken outside of the avifauna nesting season (provided in Table 3.2). If vegetation clearance is required during the breeding season, the following protocol should be adhered to. These protections are recommended for all forest birds (including birds nesting in trees, shrubs and tree cavities, as provided in Table 3.2), and apply to native species only:

- Vegetation clearance during the birds' breeding season (Table 3.2) should be preceded by a nest check by a suitably qualified and experienced ecologist or ornithologist;
- A bird nesting check should be undertaken no more than 24 hours prior to tree felling (e.g., morning before, or morning of). If tree felling occurs outside of the breeding season for native forest birds, nest checks for these species are not required;
- Nest checks are best undertaken in the morning when birds are most active, however can be undertaken at other times of the day;
- Nest checks should include a thorough inspection of the branches, foliage, and cavities of standing trees, as well as the ground and any groundcover/rank grass habitat;
- Where a nesting bird and/or eggs are detected, all operations will cease within 20 m of that nest until the Project Ornithologist has confirmed that the nest has either naturally failed or the chicks have fledged (noting that this potential constraint can effectively be avoided by felling trees outside of the breeding season);
- The nest location should be visibly marked by the Project Ornithologist (e.g., spray paint on nearby tree, flagging tape). The 20 m radius should also be marked with spray paint, or if this is not possible, on a map/GPS;
- All contractors working within the area should be informed of the nest location and 20 m buffer zone.
- The nest would be monitored until the chicks have fully fledged (i.e. can leave the nest of their own accord) and are capable of dispersing from the site independently, or until the nest is confirmed failed. Vegetation clearance or felling can occur once the nest is determined to be inactive, and the parents have not re-nested in the same vegetation;
- If a nest is discovered outside of the nest check, the Project Ornithologist should be contacted immediately, and works must cease within a 20 m radius of the nest. Photos should be provided where possible, as well as the location; and
- The Project Ornithologist will notify the Site Manager and Contractor responsible for vegetation clearance upon completion of the survey and advise on the location of any nesting native birds with a map/GPS location if required.

8 MONITORING AND REPORTING

Ongoing monitoring is required to ensure compliance with the above conditions, and the outcomes are achieved as set out in Section 2.5.

Should Project works be found or suspected to adversely affect breeding avifauna on site, the Project Ornithologist may implement additional mitigation and/or monitoring strategies at their discretion, to ensure there is no impact on the breeding success of avifauna by the Project works. This will be discussed with the client prior to and only implemented where necessary.

8.1 Operational nest monitoring

8.1.1 Weekly monitoring of the works area during the breeding season

During the breeding season, weekly monitoring of the works area should be undertaken to provide early warning to management if breeding pairs of ground-nesting shorebirds are prospecting territories within a works area and implement deterrence methods to actively reduce the chance of having nesting birds or chicks within the planned or actual works area. See Section 5 for recommended methods.

Deterrence options (Table 5.1) are encouraged to prevent ground-nesting shorebirds from establishing nests in areas intended to be cleared during the breeding season. No such deterrent methods are available for eastern falcon or forest birds, so vegetation clearance should occur before the forest birds' breeding season, where possible (see Sections 6 and 7), to prevent delays and impacts to Project works.

To minimise delays to Project works, weekly monitoring of the works area should be undertaken by a SQEP during the breeding season. This should be in addition to weekly nest checks (if nests are present), and daily monitoring of shorebird chicks (if chicks are present) as additional birds may nest within suitable habitat on site.

8.1.2 Weekly monitoring of nesting birds

If birds are found nesting on site, ongoing site visits and surveys will be required to ensure there is no impact on the breeding success of avifauna by the proposed activities. This will include the following management provisions:

- Weekly monitoring inspections of any nest and/or chicks on site, or within buffer areas, by a SQEP, such as an ornithologist and/or ecologist, until the completion of nesting and fledging. Where inspections are not undertaken by a SQEP, they should be approved by the Project Ornithologist.
- Positioning monitoring equipment (i.e. trail camera) at each nest site within active works area. If nests are located close enough together, a single camera can be used to monitor multiple nests at once. This is only necessary where an active nest remains within a works area, while works continues immediately adjacent, to ensure no direct nest disturbance. This includes when nests are within their respective buffer distance (i.e. 50 m, 200 m) of active works areas that may cause disturbance. This footage will be provided by OGNZL and reviewed by the Project Ornithologist/ecologist weekly; and
- Weekly site visits by a person appointed by the Project Ornithologist, monitoring the nests with binoculars from outside the specified buffer zones. If undertaken by an appointed person, the inspection reports should outline the weekly inspection findings to the Project Ornithologist within 24 hours of inspection, or an alternative reduced frequency when birds are not found to be present on site, as approved by the Project Ornithologist.

