Southern Seawall Renewal Project

Wellington International Airport Ltd

Kororā (little penguin) management plan

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1. Introduction

1.1 Objectives of the kororā (little penguin) management plan

Kororā live in and around the existing Southern Seawall. The objectives of the kororā (little penguin) management plan, referred to hereafter as the penguin management plan, are to:

- minimise adverse effects to kororā during construction activities
- describe measures to ensure the safety of kororā during construction
- describe the provision of safe new nesting habitat for kororā

To achieve these objectives, the plan includes:

- identification of personnel working with penguins
- a map and description of kororā habitat within the Moa Point Yard, Southern Seawall and Eastern Bank Remediation Area
- procedures for kororā surveys
- methods for handling penguins and for the movement of penguins to a new kororā colony
- methods to exclude kororā from construction works areas
- procedures for the creation of new kororā habitat
- procedures to be implemented if kororā are found in construction areas during works
- details of timing for actions and protocols set out in the penguin management plan
- procedures for monitoring and reporting

The penguin management plan addresses the requirements of the resource consents authorising the Project, and the Wildlife Act approval (to handle and transfer kororā to the two colonies proposed as part of the Project) obtained through the Fast Track Approvals Act 2024 process.

1.2 Project description

The Southern Seawall (the Seawall) at Wellington International Airport has reached the end of its functional life. The proposed Southern Seawall Renewal Project (the Project) will help safeguard the long-term operation of the Airport against natural hazards, increase the Airport's resilience to climate change, and reduce the (otherwise increasing) maintenance demands of the existing seawall.

The Project includes the following key elements:

- establishing two new construction yards (Miramar Golf Course Construction Yard (MGC Yard) and Moa Point Construction Yard (Moa Point Yard)), and using them, along with the existing George Bolt Street Construction Yard, for storage and construction activities. The MGC and George Bolt Street Construction Yards are not relevant for this assessment of effects on kororā, and so are not discussed further in this report.
- reconstructing the Southern Seawall with rock and cubipods
- remediating the eroding Eastern Bank with rock protection
- ongoing maintenance and repair of the newly constructed Southern Seawall

Two new kororā colonies will be established to provide kororā habitat and nestboxes that will be safe from threats such as predation, disturbance by people and sea level rise, with the new colonies providing significantly more safe breeding habitat and nest sites than are currently available to kororā in the Southern Seawall.

Overall, the Project is expected to take six to eight years, with the seawall construction itself taking 24 to 30 months. Construction will be managed to maintain airport operations, minimise nighttime noise, and work around adverse weather and sea conditions. The Project must also appropriately manage constraints arising from sourcing, transporting and stockpiling the significant volumes of rock and cubipods required to complete the seawall works.

Moa Point Yard

The Moa Point Yard will serve as the main operational hub during the seawall construction, operating 24 hours a day, 7 days per week. The site will be recontoured and all-weather access roads will be formed to facilitate yard activities. Once operational, the yard will store construction materials and support general plant setup and maintenance. Most cubipods will be delivered directly to the Moa Point Yard, but rock, other construction materials (including small numbers of cubipods) and equipment to support the seawall works will be transported from the MGC Yard to the Moa Point Yard during the day to ensure ready access to necessary materials overnight, thereby improving construction efficiency and minimising overnight truck movements. Upon Project completion, some of the Moa Point Yard area will be rehabilitated, with one of the new kororā colonies built on the remainder of the area.

Southern Seawall construction

Rocks and concrete rubble at the north-western end of the Southern Seawall, near the Lyall Bay breakwater, and at the Eastern Bank will be removed before construction of the seawall begins. The exposed banks will be reinforced with concrete.

Ground improvements, including micropiling and potentially cement-stabilized hardstanding will be required to support construction equipment. Once the site is established, the construction process includes:

- removing existing reno mattresses, gabion baskets, Akmons and rock from the seawall crest area
- excavation of the seawall toe trench
- smoothing rock pinnacles and/or placing toe rock
- placing underlayer rock and reused Akmons

Cubipods will be installed over the underlayer. Additional tasks include placing a gabion and crest wall, constructing rock protection on the crest, and replacing rear slope geotextile, underlayer and rock armour.

The upgraded Southern Seawall will extend approximately 400 m (measured along the crest) from the Lyall Bay Breakwater to the eastern end of the existing informal Eastern Area rubble seawall. The majority of the work will be done using shore-based equipment, with small dive or survey boats used as needed. The construction is expected to take approximately 24 - 30 months, operating up to 24 hours a day, 7 days a week, with activities that will penetrate the airport's designated obstacle limitation surfaces (OLS) scheduled to occur overnight, outside the airport's core operating hours.

Eastern Bank remediation

The Eastern Bank remediation involves protecting approximately 80 m of bank with rock to reduce erosion. The plant and equipment required for works on the Eastern Bank Remediation will be able to operate under the OLS, therefore, construction in this area will occur within daylight hours. It will take approximately three months to construct the Eastern Bank Remediation.

2. Kororā (little penguins)

The kororā (little penguin; *Eudyptula minor*) is also known as the little blue penguin or blue penguin, and in Australia the fairy penguin. The kororā is the most widespread of the three species of penguin that nest on the New Zealand mainland. Kororā are found along the coasts of the North and South Islands, Stewart Island and the Chatham Islands (Marchant and Higgins, 1990; Robertson *et al.*, 2007; Checklist Committee of the Ornithological Society of New Zealand, 2010).

2.1 Taxonomy

The kororā is recognised by the Ornithological Society of New Zealand as being a single species with two subspecies (Checklist Committee of the Ornithological Society of New Zealand, 2022). The subspecies are *Eudyptula minor minor* (New Zealand little penguin, kororā) and *Eudyptula minor novaehollandiae* (Australian little penguin). The Checklist considered *Eudyptula minor minor* to be widespread throughout the coastal North and South Islands and the Chatham Islands, with *Eudyptula minor novaehollandiae* considered to be the predominant subspecies in Otago.

The Department of Conservation assesses the conservation status of native New Zealand animals using the New Zealand Threat Classification System (NZTCS). The taxonomy of the kororā in the NZTCS (Robertson *et al.*, 2021) differs from that of the Ornithological Society of New Zealand. Robertson *et al.* (2021) considered there to be two species of little penguins (*Eudyptula minor* and *Eudyptula novaehollandiaei*), and recognised four subspecies of *Eudyptula minor* (white-flippered blue penguin *(Eudyptula minor albosignata*), northern blue penguin (*Eudyptula minor iredalei*), southern blue penguin (*Eudyptula minor minor*) and Chatham Island blue penguin (*Eudyptula minor chathamensis*)). Under the NZTCS classification, kororā in the North Island are classified as northern blue penguins (*Eudyptula minor iredalei*).

2.2 Conservation status

Aotearoa New Zealand conservation status

The NZTCS is used by the Department of Conservation to assess the threat status of New Zealand taxa (species, subspecies and other taxonomic categories). The three levels of threat status for native taxa resident in New Zealand taxa are threatened, at risk, and not threatened (Townsend *et al.*, 2008; Michel *et al.*, 2022; Rolfe *et al.*, 2022).

The most recent assessment of the conservation status of New Zealand birds, using the NZTCS, was published in 2021 (Robertson *et al.*, 2021). Little penguins, including the penguins in the Wellington region, which are classified under the NZTCS as northern blue penguins (*Eudyptula minor iredalei*), are classified as at risk - declining. Declining is defined as a predicted decline of 10 to 30% over 10 years or three generations, whichever is the longer. The little penguin classification has qualifiers that the species is known or predicted to be adversely affected by long-term climate trends and/or extreme climatic events, conservation research is needed to understand causes of population declines, and the

available data were considered insufficient for good estimates of the population and the trend in population size (stable, increasing or decreasing).

Wellington region conservation status

The Greater Wellington Regional Council (GWRC) has used the NZTCS criteria to assign a regional threat status to Nationally Threatened and At Risk native bird species in the Wellington region (Crisp, 2020; Crisp *et al.*, 2024). In 2020, GWRC considered the regional status of the kororā to be regionally threatened - vulnerable (Crisp, 2020), with notes that the status of the kororā was conservation dependent, the available population data were poor, and the species was stable or in decline. Crisp (2020) followed the kororā taxonomy used by DOC and referred to the kororā in the Wellington region as the northern blue penguin (*Eudyptula minor iredalei*).

The most recent GWRC conservation assessment of birds of the Wellington region (Crisp *et al.*, 2024) maintained the 2020 regional status of regionally threatened - vulnerable. The 2024 assessment introduced a new status category of Wellington mainland conservation status, with a classification of kororā as threatened - endangered for this new status. The population trend on the Wellington mainland was considered to be stable or in decline. In addition to the species notes from 2020, an additional note recognised that kororā will be adversely affected by long-term climate trends and/or extreme climatic events. Crisp *et al.* (2024) also noted "This species is largely known from the Wellington Harbour islands, Mana Island and the Wellington South Coast. Dogs and mustelids are the main threats, but large development projects in Wellington Harbour could affect habitat during development".

2.3 Threats

Kororā are declining where there is urban development, residential housing and public access to coastlines. Threats to kororā in these areas include predation by dogs, loss of safe nesting habitat, disturbance by people, and mortality on roads. Kororā around all New Zealand coastlines face threats that include predation by cats, stoats, ferrets and rats, food shortages at sea, and changes in the marine environment associated with climate change.

Kororā are vulnerable to natural shortages of food at sea, and the major cause of mortality identified for little penguins found dead on beaches is starvation (Crockett and Kearns, 1975; Veitch, 1975; Powlesland, 1984). Increases in sea surface temperatures and marine heatwaves that are occurring around New Zealand generally lead to reductions in food availability for penguins. Increases in the frequency and intensity of storms will reduce feeding opportunities at sea and, together with sea level rise, will cause coastal erosion and loss of penguin nesting habitat.

A new threat that became apparent in 2024 is the likely arrival in New Zealand of the H5N1 avian influenza strain which can kill penguins (https://www.abc.net.au/news/2024-06-23/phillip-island-penguin-parade-avian-influenza-outbreak-bird-flu/104007418).