8.1.3 Daily monitoring of shorebird chicks

Shorebird chicks (e.g. SIPO, banded dotterel, pied stilts) are mobile shortly after hatching but before they can fly. Should a nest be present and chicks have hatched, while works occur immediately adjacent (i.e. truck movements, earthworks), additional monitoring will be required. If it is feasible for work to continue, the location of shorebird chicks should be checked each day within the works area. This is primarily for when vehicles/machinery have been left inactive, as chicks can hide underneath, leading to a risk of them being run over when work starts. If work is continuous, daily checks should locate the chicks and assess if there is any risk of them entering into high risk work areas. If so, implementation of barriers should be considered. This is necessary to reduce the risk of shorebird chick injury or mortality.

8.1.4 Site vacant for extended periods

Should the works area be inactive for more than 72 hours (e.g. long weekends, Christmas holidays, site shutdowns), an additional inspection is required before work on the site recommences to check for new nests. Shorebirds, such as banded dotterels, are known to take advantage of quiet work areas and build nests and lay eggs within a very short window of opportunity.

8.1.5 Accidental Discovery Protocol

Where an indigenous bird, active nest, eggs or dependent young are unexpectedly identified within, or immediately adjacent to an active work area, and continued works could result in injury, mortality, nest destruction or material disturbance, works within the immediately affected area will cease. The Project Ornithologist or delegated SQEP will assess the discovery and determine the appropriate management response, including any exclusion area, monitoring requirements or modification to works.

Works may continue outside the affected area where this does not create an additional risk to the bird or breeding attempt. Works within the affected area may recommence once the Project Ornithologist or delegated SQEP confirms that the required management measures are in place or that the risk has otherwise ceased.

This provision applies to unexpected discoveries rather than simply to observations of birds at higher than anticipated densities. Bird abundance alone will not constitute an automatic stop-work trigger unless the Project Ornithologist determines that continued works create a material risk to protected birds.

8.2 Operational waterfowl monitoring

Artificial waterbodies associated with the Macraes Operation, including settling ponds, water-management ponds and tailings storage areas, are used from time to time by indigenous waterfowl. Operational monitoring will therefore include periodic observations of selected waterbodies that support regular or appreciable waterfowl use.

The purpose of this monitoring is to:

- record the species and approximate number of indigenous waterfowl using selected operational waterbodies;
- identify substantial changes in waterfowl use where these are apparent;
- identify sick, injured or dead birds, or unusual behaviour that may warrant investigation; and
- provide information to support management of operational risks to avifauna.

Monitoring will focus on representative waterbodies that have previously supported appreciable waterfowl use or that are identified by the Project Ornithologist or OGNZL Environmental Team as warranting monitoring. It is not necessary to routinely monitor every operational pond or waterbody.

Where practicable, monitoring will be undertaken using consistent observation locations and methods so that broad changes in use can be compared over time. Records will include the waterbody, date, species present, approximate abundance and any unusual behaviour, injury or mortality observed.

8.2.1 Waterfowl incident trigger

The observation of unexplained bird mortality, multiple sick or impaired birds, or repeated abnormal behaviour at an operational waterbody will trigger notification of the OGNZL Environmental Manager and Project Ornithologist as soon as practicable. The immediate response will include an assessment of the number and species affected and consideration of whether the observations may be associated with disease, water quality, physical hazards or another cause.

Where water quality is a plausible contributing factor, relevant available water-quality monitoring results will be reviewed in conjunction with the personnel responsible for mine-water management. Further investigation or management will be undertaken where warranted by the findings.

Suspected disease events will be managed in accordance with Section 9 of this AMMP.

The presence of birds on a tailings or settling pond does not, by itself, indicate contaminant exposure or an adverse ecological effect.

8.3 Residual effects monitoring

Residual effects monitoring will be undertaken to determine whether the avifauna outcomes anticipated from the terrestrial residual effects management package are being achieved. This monitoring is separate from the operational monitoring of nesting birds, eggs and chicks required during Project works under Section 8.1.

The residual effects monitoring programme will assess:

- indigenous bird diversity within the grey scrub revegetation at Cranky Jim's Link; and
- the relative abundance and occurrence of banded dotterel, South Island pied oystercatcher and eastern falcon within the MEEA and Redbank link.

A new Year 0 baseline survey is required because the surveys undertaken for the Assessment of Avifauna Values were designed to characterise avifauna within and around the Project area. They do not provide complete baseline coverage of the residual effects management areas.

The Year 0 baseline must be completed before construction of the MEEA predator-exclusion fence commences and before pest-control operations associated with the residual effects management package begin. This is necessary to establish avifauna abundance and distribution before construction disturbance, predator exclusion or predator suppression could influence bird use of the monitored areas. As far as practicable, the baseline at Cranky Jim's Link will also be completed before restoration planting begins.

Relevant existing survey stations will be retained where they adequately represent the residual effects management areas. Additional permanent stations will be established within:

- the replanting areas at Cranky Jim's Link;
- the MEEA buffer zone; and
- Murphys Link.

Mt Highlay is not included in the avifauna residual effects monitoring programme at this stage.

8.3.1 Monitoring objectives

The objectives of the residual effects monitoring programme are to:

- establish a robust and repeatable Year 0 baseline for indigenous bird diversity, relative abundance and occurrence within the residual effects management areas;
- determine whether indigenous bird diversity within the Cranky Jim's Link grey scrub revegetation is progressing towards the residual effects management targets;
- measure changes in the relative abundance and occurrence of banded dotterel, South Island pied oystercatcher and eastern falcon;
- assess whether observed avifauna responses are consistent with the outcomes anticipated from habitat restoration, predator exclusion and landscape-scale pest management;
- identify adverse trends or shortfalls that may require investigation or adaptive management; and
- provide monitoring information for the detailed residual effects monitoring reports prepared at Years 5, 10, 15 and 20.

8.3.2 Monitoring design and methods

Residual effects monitoring will use a repeatable survey design based on the baseline avifauna survey programme. The final number and location of five-minute bird count and autonomous acoustic monitoring stations will be determined by the Project Ornithologist prior to Year 0 monitoring, taking account of habitat distribution, access, topography and the final configuration of the predator exclusion fence.

Monitoring stations will be established both within and outside the predator exclusion fence, at a minimum sampling density of one station per 500 m, consistent with the spatial approach used for the baseline avifauna survey design. Station placement will seek to provide representative coverage of the principal habitat types and to support comparison of avifauna responses between areas subject to different management treatments.

The Year 0 station network will form the basis for subsequent monitoring at Years 5, 10, 15 and 20. The same locations, methods and seasonal timing will be retained as far as practicable. Where a station needs to be relocated because of access, habitat change, site development or another practical constraint, the

replacement location will be selected to maintain comparability with the original monitoring design and the change will be documented by the Project Ornithologist..

Station selection will be undertaken by a suitably qualified and experienced ornithologist or ecologist. The monitoring network will be designed to:

- provide representative coverage of the principal habitats and management areas;
- enable changes within the different management areas to be evaluated;
- avoid unnecessary spatial duplication between stations;
- provide suitable coverage for detecting the three key species; and
- remain accessible and repeatable throughout the monitoring period.

Each monitoring station will be permanently identified by GPS coordinates and mapped so that the same locations can be surveyed during subsequent monitoring events.

Five-minute bird counts will record all birds seen or heard, including:

- species;
- number of individuals;
- distance or distance band from the observer, where practicable;
- relevant behaviour and habitat use;
- incidental evidence of breeding activity; and
- survey conditions, including date, time, weather and observer.

Passive acoustic monitoring devices will be deployed at selected permanent stations to supplement the five-minute bird counts. Acoustic monitoring will increase temporal survey coverage and improve the likelihood of detecting species that occur at low density, range over large areas or may not be present during individual count periods. It will also provide additional information on the occurrence and activity of other indigenous birds.

The number of repeat five-minute counts, acoustic-monitoring locations, deployment duration and seasonal survey window will be established during the Year 0 baseline survey by the Project Ornithologist. The survey design must provide sufficient repeat sampling to account for variation in detectability and support meaningful comparison between monitoring events.

Subsequent monitoring will replicate the Year 0 locations, seasonal timing, duration, methods and survey effort as closely as practicable. Surveys will be undertaken during comparable seasonal and weather conditions. Any material departure from the baseline methodology will be documented and considered when interpreting the results.

Monitoring will be undertaken at:

- Year 0, before construction of the predator-exclusion fence and commencement of the associated pest-control operations;
- Year 5;
- Year 10;
- Year 15; and
- Year 20.

The timing of Years 5, 10, 15 and 20 will be measured from commencement of the residual effects management actions. The applicable commencement date will be recorded in the Year 0 baseline report.

8.3.3 Monitoring attributes and targets

Indigenous bird diversity within the Cranky Jim's Link grey scrub revegetation will be assessed against the following indicative targets:

- Year 5: two indigenous bird species;
- Year 10: three indigenous bird species;
- Year 15: four indigenous bird species; and
- Year 20: four indigenous bird species.

The relative abundance and occurrence of banded dotterel, South Island pied oystercatcher and eastern falcon will be compared with the Year 0 baseline and with the results of each preceding monitoring event.

Measures used to assess relative abundance and occurrence may include:

- mean detections per five-minute bird count;
- frequency of detection across monitoring stations;
- passive acoustic detection;
- proportion of monitoring stations occupied; and
- spatial distribution of detections across the management areas.

The analysis will use consistent measures across monitoring events wherever practicable. Monitoring results will be interpreted in the context of survey conditions, seasonal variation, species detectability, habitat development, pest-management performance and wider population or environmental changes that may influence bird distribution and activity.

8.3.4 Use of abundance and occurrence as an indicator of breeding success outcomes

Improved breeding success is the avifauna response represented in the Biodiversity Offset Accounting Models, reflecting the expected benefit of effective predator exclusion and pest control. Monitoring should therefore provide a reasonable basis for assessing whether management is producing the ecological response assumed in the models.

Systematic monitoring of breeding success for every target species throughout the residual effects management areas and over the full 20-year monitoring period would be difficult to implement consistently. Direct monitoring would require sufficient nests or breeding territories to be located and repeatedly monitored during each breeding season. The required effort would be substantial, and sample sizes may be small or variable for species that occur at low densities, range widely or move between habitats.