2.4 Nest sites

Kororā nest underneath vegetation such as taupata (*Coprosma repens*) and flax (*Phormium tenax*), in burrows dug in soil, in cavities and crevices between rocks, and in caves (Kinsky, 1960; Marchant and Higgins, 1990; Dann, 1994; Perriman and Steen, 2000). They also nest underneath buildings, and use artificial nestboxes.

Kororā nesting habitat

The immediate environment of kororā nest sites is important for adult kororā and for kororā chicks. Flat, shaded, sheltered areas with open ground around the nest site provide opportunities for adults to engage in social and reproductive behaviour such as pair bonding, mating, and displaying to other penguins. Kororā chicks stay in the nestbox during the guard stage, when a parent is present all the time. Once chicks reach around four weeks of age and are in the post-guard stage when the parents come back from the sea to feed the chicks at night, chicks at nest sites on flat, open ground underneath a canopy of shrubs or low trees spend time at night outside the nest box.

Characteristics of good quality nesting habitat for kororā, in addition to flat open ground underneath a low canopy shrubs, include shelter from wind, being close to the sea, easy walking access to and from landing sites, and landing sites that are sheltered from large waves.

Revetment rock walls and rock breakwaters built to protect coastal shorelines can provide nesting habitat for kororā. This habitat is of relatively low quality, as flat, shaded, sheltered areas with open ground around the nest site are not available. The suitability of rock walls and rock breakwaters for kororā depends on the size of the rocks, the width of the rock wall or breakwater, the height above the sea of the top of the wall or breakwater, the level of exposure to waves during storms, and the substrate underneath the rocks. An earth substrate underneath rocks, if accessible to penguins, provides opportunities to dig burrows, whereas a groundcover of synthetic material or concrete is not suitable for penguin digging.

Kororā nestbox preferences

My study of kororā using nestboxes on Mana Island, off the Porirua coast, has shown that kororā prefer nestboxes that are underneath a low canopy provided by shrubs, with open ground around the nestboxes (J.F. Cockrem, pers. obs.), and shelter from wind. These results are consistent with a study at a nestbox colony at Taiaroa Head in Otago, where kororā preferred nestboxes that were shaded by shrubs, free of vegetation at ground level, and on flat rather than sloping ground, in comparison with nestboxes that were not shaded, surrounded by introduced grasses, on sloping ground or had a sloping entrance (Ratz, 2019).

Kororā in natural nest sites and in nestboxes

Kororā breeding success was higher in nestboxes than in natural sites in five of seven years of a study on the Otago Peninsula (Perriman and Steen, 2000). At Phillip Island, Victoria, Australia, breeding success was higher in nestboxes than at natural sites in poor breeding

seasons, survival rates to hatching and fledging were 7.6% and 8.6% higher in nestboxes, and the average total observed mass of chicks produced per clutch was 11% heavier in nestboxes (Sutherland *et al.*, 2014).

2.5 Annual cycle and breeding season

The kororā annual cycle, shown in Fig. 2.1, begins in early autumn after birds have finished moult, spent some time at sea, and start returning to land. Occupation of nest sites, nest building and pair formation occurs from March and April onwards.

The timing of egg-laying varies from year to year and between locations around New Zealand. While eggs can be laid from April until January, egg-laying is usually from mid-July until December. Almost all clutches consist of two eggs, with the eggs incubated for five weeks. After hatching, chicks are guarded by one or other parent for two to three weeks, then chick rearing continues with both parents away during the day until the chicks fledge at around eight weeks old. In the Wellington region the breeding season when eggs or chicks are most likely to be present in nests is considered to be from July to January.

Moult in kororā takes two to three weeks and occurs after birds have finished breeding. Before moulting, the birds spend time at sea to increase their body weight by about 50% from the average. Once ashore and moult begins, all of the old feathers are pushed out by the new feathers, so the birds must stay on land as they cannot swim whilst they are moulting. Moult can occur from December into February and March.

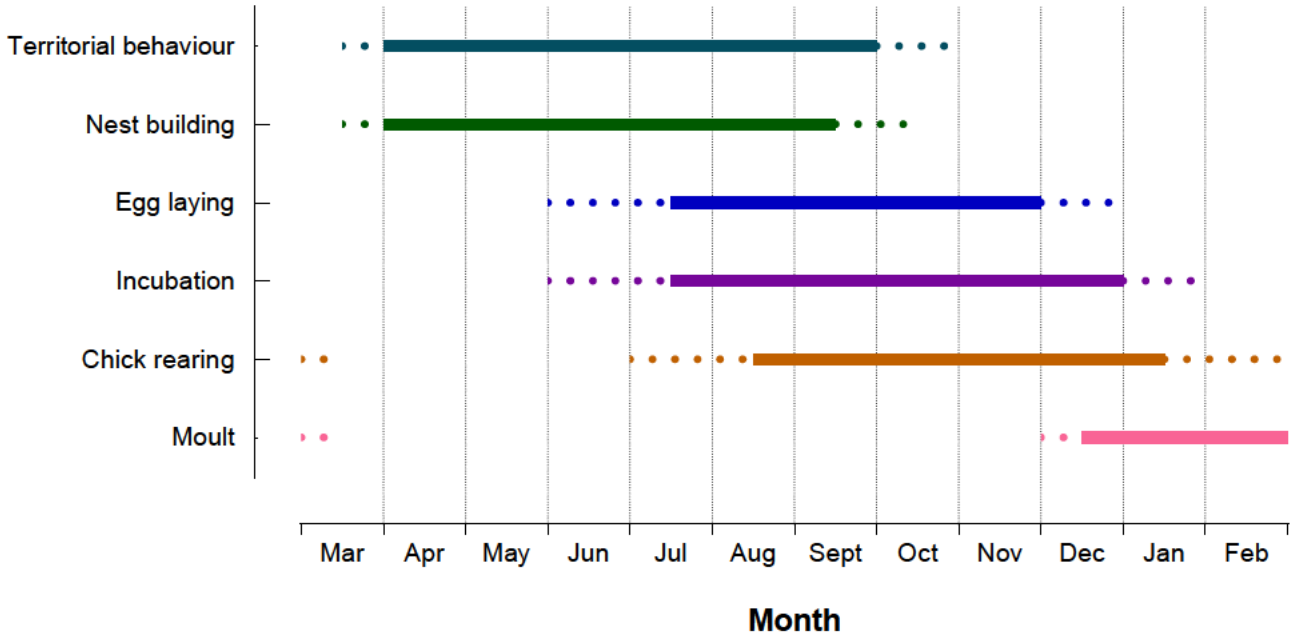

Fig. 2.1. Annual cycle of the kororā. Timing of events in the annual cycle varies between locations, and varies between years at each kororā location.

2.6 Foraging ranges, diving behaviour and diet

Foraging ranges

Tracking studies of kororā that breed on Mana Island, at Napier Port, and at Port Tarakohe in Golden Bay showed that kororā left their colonies towards dawn, swam steadily away from the shore, remained at sea for periods from one day to several weeks or longer, and foraged at distances from shore of up to 50 km and sometimes more than 50 km (J.F. Cockrem, pers. obs). Most foraging occurred within 5 to 30 km offshore. Foraging within 500 m of the shore, as determined from dive profiles, was observed rarely.

Zhang *et al.* (2015) reported that the maximum distance from the colony reached by kororā tracked from Matiu Somes Island in Wellington harbour during chick rearing ranged from 3.5 to 27.4 km. Distances from the shoreline of GPS locations of foraging penguins, estimated from figures in the paper, were >0.5 km for the majority of the fixes. Some fixes were estimated to be 100 to 500 from the shoreline, and a small number of fixes were estimated to be <100 m from the shoreline.

Foraging ranges of kororā in New Zealand have been determined during the pre-egg, incubation and chick rearing stages of breeding for penguins breeding at Oamaru and on Motuara Island in the Marlborough Sounds. The mean farthest distance from the colony reached by penguins at Oamaru varied from 12.8 to 22.6 km for penguins tracked during different stages of breeding in three years (Agnew, 2014). The maximum farthest point was 35.2 km from the colony and the maximum total distance travelled during a foraging trip was 75.4 km.

Foraging ranges of little penguins in Australia have been determined during both the breeding and non-breeding seasons. The mean maximum distance from the colony for day trips at different stages of the breeding season and in the non-breeding season by penguins at Phillip Island was 14.8 km (Collins *et al.*, 1999). Mean maximum distances during chick rearing at three colonies were 17 to 20 km (Hoskins *et al.*, 2008). Penguins on long foraging trips from Phillip Island in winter swam up to 500 km from the colony in one study (Collins *et al.*, 1999) and up to 710 km in another study (Weavers, 1992). The mean maximum distance for five penguins in August was 146.9 km (McCutcheon *et al.*, 2011).

Diving behaviour

Kororā dive and feed both at mid-water depths and along the bottom of the sea (Ropert-Coudert *et al.*, 2006b; Chiaradia *et al.*, 2007; Preston *et al.*, 2008; Preston *et al.*, 2010). The deepest recorded dives were 67 and 69 m (Montague, 1985; Ropert-Coudert *et al.*, 2006a), with the great majority of dives being to depths of <50 m (Chiaradia *et al.*, 2007). Kororā at Oamaru mostly foraged in water <50 m deep (Agnew, 2014) whilst little penguins from Phillip Island in Australia often forage in water >50 m deep (Hoskins *et al.*, 2008). Mean durations of dives of kororā in New Zealand (20 to 30 sec; (Mattern, 2001; Chilvers *et al.*, 2015)) were similar to dive durations of little penguins in Australia (Preston *et al.*, 2008). Mean dive depths were 6.1 m at Tauranga (Chilvers *et al.*, 2015) and 10.1 m at Motuara

Island (Mattern, 2001). Mean dive depths at different stages of breeding in three years at Oamaru ranged from 5.1 to 12.7 m (Agnew, 2014). Kororā at Motuara Island that experience limitations in their food supply dived to greater depths and made greater diving efforts than penguins at Oamaru (Mattern, 2001; Chiaradia *et al.*, 2007).