These limitations are particularly relevant to eastern falcon, which occurs at low density, occupies large home ranges and may nest in inaccessible or difficult-to-detect locations. Banded dotterel and South Island pied oystercatcher may also move among open habitats within and beyond the management areas. Intensive nest monitoring may therefore produce inconsistent results and could increase the risk of disturbance.

Routine monitoring will use relative abundance and occurrence as indicators of the broader avifauna response to management. These measures will help determine whether target species continue to use the managed areas and whether their recorded occurrence is stable, increasing or declining over time.

Five-minute bird counts and passive acoustic monitoring will provide repeatable methods that can be applied consistently throughout the monitoring period.

Relative abundance and occurrence will not be treated as direct measures of breeding success, population size or achievement of the modelled compensation targets. They will be interpreted as part of a broader weight-of-evidence assessment that includes:

- habitat establishment, extent and condition;
- the timing and extent of predator exclusion and pest-control operations;
- pest abundance and pest-control performance;
- observations of territorial, nesting or fledgling activity;
- relevant regional and national population trends; and
- other ecological information that may explain observed changes.

Where practicable, anecdotal breeding assessments will also be recorded for selected species and locations where sufficient breeding territories or nests can be identified. These assessments may include measures such as territory occupancy, evidence of nesting, the presence of dependent young or fledglings, and nest outcome.

The monitoring results will be reviewed against defined performance measures and expected response trajectories. Where the combined monitoring evidence does not support the anticipated avifauna response, or where predator-control targets are not achieved, the causes will be investigated and corrective or additional management implemented in accordance with the adaptive management framework.

8.3.5 Adaptive-management triggers

Adaptive management will be used where residual effects monitoring indicates that avifauna outcomes are not progressing as anticipated or where management measures that support those outcomes may not be performing as required. The purpose of adaptive management is to identify the cause of an observed monitoring result and, where practicable, modify management before the intended ecological outcome is compromised.

Monitoring results will be considered in the context of the Year 0 baseline, preceding monitoring events, survey conditions and effort, habitat development, and relevant pest-management results. Changes in relative abundance or occurrence will not, on their own, be assumed to represent changes in population size or breeding success. Where a trigger in Table 8.1 is reached, the Project Ornithologist will first assess whether the result is likely to reflect ecological change, natural temporal variability, differences in detectability or survey conditions, or another identifiable cause.

Adaptive-management actions will be proportionate to the significance of the monitoring result and the level of confidence that the result represents a management-related ecological response. Potential responses may include changes to pest-control intensity or methods, modification of habitat management, targeted investigation or additional avifauna monitoring. Where the appropriate response falls within another MP4 ecological management plan, implementation will occur through that plan rather than duplicating management requirements in the AMMP.

The Project Ornithologist will document each adaptive-management trigger, the assessment undertaken, the response recommended, the person responsible for implementation and the timeframe for

completion. These matters will be reported in accordance with Section 8.4.2 and tracked in accordance with Section 8.4.3.

Where a management response has been implemented, its effectiveness will be assessed at the next appropriate monitoring opportunity. Monitoring need not wait until the next scheduled five-year residual effects monitoring event where the Project Ornithologist determines that earlier targeted monitoring is necessary to establish whether the response has been effective.

Table 8.1. Adaptive-management triggers and responses for residual effects avifauna monitoring.