Diet

Kororā in New Zealand eat small fish and small cephalopods (squid and octopuses). They can also eat small amounts of crustaceans, especially krill (van Heezik, 1990; Fraser and Lalas, 2004; Flemming *et al.*, 2013; Flemming and van Heezik, 2014). The proportions of different species of small fish and of arrow squid vary between locations and between months of the year. Fish are also the predominant food of little penguins in Australia (Montague and Cullen, 1988; Cullen *et al.*, 1992; Chiaradia *et al.*, 2012), with the proportions of fish, cephalopods and crustaceans in the diet generally similar to the proportions of these foods in the diet of New Zealand kororā.

2.7 Hearing and responses to sound

Hearing in birds

(Dooling *et al.*, 2000) and (Dooling and Therrien, 2012) have reviewed hearing in birds. Birds hear best at frequencies between about 1 and 5 kHz (Dooling *et al.*, 2000), which is similar to the range of human hearing where the greatest sensitivities are from 2 to 5 kHz.

Effects of anthropogenic noise in air on birds include auditory system damage and permanent threshold shift (PTS) from acoustic overexposure, temporary threshold shift (TTS) from acoustic overexposure, and masking of important biological sounds (Dooling and Therrien, 2012). These effects depend strongly on the level of noise exposure, which is highly correlated with the distance of the bird from the noise source.

Birds are generally more resistant to auditory system damage and PTS from noise exposure than mammals (Dooling and Therrien, 2012). Continuous noise exposure at levels above 110 dB(A) SPL or blast noise over 140 dB SPL can result in physical damage of the auditory system and PTS. Continuous noise exposure at levels above 90 - 95 dB SPL does not cause permanent damage in birds, but can cause a temporary elevation of hearing thresholds (Dooling and Therrien, 2012).

Hearing and responses to sound in little penguins

Hearing sensitivities of little penguins, at different frequencies of sound, were predicted by Wei and Erbe (2024) using a model of the little penguin ear. They reported that predicted sensitivities were similar to those of other diving birds, and that predicted little penguin sensitivities to sound were lower than sound sensitivities in terrestrial birds.

There is a single published study of behavioural responses of little penguins to sound. Iasiello *et al.* (2023) played recorded constructions sounds and rainfall sounds for one minute at a distance of 0.5 m from little penguins that were incubating eggs in nests. Construction

sounds were played at ~70 dB (measured at 1 m), with peaks of ~75–80 dB when a jackhammer was heard. The construction noises included general construction noises, such as vehicles, banging and a jackhammer. The rainfall noises were played at ~60–65 dB (measured at 1 m). Video recordings were made of the behaviour of birds on nests during sound playback, with behaviours classified following Schaefer and Colombelli-Negrel (2021). Construction noise did not affect the incidence of behaviours considered to be distress behaviours, increased time in vigilance behaviours, and had no effect on the intensity of vigilance behaviours.

Distress behaviours are behaviours that are subjectively considered to be situations when an animal is experiencing stress. Vigilance behaviours are displayed by animals when they are aware of a stimulus from their environment. Vigilance is not a situation when an animal perceives a stimulus to be a threat and initiates a stress response. Animals can become habituated to stimuli that are not perceived as threatening, with vigilance behaviours declining as animals become accustomed to the stimulus. The study of Schaefer and Colombelli-Negrel (2021) involved playing of recorded sound for a single 1 min period, and responses of little penguins and potential habituation to repeated construction noise are unknown.

Corticosterone in birds, and cortisol in mammals, are hormones secreted by the adrenal gland when an animal perceives a stimulus to be threatening (Cockrem, 2007; Cockrem, 2013). Kororā corticosterone responses to handling vary markedly, with some penguins having very low responses while others have large responses (Cockrem *et al.*, 2017). Rachel Choi conducted an MSc study of corticosterone responses of little penguins to the sounds of a person talking, a dog barking, and kororā alarm calls. Sounds were played directly into nestboxes. Corticosterone concentrations after 15 min of the sound of a dog barking did not differ from concentrations after 15 min of talking, whereas concentrations were higher in response to penguin alarm calls.

The corticosterone results illustrate how little penguins may not perceive threatening stimuli that might otherwise be thought by humans to be disturbances. As there is limited evidence regarding the effects of different activities on kororā, observations and measurements of kororā behavioural and physiological responses are needed to determine how kororā respond to construction activities.

3. Kororā in the Southern Seawall project area

3.1 The existing environment

The southern end of Wellington Airport forms part of the Wellington south coast. The shoreline of the airport consists of the Western Seawall and the Southern Seawall.

For the purpose of this report, construction areas for the Project are identified as shown in Fig. 3.1.[1] The areas are:

A - Southern Seawall beside breakwater
B - Southern Seawall rear slope rock bank beside Moa Point Road
C - Southern Seawall
D - Informal Eastern Area rubble seawall
E - Moa Point Yard
F - Eastern Bank Remediation

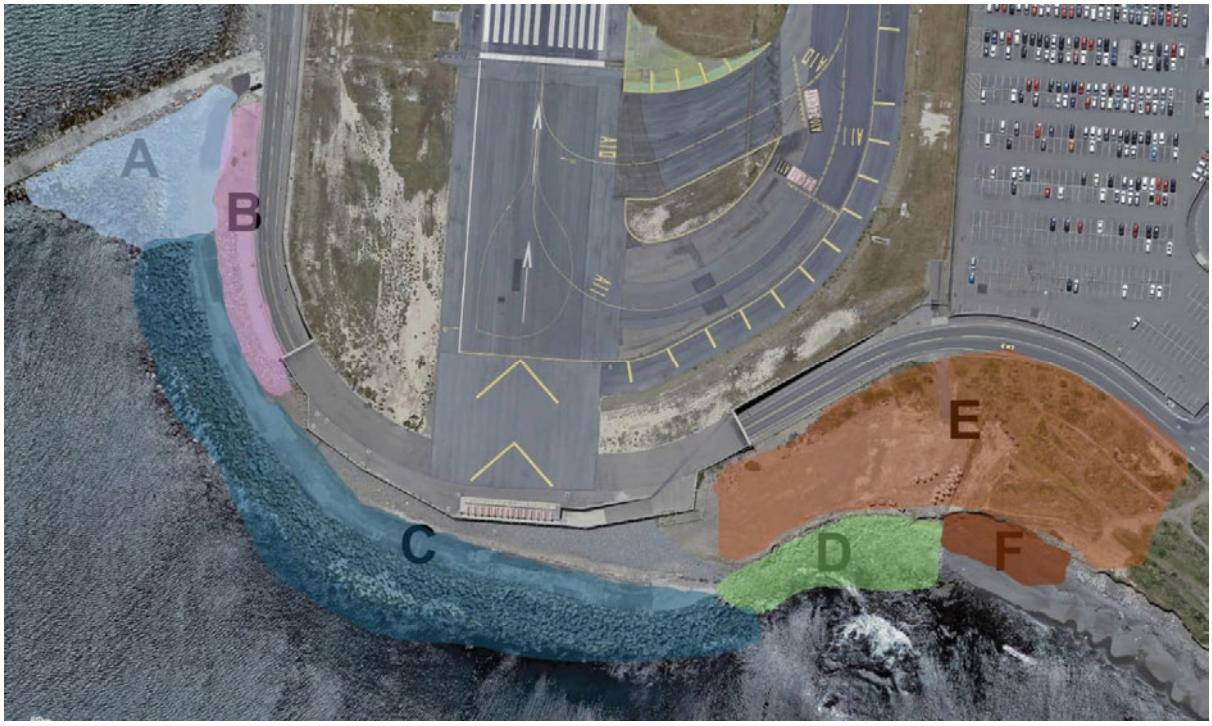

Fig. 3.1. Construction areas for the Southern Seawall renewal project.

Construction area A (Southern Seawall beside breakwater)
The eroding rock wall beside the breakwater has large rocks and concrete structures next to the breakwater, along the seaward edge of this area and adjacent to the large concrete armour units of the Southern Seawall. There are rocks of varying sizes, and some blocks of concrete, together with an earth bank with loose small rocks and gravel on the landward side of the area.

[1] The MGC Yard and George Bolt Street Yard are not relevant to this assessment, and are not shown below or discussed further.

Construction area B (Southern Seawall rear slope rock bank beside Moa Point Road)
This area has an earth bank extending from the road tunnel to the base of the breakwater. There are rocks on the earth bank beside the road and at the edge of the concrete road tunnel.

Construction area C (Southern Seawall)
The Southern Seawall has large concrete armour units that abut gabion rock baskets that have concrete on the top. There are rocks of varying sizes on top of, and in between, the concrete armour units where the armour units meet the gabion baskets.

Construction area D (informal Eastern Area rubble seawall)
The informal seawall in this area is a jumble of pieces of concrete, rocks and steel piled on top of each other and embedded in an earth bank.

Construction area E (Moa Point Yard)
The Moa Point yard area currently has earth mounds and hollows, with isolated bushes and patches of native vegetation including taupata and flax.

Construction area F (Eastern Bank Remediation)
An earth bank containing blocks of concrete, large rocks, and lengths of steel, at the eastern end of the Eastern Area is steadily eroding.

3.2 Kororā habitat

The Airport seawalls (construction areas A, C and D), including the rock bank by Moa Point Road (construction area B), are kororā habitat. This habitat is of relatively low quality, as flat, shaded, sheltered areas with open ground around nest sites are not available (see section 2.4). The area where the Moa Point Yard will be formed (construction area E) has patches of vegetation that provide kororā nesting habitat. The site for a new revetment rock wall (construction area F) is an eroding earth bank that is not kororā habitat. The stage one kororā colony site, located on the east side of Moa Point Road to the south east of Moa Point Yard and discussed in detail later in this management plan, is currently low quality kororā habitat.

The Western Seawall, beside the road on the western side of the runway from the breakwater to the Lyall Bay Beach, is also kororā habitat. The Western Seawall does not form part of this Project.

Quality of kororā habitat in the Southern Seawall

The Southern Seawall is not good quality habitat for kororā. Kororā nest sites are underneath and in amongst rocks, concrete akmons, and concrete rubble, and in earth banks and rocks. Rocks in seawalls generally do not provide safe places for eggs to be laid. There have been observations of eggs laid on rocks in seawalls disappearing and breeding attempts failing (J.F. Cockrem, pers. comm.). Nest sites in the seawalls do not have sheltered flat open

ground around the sites, access from the sea is generally difficult, and the nest sites on the landing areas are exposed to waves and storms from the south.