Monitoring attribute	Adaptive-management trigger	Initial response and timeframe	Adaptive-management response and escalation	Responsibility
Indigenous bird diversity within Cranky Jim's Link	An applicable bird-diversity performance target specified in Section 8.3.3 is not achieved at a scheduled monitoring event.	Within three months of the monitoring event, review the monitoring data, survey conditions and effort, habitat establishment and pest-management results to identify factors that may explain the result.	Where the review identifies a management-related constraint, the Project Ornithologist will recommend proportionate changes to habitat or pest management in consultation with the relevant management-plan specialist. If the applicable target remains unmet at the next scheduled monitoring event, the management response and monitoring programme will be formally reviewed and additional measures identified where required.	Project Ornithologist, in consultation with the relevant restoration and pest-management specialists.
Relative abundance and occurrence of banded dotterel, SIPO, or eastern falcon	Monitoring identifies a marked decline in relative abundance or occurrence compared with the Year 0 baseline or preceding monitoring results, including an unexpected absence of a focal species from areas in which it was previously regularly recorded (outside the MP4 Project area).	Within three months of the monitoring event, review survey effort and detectability, species records, habitat condition, pest-management results and other relevant contextual information. Targeted follow-up monitoring may be undertaken where this is required to determine whether the result is likely to represent an ecological change.	Where the review identifies a plausible relationship with habitat condition, pest pressure or another matter capable of being addressed through Project management, the Project Ornithologist will recommend an appropriate management response. Where the cause remains uncertain, additional targeted monitoring may be undertaken before substantive management changes are made. If the adverse pattern persists at the next scheduled monitoring event, the monitoring and management approach will be formally reviewed.	Project Ornithologist, with input from relevant habitat or pest-management specialists where required.
Habitat condition within avifauna compensation areas	Monitoring identifies that habitat establishment or condition relevant to the intended avifauna outcome is not meeting the applicable performance target or is otherwise unlikely to provide the habitat conditions assumed for the avifauna outcome.	Review the relevant vegetation or restoration monitoring results as part of the avifauna monitoring assessment.	Management will be addressed through the relevant vegetation or restoration management plan. The Project Ornithologist will assess whether the habitat result also requires a change to avifauna monitoring locations, methods or interpretation.	Relevant restoration specialist and Project Ornithologist.
Pest-management performance within areas relied upon for avifauna outcomes	A pest-management target or response threshold specified in the Pest Control and Elimination Plan is exceeded.	Implement the response required under the Pest Control and Elimination Plan within the timeframe specified by that plan. The Project Ornithologist will assess whether the exceedance could materially affect the interpretation of avifauna monitoring results.	Where pest-management performance is considered likely to constrain the intended avifauna outcome, the Project Ornithologist and pest-management specialist will review whether additional control, surveillance or avifauna monitoring is warranted. Persistent failure to achieve the applicable pest-management target will be escalated in accordance with the Pest Control and Elimination Plan.	Pest-management specialist and Project Ornithologist.
Effectiveness of an adaptive-management response	Monitoring or subsequent review indicates that an implemented management response has not adequately addressed the matter that triggered it.	Review the effectiveness of the response and the evidence for the underlying cause.	Revise the management response, monitoring approach, or both. Where the issue remains unresolved and could materially affect the achievement of the intended residual effects outcome, additional specialist advice will be obtained and the relevant management plan reviewed.	OGNZL and Project Ornithologist, with relevant specialist input.

8.3.6 Monitoring duration and completion criteria

Residual effects avifauna monitoring will be undertaken at Year 0 and Years 5, 10, 15 and 20 in accordance with Section 8.3.2. The Year 20 monitoring event is the final scheduled monitoring event but does not automatically represent completion of the monitoring programme.

The purpose of the monitoring programme is to determine whether the avifauna outcomes anticipated from the residual effects management package are being achieved and maintained over time. Success will be assessed against the monitoring attributes and targets in Section 8.3.3 and the adaptive-management framework in Section 8.3.5. All monitored bird species do not need to increase in abundance or occurrence for the programme to be considered successful, as bird populations and detectability may vary naturally between monitoring events.

Following the Year 20 monitoring event, the Project Ornithologist will review the monitoring record and determine whether the residual effects avifauna monitoring programme can be completed. Completion may be recommended where:

- the applicable indigenous bird-diversity performance targets have been achieved;
- no unresolved adaptive-management trigger identified under Section 8.3.5 remains;
- monitoring does not indicate a persistent adverse change in the relative abundance or occurrence of the focal bird species that is reasonably attributable to the Project or failure of the residual effects management measures;
- habitat and pest-management measures relied upon to support the intended avifauna outcomes are meeting their relevant performance requirements; and
- any corrective or adaptive-management actions previously identified have been implemented and there is sufficient monitoring information to assess their effectiveness.

Where these criteria are met, the Project Ornithologist may recommend completion of scheduled residual effects avifauna monitoring. The basis for that recommendation will be documented in the Year 20 residual effects monitoring report prepared under Section 8.4.2.

Where one or more of the completion criteria are not met, monitoring will continue for the affected monitoring attribute or species. The Project Ornithologist will identify the reason that monitoring is to continue, any additional investigation or management required, the monitoring method and an appropriate timeframe for reassessment. Monitoring may be targeted to the unresolved matter rather than requiring repetition of the entire residual effects monitoring programme, where this is ecologically appropriate.

Where an adaptive-management response is required, at least one subsequent monitoring assessment will be undertaken at a time appropriate to determine whether the response has been effective. Monitoring of the affected component will not be considered complete while a material adaptive-management trigger remains unresolved.

Any extension, modification or completion of the residual effects monitoring programme will be recorded in the relevant monitoring report and reported in accordance with Sections 8.4.2 and 8.4.3.

8.4 Reporting

Reporting under this AMMP will address two distinct monitoring programmes:

- operational monitoring of nesting birds, eggs and chicks during Project works, as described in Section 8.1; and
- longer-term residual effects monitoring of bird diversity, relative abundance and occurrence, as described in Section 8.3.

The purpose, timing and interpretation of these reporting programmes differ. Operational reporting will document compliance with the measures intended to avoid or minimise effects on birds during works. Residual effects reporting will assess whether the longer-term avifauna outcomes anticipated from the residual effects management package are being achieved.

All avifauna monitoring and management reports prepared under this AMMP will be provided to the relevant Department of Conservation Operations office and the Department of Conservation Permissions team, in addition to any reporting required for the relevant consent authority, where required by the applicable resource consent conditions, Wildlife Act Authority requirements, or other applicable approvals. Where an incident or management issue requires more immediate notification, this will be reported to DOC as soon as practicable and will not be deferred until the next scheduled reporting cycle.