Some of the sites are subject to inundation during the southerly storms, and nest sites in the concrete rubble area of the Eastern Bank are vulnerable to loss due to erosion. This was apparent during a storm in early May 2025, when some of the earth bank was lost to erosion.

Over time, the area of kororā habitat in the Southern Seawall will diminish, sites will be lost in the Eastern Bank, and inundation of nest sites will increase as sea level rises and the frequency and intensity of storms change.

3.3 Kororā surveys

Kororā surveys can be conducted by close visual inspection of potential habitat and by using a trained penguin dog. Trail cameras can also be placed to provide information on the presence of penguins in an area.

While kororā habitat can be readily identified, features of kororā biology and limitations of survey methods mean that it is not possible to accurately determine the number of kororā living along a stretch of coastline, especially when there are rock walls on the coastline. Kororā surveys need to be interpreted with a knowledge of penguin biology and usually underestimate the number of penguins that live in an area.

Kororā roost and nest sites in rock walls are underneath rocks, or in earth banks underneath rocks, and are almost always inaccessible for visual inspection. For most of these sites, a visual survey will not find signs of penguins (droppings on the ground or on rocks, scrape marks on an earth bank, or a burrow entrance in an earth bank). When signs of penguins are found, it is usually not possible to confirm whether a penguin or penguins are present.

The smell of penguins is very attractive to dogs, and dogs trained to indicate where they smell penguins can be certified by DOC to conduct kororā surveys. Penguin sites identified during a dog survey are sites where a dog stopped and indicated that it could detect the smell of a penguin. The number of penguin sites that a dog finds on a particular day is influenced by the weather conditions, particularly the strength and direction of the wind, and by how long a dog has been working that day.

In the autumn and winter, and into the breeding season, there are pronounced cycles of the number of kororā on land during the day. These cycles have a period of 3 to 4 weeks, with penguins often staying on land for 1 to 2 weeks and then being away for 1 to 2 weeks. If a survey was conducted on a day when the penguins were away, the results of the survey would be quite different from a day at the peak of the cycle of numbers of birds on land. Furthermore, some penguins are consistently out at sea during the day at the times when other penguins are on land. These penguins come ashore at night, but are not present during the day, so will not be found by a dog survey during the day.

3.4 Kororā surveys in the Project area

Visual and penguin dog surveys were conducted on 11 January, 8 August and 10 September 2024, on 14, 20 and 21 May 2025, 21 July 2025, and 18 August 2025

Penguin sites

Locations where the penguin dog indicated that it could detect the smell of penguins, or locations where visual observations found either one or two penguins, or sign of penguins, were designated as penguin sites.

It was usually not possible to determine during visual and penguin dog surveys if a penguin was present at a site, nor was it possible to determine if there was a penguin nest and if the nest had eggs or chicks. Penguin sites may be roost sites that are occasionally or regularly used, may be moult sites, or may be breeding sites. While in my experience it is likely that the majority of penguin sites will be breeding sites, the number of breeding sites cannot be determined.

Locations of penguin sites were recorded on a handheld GPS unit and, were practicable, marked with spray paint. Some sites were found during several penguin dog surveys, and some sites were found on a single occasion. The number of sites found in an area varied between surveys. This is to be expected, as in autumn and winter, outside the breeding season, penguins may or may not be on land on the day of a survey, and survey conditions varied between occasions.

Penguin sites found in the Project area are shown in Fig. 3.2.

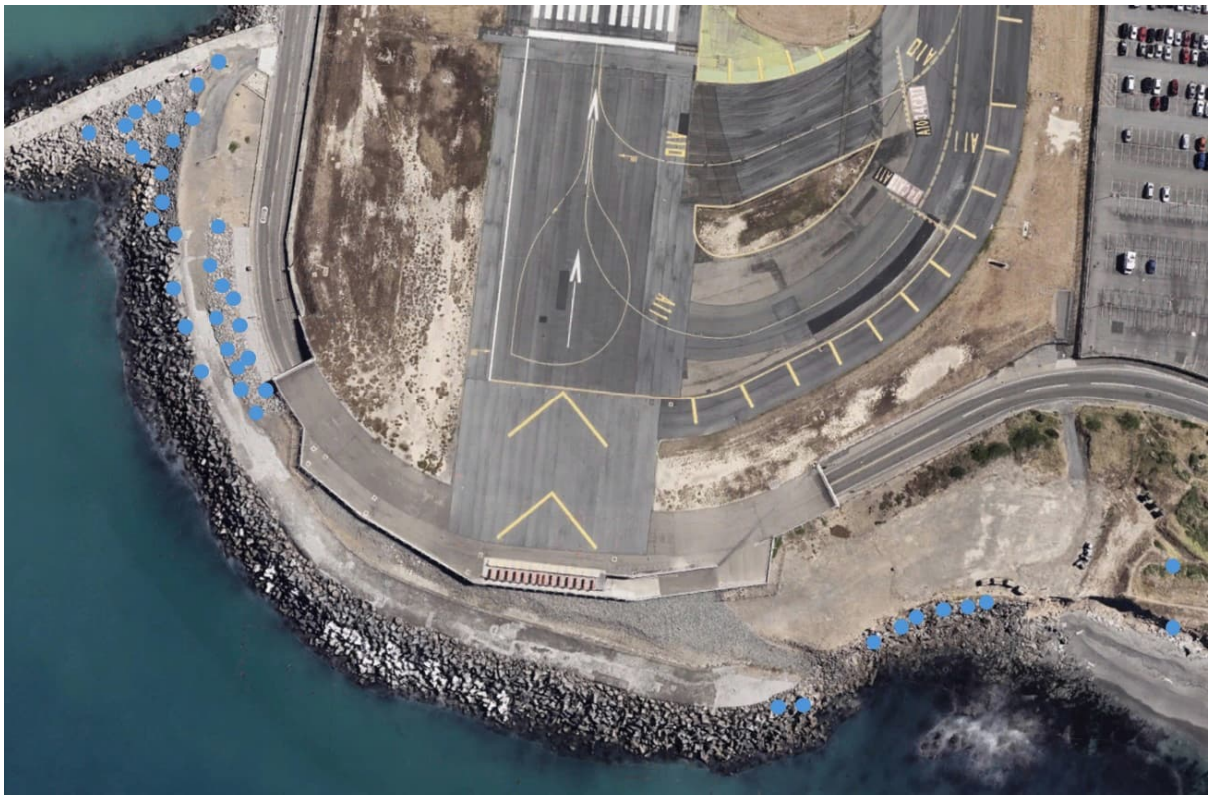

Fig. 3.2. Penguin sites identified in project construction areas.

Construction area A (Southern Seawall rock area beside breakwater)
This area provides habitat for kororā, with rocks of a variety of sizes, and some concrete pieces, spread across a shallow slope above MHWS. These rocks provide sheltered spaces for kororā underneath and between the rocks. The area is washed by waves during storms. On the landward side of this area there is an earth bank, with rocks and concrete in the bank, and some low groundcover vegetation, that provide nesting habitat for kororā.

This area has been surveyed on eight occasions, with 13 penguin sites found.

Construction area B (Southern Seawall rear slope rock bank beside Moa Point Road)
Rocks of varying sizes on an earth bank beside the road and at the edge of the road tunnel provide nesting habitat for penguins. This area is sheltered from waves.

This area has been surveyed on eight occasions, with 12 penguin sites found.

Construction area C (Southern Seawall)
The majority of the Southern Seawall (area C) has large concrete armour units with cavities underneath, together with rocks of varying sizes that abut gabion baskets at the top of the wall. It would be difficult for kororā to make their way from the sea up through the large concrete armour units of this seawall. The rocks of varying sizes in amongst the concrete armour units at the top of the seawall provide potential kororā habitat. While it is possible

that penguins live along the length of the seawall, this is most likely at each end of the seawall where penguins could make their way up through rocks adjacent to the concrete armour units.

This area, apart from some short stretches of rocks at the top and at each end, is largely almost entirely inaccessible for surveys. A penguin dog check along the gabion baskets at the top of the seawall was conducted on three occasions, and some of the northern end of this area was surveyed on three other occasions. Four penguin sites were found at the northern end and two sites at the eastern end of this area.

Construction area D (informal Eastern Area rubble seawall)
This seawall has a mix of concrete, rocks and steel resting on an earth bank, with rocks and pieces of concrete in the earth bank. The top of the bank is well above MHWS. The bank offers opportunities for penguins to burrow into the bank and to have nest sites underneath rocks and pieces of concrete. This is low quality penguin habitat that is washed by waves during storms, with concrete rubble moved by waves in large storms and erosion of the earth bank occurring during storms (see Figs. 3.9 and 3.10).

The informal Eastern Area rubble seawall (area D) has jumbled concrete slabs with cavities underneath that cannot be thoroughly surveyed. This area has been surveyed on four occasions, with six penguin sites found.

Construction area E (Moa Point Yard)
The Moa Point Yard has kororā habitat in patches of native vegetation on earth mounds and in hollows. Some of the hollows have rocks which offer good nesting sites for kororā underneath the rocks. Kororā nesting in this area are exposed to the threat of predation by dogs around their nest sites.

This area has been surveyed on four occasions, with one penguin site found.

Construction area F (Eastern Bank Remediation)
The site for a new revetment rock wall is an eroding earth bank at the edge of the beach to the east of the Eastern area. The earth bank, with rocks and concrete in the bank, is steep and only the base of the bank is accessible to kororā. While kororā could use cavities underneath rocks and concrete in the earth bank, potential roost sites are vulnerable to wave action and smothering by falling debris, and the bank is not suitable as breeding habitat.

One kororā site, underneath a piece of concrete at the base of the bank, was found on 8 August 2024. This site was subsequently washed away.

Stage one kororā colony
The existing native and exotic vegetation areas at the site do not provide penguin habitat, and crevices suitable for penguins have not been found at the base of the slope behind the colony

area. This site has been thoroughly searched for signs of penguins, with penguin dog surveys conducted on 14 May and 18 August 2025. No evidence of penguins has been found at the stage one kororā colony site.

3.5 Estimate of number of kororā sites in the Project area

A total of 39 penguin sites have been found in the Project area.

It has been found in penguin dog surveys at other kororā locations, in seawalls and in areas of natural kororā sites, that the number of identified sites gradually increases as more surveys are conducted. Construction areas C and D in the project area cannot be thoroughly surveyed.

When results from surveys of the Project area, experience from other locations, and limitations of the surveyed areas are taken together, it is considered likely that there are up to 50 kororā sites in the Project area.

4. Construction sequence

The construction sequence has been planned to avoid and minimise potential adverse effects on kororā. A new kororā colony will be built on the east side of Moa Point Road, to the north of the Moa Point Animal Shelter, in advance of other construction activities, so penguins can be moved from construction sites to the new kororā colony. The new kororā colony, called the stage one colony, will have nestboxes in safe habitat that will be of higher quality than existing habitat in the Southern Seawall. Existing seawall habitat will then be carefully removed, with any kororā found in these areas moved to the new kororā colony.

After a former habitat area has been checked and the absence of penguins confirmed, the ground will be covered with a protective surface, or netting installed to exclude penguins, until construction begins (this is addressed further below). The former habitat areas will then be available for seawall construction.

The following overall construction sequence will be followed:

- Build stage one kororā colony at Moa Point in advance of other construction activities, so penguins can be moved from construction sites to the new kororā colony.
- Form the Moa Point Yard (Area E), with penguins living in vegetation on the site moved to the new kororā colony.
- Remove rocks from the rear slope bank beside Moa Point Road, adjacent to the road tunnel (Area B), with penguins living in the rocks moved to the new kororā colony.
- Remove rocks and concrete rubble from the Southern Seawall rock area beside the Lyall Bay breakwater (Area A), with placement of protective surfaces on the exposed ground, to create an area where construction activities can proceed without penguins being present. Penguins living in the area will be moved to the new kororā colony.
- Remove rocks and concrete rubble from existing informal Eastern Area rubble seawall (Area D), with any penguins found in the seawall moved to the new kororā colony. After an area has been checked and the absence of penguins confirmed, cover the ground with a protective surface as needed for seawall protection until seawall renewal construction begins.
- As far as practicable, remove gabion baskets, adjacent rocks and some akmons from the top of the Southern Seawall (Area C), with any penguins found in the seawall moved to the new kororā colony. After an area has been checked and the absence of penguins confirmed, install netting to exclude penguins, then replace rocks and Akmons as needed for seawall protection until seawall renewal construction begins.
- Reconstruct the Southern Seawall.
- Build Eastern Bank revetment rock wall (Area F).
- Build stage two kororā colony behind the Eastern Bank revetment rock wall.

Stage one kororā colony

The stage one kororā colony will be located on the landward side of Moa Point Road to the south of the airport (see Fig. 4.1 for view of the colony location). The new colony will be built before removal of habitat in construction areas begins, so kororā can be moved to the

new, safe location when existing roost and nest sites are lost. The new colony will have kororā nestboxes, rock mounds to provide shelter from wind, together with existing and newly planted native shrubs. There will be a fence around the colony to exclude people and dogs.

Fig. 4.1. View of area where the stage one kororā colony will be established.

Moa Point Yard formation (construction area E)

Existing earth mounds and vegetation (see Fig. 4.2) will be removed to form a flat area for an operational yard.

Fig. 4.2. View of the western end of the area where the Moa Point Yard will be formed.

Moa Point Road Rear Slope bank rock removal (construction area B)
Rocks on the bank beside Moa Point Road and adjacent to the road tunnel (see Fig. 4.3) will be removed so access to the main seawall for construction machinery can be formed.

Fig. 4.3. View of rocks on bank beside Moa Point Road (construction area B).

Southern Seawall rock area beside Lyall Bay breakwater rock removal (construction area A)
Rocks, concrete and steel in the area beside the breakwater (see Figs. 4.4 and 4.5) will be removed in advance of the construction of the seawall. Coverings will be placed on exposed ground surfaces, to protect the surfaces from erosion by waves.

Fig. 4.4. View of construction area A, looking southwards.

Fig. 4.5. View of construction area A, looking southwards.

Eastern Area informal seawall rock removal (construction area D)

Rocks, concrete and steel in the informal seawall (see Fig. 4.6) will be removed in advance of the construction of the seawall. Coverings will be placed on exposed ground surfaces, to protect the surfaces from erosion by waves.

Fig. 4.6. View of the informal eastern area seawall (Construction Area D), looking westward towards the Southern Seawall.

Southern Seawall penguin exclusion (construction area C)
Gabion baskets, adjacent rocks and some armour units will be removed from the top of the seawall (see Fig. 4.7), then netting installed to exclude penguins from the top of the seawall. Large rocks and armour units will then be replaced, to protect the top of the seawall from wave action until construction of the new seawall.

Fig. 4.7. View of the eastern end of the Southern Seawall (Construction Area C), looking eastwards.

Southern Seawall construction (construction area C)
The new seawall will be formed by the placement of large rocks and armour units on the outside of existing armour units in the current Southern Seawall, on cleared ground surfaces at the sites of the former informal seawall, and at the former rock area beside the breakwater. Seawall construction will start at the east end of the existing informal seawall and proceed westwards to finish at the breakwater.

Moa Point Road Rear Slope bank rock remediation (construction area B)
After construction of the southern seawall, the bank beside the Moa Point Road will be reformed and rocks placed on the bank.

Revetment rock wall (Eastern Bank Remediation construction area F)
An eroding earth bank at the edge of a beach (see Fig. 4.8) currently extends eastwards from the eastern end of the informal seawall. The western half of eroding bank will be replaced with a revetment rock wall 60 m long. The new wall will protect the end of the Southern Seawall, and the stage two kororā colony, from erosion. A smooth, sloping ground surface

will be formed, the surface covered with a geotextile fabric, then rocks of approximately 0.6 m diameter placed to form the rock wall.

Fig. 4.8. View of the eroding earth bank (Construction Area F), looking eastwards from the eastern end of the informal seawall.

Stage two kororā colony

The stage two kororā colony will be constructed on the site of the Moa Point Yard (see Fig. 4.9), following site demobilisation, on completion of the Southern Seawall. New kororā habitat will be built behind the revetment rock wall to create a new kororā colony. Earth mounds parallel to the rock wall will be formed, nestboxes placed between the earth mounds, rocks placed to simulate natural rocky habitat, vegetation planted to provide cover, and a surrounding earth mound to provide shelter from wind will be formed.

Fig. 4.9. View of the site where the stage two kororā colony will be constructed.

5. New kororā habitat

Two new kororā colonies, and a new revetment rock wall, will provide new kororā habitat.

Locations of the new colonies are shown in Figs. 5.1 and 5.2.

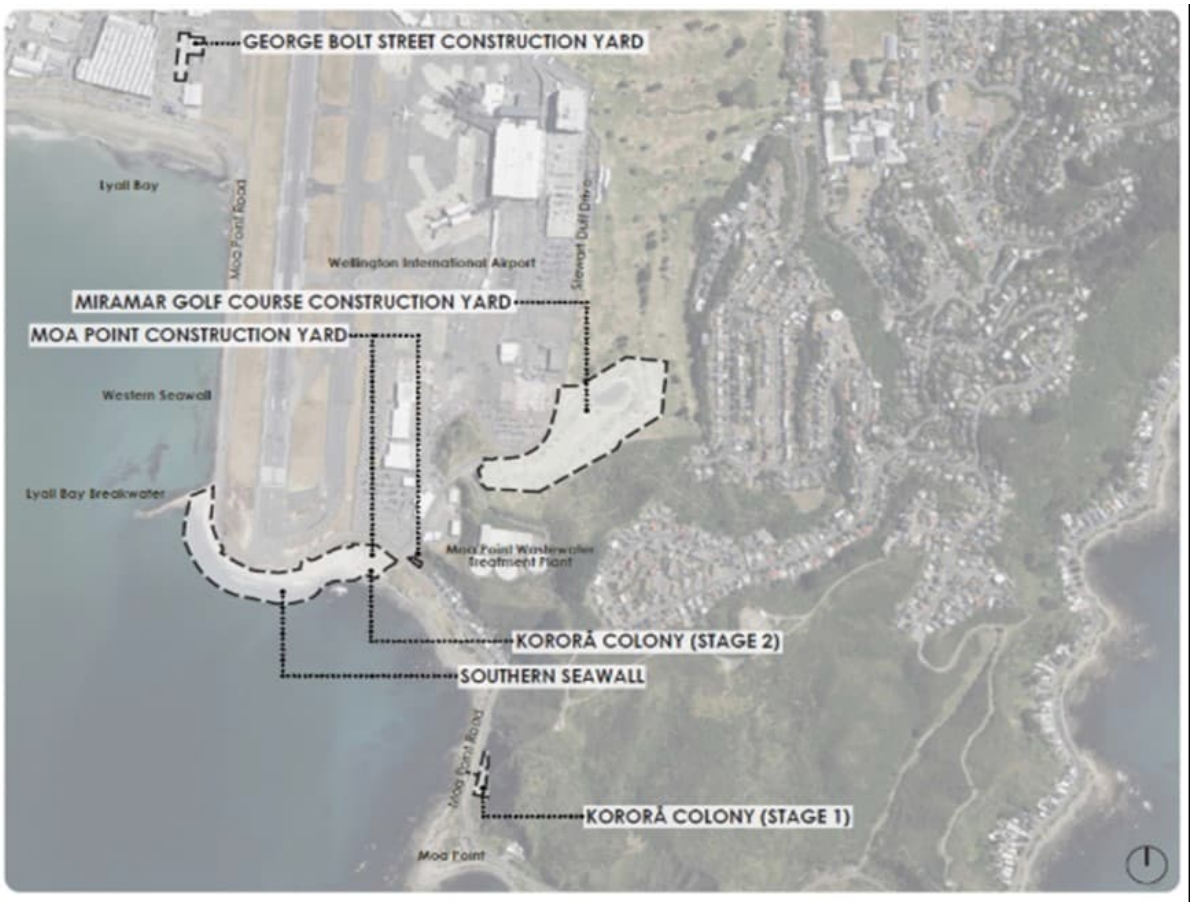

Fig. 5.1. Locations of the stage one and stage two kororā colonies, together with other key components of the Project.