8.4.1 Operational monitoring reporting

At the end of each breeding season during which Project works have occurred, the Project Ornithologist will prepare a breeding-season monitoring report for OGNZL. The report will be retained for the Project records and provided to the relevant consent authorities or other parties where required by conditions of consent or a Wildlife Act Authority.

The report will include, as applicable:

- the Project areas and activities covered by avifauna monitoring;
- monitoring dates, methods, personnel and survey effort;
- the deterrence measures implemented before or during the breeding season;
- the species and numbers of birds recorded within or near active works areas;
- details of any nests, eggs or chicks detected;
- maps or GPS coordinates of active nests and associated exclusion zones;
- nest-monitoring methods and the frequency and duration of monitoring;
- management measures implemented for nests, eggs or chicks;
- any changes made to exclusion zones or work practices on the advice of the Project Ornithologist;
- the known outcome of each monitored nest or chick, where this could be determined;
- details of any bird injury, mortality, accidental discovery or non-compliance;
- actions taken in response to any incident or identified risk; and
- recommendations for improving avifauna management during subsequent breeding seasons.

Where an active nest remains unresolved at the end of the reporting period, monitoring will continue until the Project Ornithologist confirms that the chicks have fledged, the nest has naturally failed or the nest is otherwise inactive. A supplementary record of the final outcome will then be prepared.

Information obtained through operational nest monitoring may provide useful contextual information for the residual effects monitoring programme. However, operational nest records will not be treated as a systematic or representative measure of breeding success across the residual effects management areas.

8.4.2 Residual effects monitoring reporting

Residual effects monitoring reports will be prepared in accordance with Section 8.3.6. A report will be completed within three months of:

- the Year 0 baseline survey;
- the Year 5 monitoring event;
- the Year 10 monitoring event;
- the Year 15 monitoring event; and
- the Year 20 monitoring event.

The Year 0 report will document the baseline established before construction of the MEEA predator-exclusion fence and before the associated pest-control operations commence. It will also record the status of restoration planting and any other residual effects management actions at the time of the baseline survey.

Subsequent reports will compare bird diversity, relative abundance and occurrence with the Year 0 baseline and preceding monitoring results. They will assess:

- indigenous bird diversity within the Cranky Jim's Link grey scrub revegetation;
- the relative abundance and occurrence of banded dotterel, South Island pied oystercatcher and eastern falcon;
- progress against the applicable bird-diversity targets;
- whether an adaptive-management trigger has been reached;
- relevant habitat development and pest-management performance; and
- whether further monitoring, investigation or management changes are required.

These reports will clearly acknowledge that abundance and occurrence are being used as practical surrogates for the modelled breeding-success response and are not direct measurements of breeding success or population size.

Residual effects monitoring results will be incorporated into the corresponding detailed residual effects monitoring reports and provided to the relevant consent authorities and other parties required by the conditions of consent.

8.4.3 Data management and review

Monitoring data, photographs, acoustic recordings, field forms, maps and reports will be retained by OGNZL in an accessible project record.

The Project Ornithologist will review monitoring results and recommendations with the relevant Project personnel. Any required changes to avifauna management, monitoring methods, pest management or habitat management will be documented, assigned to an appropriate person and tracked through to completion.

Where monitoring identifies an urgent risk to indigenous birds or an apparent failure of a management measure, the matter will be reported to OGNZL as soon as practicable. Corrective action will not be deferred until preparation of the next scheduled report.

9 AVIAN INFLUENZA BIOSECURITY AND RESPONSE

9.1 Background

Avian influenza is a contagious viral disease affecting domestic and wild birds, with some strains also capable of infecting mammals. Highly pathogenic avian influenza H5N1 clade 2.3.4.4b, referred to by MPI as H5 bird flu, has spread widely through wild bird populations internationally and has now been detected in wild birds in New Zealand. Waterfowl, shorebirds, gulls and other species that congregate in groups are among the wild birds most commonly affected, while predatory and scavenging birds may also be exposed through contact with, or consumption of, infected birds (Department of Conservation [DOC], 2026; Ministry for Primary Industries [MPI], 2026a).

The most readily observed indication of H5 bird flu in wild birds is sudden or unexplained mortality involving several birds. Infected birds may also show respiratory, gastrointestinal, neurological or other non-specific signs of illness (MPI, 2026b). The risk of infection to people remains low, but direct contact with sick or dead birds, their bodily fluids, faeces or contaminated materials should be avoided (Health New Zealand, 2026; MPI, 2026a).

Avian influenza is therefore treated under this AMMP as both a wildlife health and site biosecurity matter. The purpose of the measures below is to minimise the potential for Project personnel or activities to contribute to disease transmission between birds or locations and to provide a clear response where potentially affected birds are encountered. MPI is the lead agency for H5 bird flu response in New Zealand. Current MPI requirements and directions will take precedence over this AMMP where guidance changes or a site-specific response is initiated (DOC, 2026; MPI, 2026a).