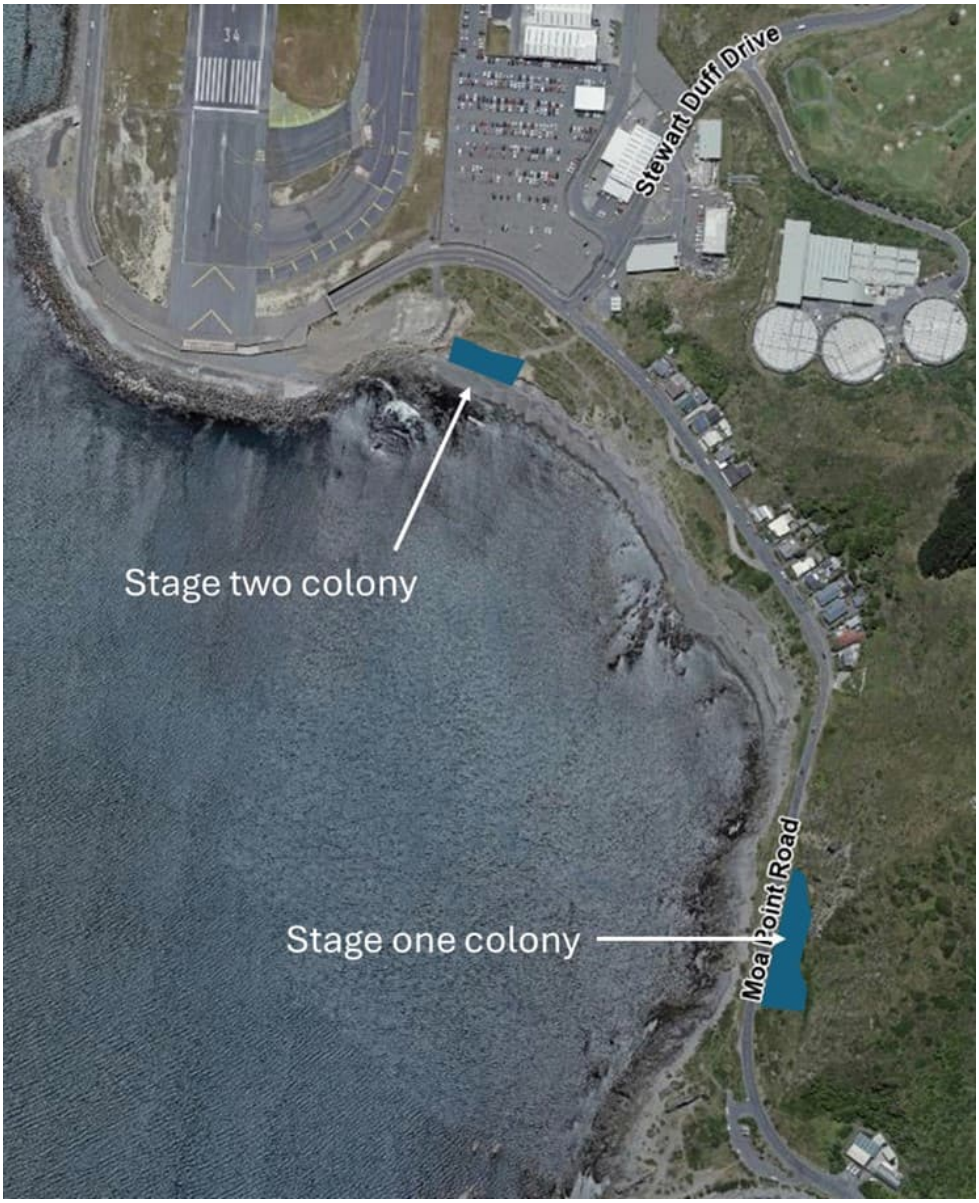

Fig. 5.2. Locations of the stage one and stage two kororā colonies.

5.1 Revetment rock wall

A new revetment rock wall will be built along the shoreline to the east of the new seawall (Eastern Bank Remediation) where there is currently an eroding earth bank. The wall will provide 610 m^2 of new kororā habitat, with roost and nest sites amongst the rocks.

5.2 New kororā colonies

There will be two new kororā colonies:

- the stage one colony on WIAL land at Moa Point (2060 m^2 of new habitat)
- the stage two colony behind the new revetment rock wall to be built in the Eastern Bank Remediation (860 m^2 of new habitat).

Together, the two new colonies will provide 2920 m^2 of kororā habitat that is safer for penguins than existing habitat in the Southern Seawall.

100 nestboxes will be initially installed in the stage one colony, with opportunities for 100 or more additional nestboxes to be placed once plantings of native shrubs are well established.

70 nestboxes will be installed in the stage two colony.

Kororā around the Wellington coastline are at risk from attacks by dogs, collision with motor vehicles whilst crossing roads, disturbance by people, and inundation of nest sites due to sea level rise and increased frequency and intensity of storms. Nestboxes in the new kororā colonies will be safe from all these threats.

5.3 Quality of kororā habitat in the new kororā colonies

The new colonies will provide habitat with nestboxes, planting, shelter, no risk of inundation by waves, and exclusion of people and dogs. The nestboxes in the new colonies will provide better kororā nest sites than those in the existing seawall (see section 2.4 for details of kororā success in natural sites compared with nestboxes).

The immediate environment of kororā nest sites is important for adult kororā and for kororā chicks. Flat, shaded, sheltered areas with open ground around the nest site provide opportunities for adults to engage in social and reproductive behaviour such as pair bonding, mating, and displaying to other penguins. Kororā chicks stay in the nestbox during the guard stage, when a parent is present all the time. Once chicks reach around four weeks of age and are in the post-guard stage when the parents come back from the sea to feed the chicks at night, chicks at nest sites on flat, open ground underneath a canopy of shrubs or low trees spend time at night outside the nest box.

Nestboxes in the new colony will be on flat ground underneath shrubs, with open ground around the nestboxes, and will be sheltered from wind, so the immediate environment of the nestboxes will have all the features that kororā prefer for nest sites. In addition, kororā using the nestboxes will also have access to nesting material, which is not the case for nest sites in the seawall.

5.4 Long term vision and timeframes for kororā colonies

Stage one colony

Five years

Colony establishment will include installation of an underpass for penguins to get to the colony, placement of nestboxes under existing native shrubs, planting of native vegetation, and the placement of nestboxes in newly planted areas. Five years after the establishment of the colony, it is expected that some nestboxes under existing shrubs will be used by penguins, and that plantings in previously open areas will be starting to provide cover for nestboxes placed in those areas.

Regular checks of nestboxes will have been undertaken since the establishment of the colony so that occupation of the nestboxes can be documented, and data gathered on the timing and success of breeding. Tracking studies to determine at sea foraging areas of the penguins can begin once several nestboxes are occupied by penguins.

Ten years
After 10 years it is expected that nestboxes under existing shrubs, and in areas planted when the colony was established, will be in use. As more and more nestboxes are used, further nestboxes can be placed in the colony, with space for up to 100 or more additional nestboxes.

Thirty years
After 30 years many nestboxes are expected to be used, with the colony completely vegetated and looking like a natural shrub area. It is anticipated that the colony will have become a significant kororā breeding site on the Wellington city coastline, and can become a location site for kororā education, advocacy and research.

Stage two colony
Five years
The stage two colony will be built on ground that had been a flat gravel area in the Moa Point Yard. Earth mounds will be formed, then native shrubs will be planted and nestboxes placed in the new colony. While the nestboxes will initially be in the open, and it will take time for plants to grow, rocks and driftwood placed around nestboxes will provide shelter and cover. Penguins are attracted to rock walls, and will come ashore and make their way up through small tunnels in the wall and into the new colony. It is expected that some nestboxes will be used by penguins five years after colony establishment.

Ten years
After 10 years, plants will provide extensive cover, and nestboxes throughout the colony are likely to be in use.

Thirty years
After 30 years, the stage two colony will be completely vegetated and look like a natural shrub area, with many nestboxes likely to be in use. It is anticipated that the stage two colony will, as for the stage one colony, be a significant kororā breeding site on the Wellington city coastline.

6. Stage one kororā colony

The stage one kororā colony will be located on the landward side of Moa Point Road to the south of the airport. The new colony will be built before removal of habitat in construction areas begins, so kororā can be moved to the new, safe location when existing roost and nest sites are lost. The new colony will have kororā nestboxes, with planting of native vegetation to replace existing exotic grasses and weed on the site. There will be a fence around the colony to exclude people and dogs. A concept drawing of the colony is shown in Fig. 6.1.

In addition to the movement of penguins from the Southern Seawall to the stage one colony, other penguins will be attracted to the new colony by lighting in the underpass (kororā are attracted to lights at night) and by the broadcast of penguin calls. Predator control (mustelids and rats) will be implemented in and around the new colony to supplement existing predator control efforts around the Moa Point coast.

The stage one kororā colony will be close to Moa Point, on the landward side of Moa Point Road. The colony area consists of stony ground sloping upwards from the road to the base of a steep face that has areas of exposed rock. Large taupata bushes, along with some ngaio and kawakawa, are present on the site, particularly along the base of the steep face. Thorough searches of the area, and two penguin dog surveys, have not found indications that penguins are present, with no sign of penguin tracks or penguin nest sites.

Construction of colony

Construction of the stage one kororā colony will involve the installation of a precast concrete underpass beneath the road, from the shoreline to inside a fence around the colony, placement of rocks along the shoreline next to the underpass entrance to help protect the existing road against erosion, and removal of introduced vegetation such as gorse from the colony site.

Work to create the colony will also include:

- installation of a security fence around the colony
- planting of native vegetation on the outside of the security fence
- clearance of some existing exotic vegetation
- planting of native vegetation inside the colony boundary
- installation of nestboxes
- placement by hand of rocks around nestboxes, and use of rocks and gravel to create narrow pathways to nestboxes
- installation inside the underpass of lighting and a sound system to play penguin calls
- installation of predator control stations for mustelids and rats in and around the colony
- control of rabbits that are currently present at the site
- placement of driftwood or branches that will initially provide shelter for plants and penguins then gradually decay

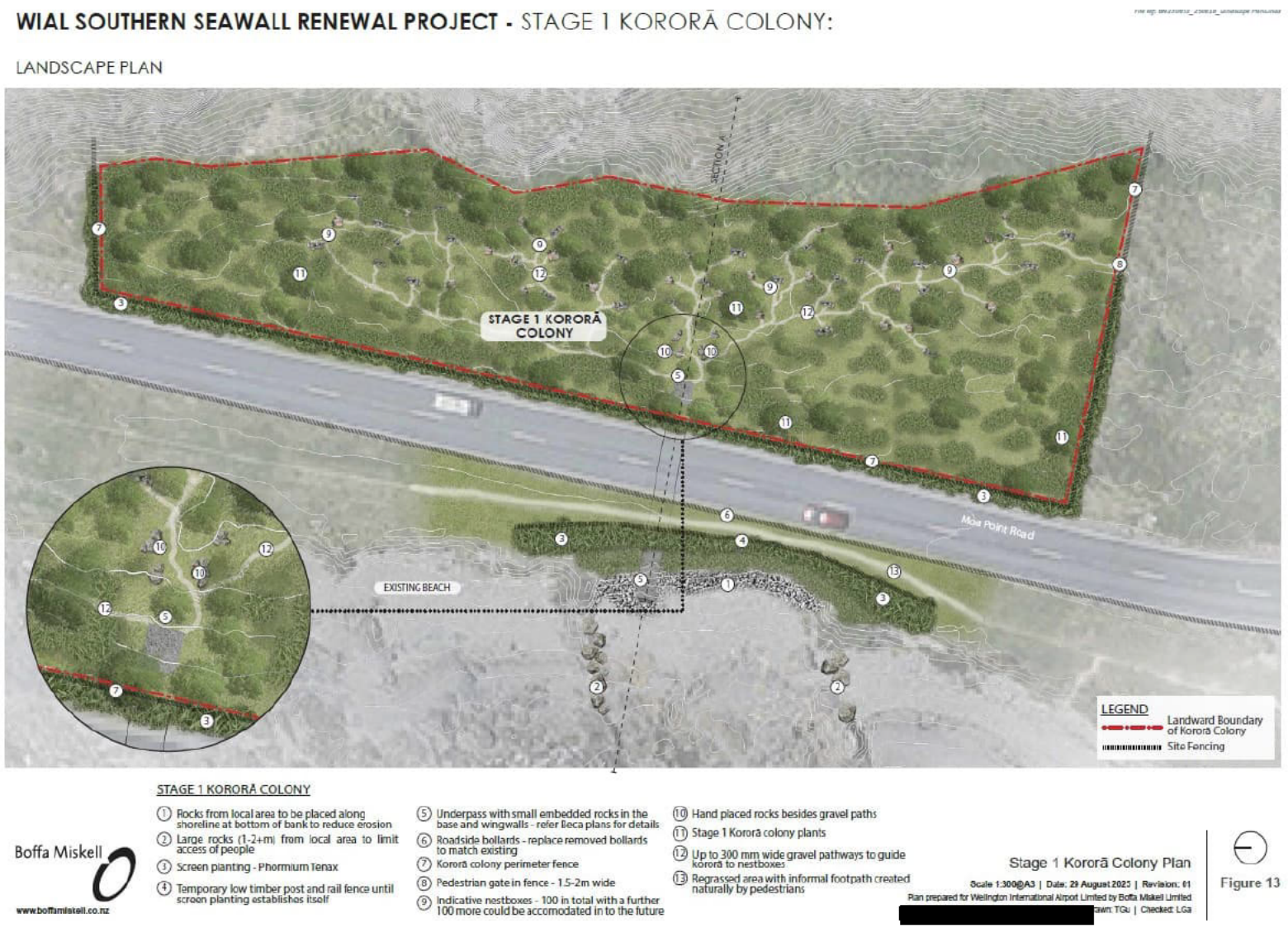

Fig. 6.1. Concept drawing of stage one kororā colony.

Underpass

An underpass 2 m wide, 1 m high and approximately 25 m in length will be built underneath Moa Point Road, from the shoreline to inside the kororā colony. The underpass will provide safe access for penguins to reach the colony. The underpass has been designed in light of experience from the Oamaru Blue Penguin Colony, where a concrete pipe was installed underneath a road in 2016 to provide access for penguins to nest sites, together with consideration of features of penguin biology. The underpass will be 2 m wide and 1 m high, and will be considerably larger than the concrete pipe at Oamaru. Engineering plans for the underpass are shown on pages 17 and 18 of the C.01 Engineering Plans document for the Project (https://www.fasttrack.govt.nz/__data/assets/pdf_file/0018/14436/C.01-Engineering-Plans-for-Consent.pdf; *reference to final approved plan to be added here*).

Kororā explore small rocky streambeds that open on to shorelines, and the underpass will have a pebble surface and rocks to mimic a natural streambed. Penguins do not like walking across open areas, and prefer to move from one sheltered location to another. Rocks will be placed inside the underpass to create a path for penguins that goes around the rocks, rather than expecting penguins to walk along a long open expanse of concrete.

Research in Australia has shown that little penguins are attracted to artificial lights, and are more likely to go into a tunnel or to walk along a path if the underpass is lit than if it is dark (Rodriguez *et al.*, 2018). LED lights, with adjustable light intensity, will be installed along the roof of the tunnel, to provide light that will attract penguins to use the underpass.

The underpass entrance will be set into an earth bank at the edge of a small beach. Native vegetation will be planted along the top of the bank, to form a screen and a barrier between a walking path beside the road and the top of the bank.

Cameras will be used to record observations of penguins on the beach and in the tunnel, to provide information on behaviour of penguins under different light intensities and to optimise the light intensity to attract penguins to the tunnel. In addition, a small sound system at the colony end of the underpass will be used to play penguin calls to attract penguins to the colony.

Exclusion of people and dogs from underpass entrance beach

It is recommended that WIAL engage with Wellington City Council (WCC) to pursue a bylaw amendment so that dogs are prohibited on the beach from 30 m north of the underpass entrance to 30 m south of the underpass entrance.

Nestboxes

100 nestboxes will initially be installed at the stage one kororā colony, with space to install more than 100 additional nestboxes in future years. Initially, 60 nestboxes will be placed underneath existing shrubs (taupata, ngaio and kawakawa), and 40 nestboxes will be placed

in areas that currently have exotic grasses and weeds. Exotic vegetation will be cleared by hand to allow penguin access to nestboxes. Nestboxes will be placed at least 2 m apart.

Experience from other locations has shown the importance of avoiding penguins sitting on earth surfaces that are damp and become muddy, and the importance of drainage for nestboxes. A 50 to 75 mm deep base of small stones and gravel will be formed for each nestbox, so the nestbox can sit on the stone and gravel base rather than on earth.

Nestboxes will be built following a design developed several years ago by Dr Cockrem (see Fig. 6.2). More than 250 of these nestboxes have been placed at sites on Mana Island, Kapiti Island, Port Tarakohe, Kaiteriteri, Waiheke Island, and at Kaikoura. The nestbox has a long entrance tunnel with a right angle entrance from the tunnel into the nest area. The entrance tunnel provides more shelter for penguins inside the nestbox than the standard design which has a short tunnel directly into the nest area.

Fig. 6.2. Nestbox with long entrance tunnel. The tunnel is on the left side of the nestbox.

A study of kororā occupancy of nestboxes on Mana Island has shown that kororā prefer nestboxes on flat ground underneath a low canopy provided by shrubs, with open ground under the canopy, and that they prefer nestboxes that have rocks placed to form a rock-lined path to the nestbox entrance, with rocks around and over the nestbox entrance. Rocks will be placed around nestboxes, ensuring that entrances cannot be blocked, and currently open areas will be planted to provide the preferred cover for penguins.

If risks to nestboxes arise due to rock falls, or other natural hazards, then affected nestboxes will be moved to other locations in the colony.

Rocks

Penguins are attracted to rocky areas, and seek nest sites that are natural cavities in rocks. Rocks approximately 20 to 35 cm in diameter will be placed around each nestbox. Gravel with small rocks or pebbles will be placed by hand to form a short gravel path to the entrance

to each nestbox, with rocks placed to line the path and guide penguins to the nestbox entrance (see Fig. 6.3). Rocks will also be placed beside gravel paths that lead from the underpass to nestboxes (see below).

Paths

Narrow gravel paths 0.3 m wide will be formed by hand, with rocks placed beside the paths, to help guide kororā to nestboxes. Paths will extend from the underpass exit to existing shrub areas, and into areas that are currently open and will be planted in native shrubs. Low intensity lighting will be installed along paths (Australian research showed that little penguins preferred lit to unlit paths; Rodriguez *et al.*, 2018).

Planting

Taupata (*Coprosma repens*) is a coastal shrub that forms the low canopy with open ground underneath that is preferred by kororā. Taupata and other native species will be planted throughout areas of the stage one colony that are not currently vegetated with native shrubs. The new plants will provide shelter for nestboxes and for penguins using nestboxes. There will also be planting to form a vegetation screen along the outside of the colony boundary fence, and on the top of the shoreline bank above the entrance to the underpass.

Fig. 6.4. Nestbox on Mana Island, showing gravel pathway leading to rocky entrance to nestbox.

Driftwood

Penguins do not like open areas, and are unlikely to use nestboxes placed in areas that are currently open until taupata and other plants have grown to shelter the nestboxes. In order to provide some cover while plants are growing, piles of driftwood will be placed in the open areas, alongside and over the paths, and around the nestboxes. The driftwood will gradually decay as the new shrubs are growing to provide cover.

Cover for penguins to move from underpass exit to existing shrubs
There will be approximately 10 m of open ground from the underpass exit to the closest existing taupata shrub area. Penguins will be reluctant to cross this open space, so cover will be provided to reduce the open space distance.