9.2 Routine biosecurity

Personnel undertaking avifauna surveys, nest monitoring or other work that brings them into proximity with wild birds will maintain appropriate field hygiene. Footwear, clothing and field equipment will be kept clean, particularly when moving between separate bird monitoring locations or areas supporting concentrations of waterfowl or other birds. Equipment or clothing visibly contaminated with bird faeces or other biological material will be cleaned before being used at another location. Hands will be washed with soap and water, or an appropriate alcohol-based hand sanitiser used where hand washing is not immediately available, following contact with birds or bird-associated environments (DOC, 2026; MPI, 2026c).

Sick or dead birds will not be handled as part of routine AMMP activities. Personnel will also avoid unnecessary disturbance of sick birds and will not move carcasses between locations. Disinfectants will not be applied directly to natural habitats or areas occupied by wild birds as a disease-control measure unless specifically directed by MPI or another responsible authority (New Zealand Veterinary Association [NZVA], 2026).

9.3 Response to sick or dead birds

Where an apparently sick bird or an unexplained bird mortality is encountered during Project activities, personnel will keep clear of the bird and notify the Project Ornithologist or other nominated environmental representative. The location, species where identifiable, the number of affected birds and relevant observations will be recorded. Photographs may be taken from a safe distance where this can be done without disturbing wildlife.

Where **three or more sick or dead wild birds are observed together**, the observation will be reported promptly to Biosecurity New Zealand through the Exotic Pest and Disease Hotline (0800 80 99 66) or the current MPI online reporting system. Birds will not be touched, collected, moved or transported unless specifically instructed by MPI (DOC, 2026; MPI, 2026c).

Pending advice from MPI, the Project Ornithologist or environmental representative will establish an appropriate temporary no-go area where necessary to prevent Project personnel, vehicles or equipment from contacting affected birds, carcasses or visibly contaminated material. Works may continue outside the affected area where this does not increase disturbance or the potential for disease transmission.

Particular attention will be given to unusual mortality or illness involving species that aggregate around waterbodies or breeding areas, including waterfowl, shorebirds and gulls, and predatory or scavenging species such as kārearea or kāhu. MPI may prioritise notifications according to the number and species of birds affected and the circumstances of the event (MPI, 2026a).

9.4 Handling and carcass management

Project personnel will not collect, relocate, dispose of or transport suspected infected birds unless this is specifically required by MPI or another responsible authority. DOC advises that disturbance or removal of carcasses may, in some circumstances, increase disturbance to surviving birds, and carcass management during an outbreak therefore requires a case-specific approach (DOC, 2026).

If MPI requires a bird or carcass to be handled, this will only be undertaken by appropriately trained personnel following the personal protective equipment, hygiene, containment and decontamination requirements specified by MPI and relevant occupational health guidance current at that time. Direct handling of suspected H5 bird flu cases is not part of routine avifauna management under this AMMP (Health New Zealand, 2026; NZVA, 2026).

9.5 Review and adaptive response

Because the status of H5 bird flu in New Zealand and associated management guidance may change during the life of MP4, the Project Ornithologist will review relevant MPI and DOC guidance when a suspected case is reported within the Project area, when MPI advises of an outbreak relevant to the Otago region,

or when substantive changes to national guidance are issued. Site procedures will be updated where required to remain consistent with current MPI directions.

Any confirmed or suspected avian influenza event affecting Project avifauna monitoring or management will be documented as part of AMMP reporting, including the location and nature of the event, notifications made, any restrictions or management actions implemented, and any implications for ongoing bird monitoring.

10 REFERENCES

- Adams, R. 2013 [updated 2022].** Pied stilt | poaka. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz
- Alliance Ecology. (2026).** *Pest control and elimination plan*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bannock, C. (2012).** *Guidance in relation to New Zealand dotterels on NZTA land*.
- Beauchamp, A.J. 2013 [updated 2022]** New Zealand pipit | pīhoihoi. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz
- Bioresearches. (2026a).** *Terrestrial and Wetland Ecology summary document*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026b).** *Assessment of invertebrate values*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026c).** *Assessment of lizard values*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026d).** *Assessment of avifauna values*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026e).** *Assessment of bat values*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026f).** *Ecological impact assessment*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026g).** *Vegetation and flora management plan*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026h).** *Wetland management plan*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026i).** *Invertebrate management plan*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026j).** *Lizard management plan*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026k).** *Avifauna Management & Monitoring Plan*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026l).** *Residual effects analysis report: Terrestrial ecology*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026m).** *Residual effects analysis report: Wetlands*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026n).** *Residual effects restoration plan*. Report prepared for Oceana Gold (New Zealand) Limited.

- Bioresearches. (2026o).** *Residual effects wetland management plan*. Report prepared for Oceana Gold (New Zealand) Limited.
- Bioresearches. (2026p).** *Ecological impact assessment: Pest-proof fence construction*. Report prepared for Oceana Gold (New Zealand) Limited.
- Department of Conservation. (2026).** H5 bird flu: Wildlife health. New Zealand Government. <https://www.doc.govt.nz/our-work/wildlife-health/avian-influenza/>
- Dowding, J., Chamberlin, S. (1991)** Annual movement patterns and breeding-site fidelity of the New Zealand Dotterel (*Charadrius obscurus*), 38 (2) https://www.birdsnz.org.nz/wp-content/uploads/2021/12/Dowding___Chamberlain_1991_Annual_movements_of_NZ_dotterel.pdf
- Dowding, J. E., & Murphy, E. C. (2001).** The impact of predation by introduced mammals on endemic shorebirds in New Zealand: A conservation perspective. *Biological Conservation*, 99(1), 47–64. [https://doi.org/10.1016/S0006-3207\(00\)00187-7](https://doi.org/10.1016/S0006-3207(00)00187-7)
- Health New Zealand. (2026).** *Avian influenza*. Health New Zealand | Te Whatu Ora. <https://www.healthnz.govt.nz/health-topics/conditions-treatments/infectious-diseases/avian-influenza>
- Jarvie, S., McKinlay, B., Palmer, D., Rawlence, N. J., Thomas O. (2025).** Regional conservation status of birds in Otago. Otago Regional Council, Otago Threat Classification Series, 2025/4
- Marchant, S., & Higgins, P. J. (Eds.). (1993).** *Handbook of Australian, New Zealand & Antarctic Birds, Volume 2, Raptors to Lapwings*. Oxford University Press.
- McVeagh J and John D. 2020.** Do Shorebirds Tolerate Machinery, Greater Wellington Regional Council, Publication No. GW/ESCI-G-20/31, Wellington.
- Ministry for Primary Industries. (2026a).** *Avian influenza, HPAI, bird flu, risk to New Zealand*. <https://www.mpi.govt.nz/biosecurity/pest-and-disease-threats-to-new-zealand/animal-disease-threats-to-new-zealand/high-pathogenicity-avian-influenza/about-avian-influenza-and-the-risk-to-nz>
- Ministry for Primary Industries. (2026b).** *Information for vets about HPAI (bird flu)*. <https://www.mpi.govt.nz/biosecurity/pest-and-disease-threats-to-new-zealand/animal-disease-threats-to-new-zealand/bird-flu/information-for-veterinarians>
- Ministry for Primary Industries. (2026c).** *Bird flu: Staying safe and alert when outdoors*. <https://www.mpi.govt.nz/biosecurity/pest-and-disease-threats-to-new-zealand/animal-disease-threats-to-new-zealand/bird-flu/staying-safe-when-outdoors>
- New Zealand Veterinary Association. (2026).** *HPAI: High pathogenicity avian influenza*. <https://nzva.org.nz/clinical-resources/general/hpai>
- Pierce, R.J. 2013 [updated 2022].** Banded dotterel | pohowera. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz
- Robertson, H. A., Baird, K. A., Elliott, G. P., Hitchmough, R. A., McArthur, N. J., Makan, T. D., Miskelly, C. M., O'donnell, C. F. J., Sagar, P. M., Scofield, R. P., Taylor, G. A., & Michel, P. (2021).** *Conservation status of birds in Aotearoa New Zealand, 2021*. www.doc.govt.nz

- Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. (2018).** *Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems*. 2nd edition. EIANZ, Melbourne.
- Seaton, R., Holland, J., Minot, E., Springett, B. (2009)** Breeding success of New Zealand falcons (*Falco novaeseelandiae*) in a pine plantation, *New Zealand Journal of Ecology*, 33 (1), 32-39
- Seaton, R.; Hyde, N. 2013 [updated 2022].** New Zealand falcon | kārearea. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz
- Wingspan (n.d.).** New Zealand Falcon Management Guide: Plantation Forestry.
<https://www.wingspan.co.nz/PDF/Forestry-Management-Protocols-final.pdf>
- Whirika. (2026).** *Assessment of vegetation and wetland values*. Report prepared for Oceana Gold (New Zealand) Limited.

APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of Oceana Gold (New Zealand) Limited as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk. Babbage/Bioresearches acknowledges that this report will be relied on by a Panel appointed under the Fast Track Approvals Act 2024 and these disclaimers do not prevent that reliance.

Legal Interpretation

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

Maps and Images

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

Reliability of Investigation

Babbage/ Bioresearches has performed the services for this project in accordance with the standard agreement for consulting services and current professional standards for environmental site assessment. No guarantees are either expressed or implied.

Recommendations and opinions in this report are based on discrete sampling data. The nature and continuity of matrix sampled away from the sampling points are inferred and it must be appreciated that actual conditions could vary from the assumed model.

There is no investigation that is thorough enough to preclude the presence of materials at the site that presently, or in the future, may be considered hazardous. Because regulatory evaluation criteria are constantly changing, concentrations of contaminants present and considered to be acceptable may in the future become subject to different regulatory standards, which cause them to become unacceptable and require further remediation for this site to be suitable for the existing or proposed land use activities.

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