At the Napier Port kororā colony, wooden pallets on blocks have been placed to create a covered walkway from the top of a ramp from the sea to areas of shrubs. This is a practical and successful approach that could be taken at the stage one colony.

An alternative approach, which would be in keeping with the natural features of the landscape, will be to place large rocks (0.5 to 1.0 m or greater in diameter) in groups, with rocks placed on other rocks to form small caverns or caves that penguins could move into. Penguins could then emerge from the underpass exit, walk or run to a rock group, shelter in caverns in the rocks, then move to another rock group and then to the shrubs.

Piles of driftwood can also be placed between the exit from the underpass and the existing shrubs.

Fence
A boundary fence along the roadside and along the south end of the colony will be built using the same materials as a fence at the Port Tarakohe kororā colony in Golden Bay. The fence will be Waratah netting 150 cm high, with Waratah metal posts (set in concrete), and a strand of barbed wire along the top of the netting. Additional steel mesh netting (12 mm x 12 mm mesh; extending from 300 mm above ground level to 100 mm below ground level) will be installed on the bottom of the Waratah netting. The mesh netting will ensure that penguins could not move from the colony on to the road. The netting will also be rabbit-proof.

Pest control
A pest control programme will be initiated when the colony is constructed. DOC200 double-set traps for mustelids and rats, and bait stations for rodents, will be installed and then maintained for at least 20 years, so risks to penguins from predation of adults, chicks or eggs will be minimised. Rabbit control will be undertaken before planting begins at the stage one colony, and repeated if needed for at least 20 years.

Nestboxes as habitat for lizards
The kororā nestboxes will provide dry, sheltered habitat for geckos and skinks, as on Mana Island where some nestboxes are occupied by dozens of geckos (see Fig. 6.4).

Fig. 6.4. Geckos in a nestbox on Mana Island.

Soft release site for rehabilitated and translocated kororā

The stage one colony can become a soft release site for the release of rehabilitated kororā, and can also be a safe release site for kororā that have to be translocated from any Wellington coastal location.

Kororā that are taken into rehabilitation facilities are usually returned to the wild by "hard release", which involves letting them go into the water at a beach. An alternative approach, that is used very successfully on Waiheke Island, is "soft release" of penguins. When kororā are considered to be ready for release, they are taken to a nestbox at a soft release site near the shore. The site has several nestboxes within a fenced area. Kororā moved to a nestbox at the soft release site continue to be hand fed daily, as at the rehabilitation centre. The penguins can go out into the pen at night and stay in the nestbox during the day. After approximately one week, a gate in the fence is opened, then hand feeding continues daily until the penguin has departed.

A soft release site will be established at the stage one colony. The site will provide a safe release site for rehabilitated penguins and for penguins that have been moved from their original location. Furthermore, based on experience at other locations, penguins that have been soft released may return to breed at the stage one colony.

7. Stage two kororā colony

The stage two kororā colony will be constructed on the south-eastern part of the Moa Point Yard, following site demobilisation, on completion of the Southern Seawall.

The new colony will abut a rock revetment wall of which will be built to protect the existing earth bank from erosion. Kororā are attracted to rocks and will be able to come ashore and follow access routes, including short tunnels, from the seaward edge of the rock wall up to the kororā colony. Each access route will have a series of short tunnels, with the last tunnel opening into the kororā colony. The access routes will enable kororā to move through the revetment rock wall and follow rock paths into the new colony.
The colony will consist of earth mounds to provide shelter from wind, kororā nestboxes, rocks, and planted vegetation. There will be a fence around the colony to exclude people and dogs.

Construction of the stage two kororā colony will involve earthworks to form earth mounds, with a mound surrounding the colony and smaller mounds within the colony. Work to create the colony will also include:

- establishing a security fence around the colony
- planting shrubs within the colony, and around the perimeter mound
- installation of 70 nestboxes
- placing rocks around nestboxes and along paths from nestboxes to the rock wall
- placing predator control stations for mustelids and rats in the colony and in the surrounding area
- placement of driftwood or branches that will initially provide shelter for plants and penguins then gradually decay

A concept drawing of the colony is shown in Fig. 7.1. The stage two colony will have nestboxes, rocks, paths, planting, driftwood, a boundary fence surrounding the colony and predator control, as described for the stage one colony.

The beach below the site of the stage two colony that extends to the east is used by people who walk their dogs, usually off leash. Kororā will cross this beach to reach the new revetment wall, on their way to the new kororā colony, and will be vulnerable to dog attacks.

It is recommended that WIAL engage with Wellington City Council (WCC) to pursue a bylaw amendment in due course so that dogs are prohibited from the 60 m length of beach adjacent to the new revetment rock wall. Dog access would still be permitted along the 320 m length of beach from the eastern end of the revetment rock wall to the beginning of the rocky shoreline close to Moa Point Road. Prohibition of dogs from the beach adjacent to the revetment rock wall would ensure that kororā using the new colony are safe from dog attacks. It is also recommended that WIAL seek to have signs requesting dogs to be kept on leash installed as an interim measure in advance of a bylaw change.

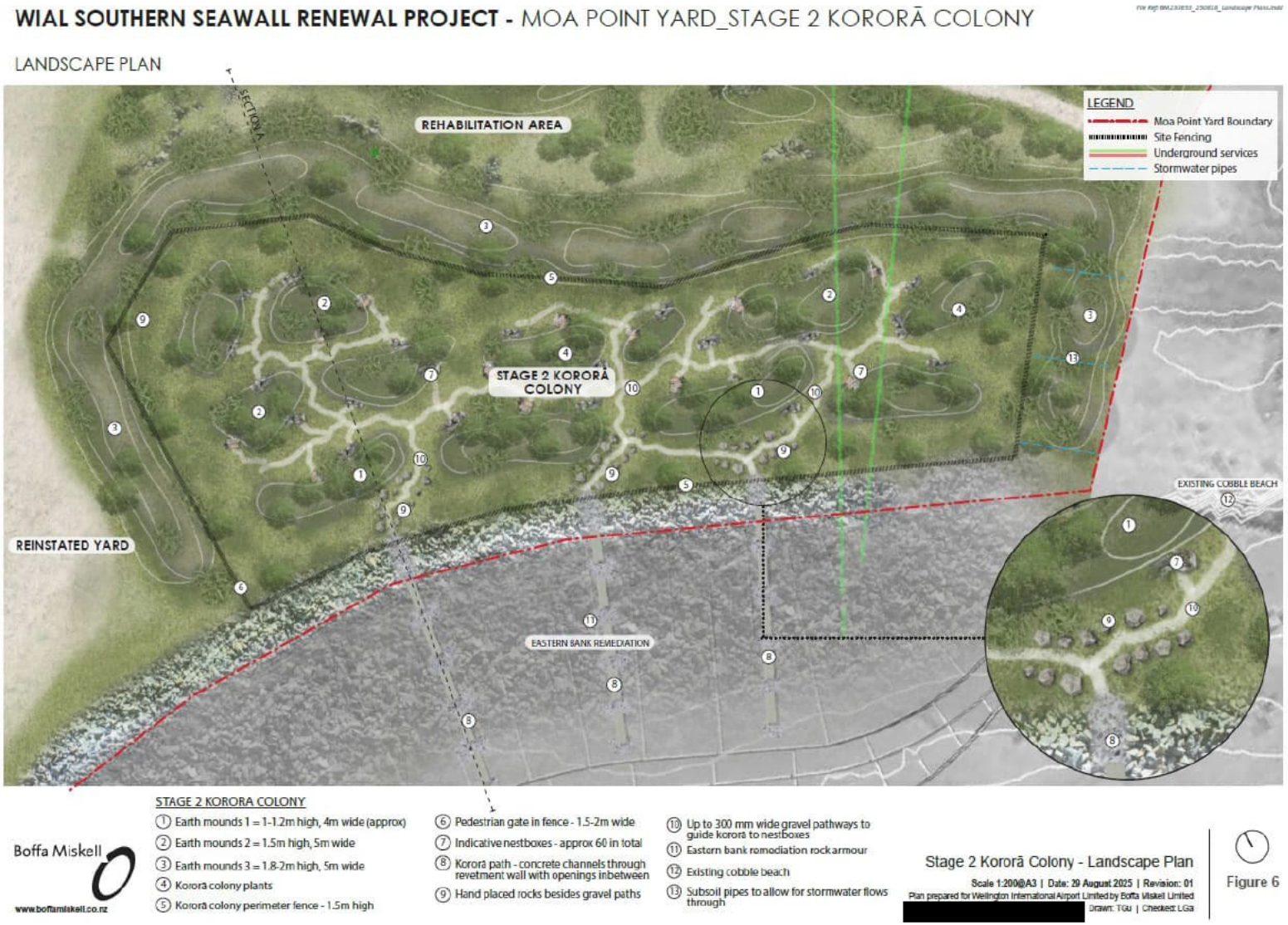

Fig. 7.1. Concept drawing of stage two kororā colony.

8. Kororā management

Measures to avoid and minimise adverse effects of the construction project on kororā are described below.

Construction sequence and movement of penguins to stage one colony

The construction sequence has been planned to avoid and minimise potential adverse effects on kororā. The stage one kororā colony at Moa Point will be built in advance of other construction activities, so penguins can be moved from construction sites to the new kororā colony. The new kororā colony will have nestboxes in safe habitat that will be of higher quality than existing habitat in the Southern Seawall.

Once the stage one colony has been built, existing seawall habitat will then be carefully removed, with any kororā found in these areas moved to the new kororā colony.

After a former habitat area has been checked and the absence of penguins confirmed, the ground will be covered with a protective surface, or netting installed to exclude penguins, until construction begins (this is addressed further below). The former habitat areas will then be available for seawall construction.

8.1 Procedures for all construction works for the Project

Assumption that penguins are present

When planning and undertaking the Project works, it will be assumed that a penguin could be present underneath every rock and piece of concrete in seawalls, and in every crevice in seawalls, on every day of the year. It will also be assumed that penguins might be present in areas within penguin exclusion fences.

People working with kororā

The Project Penguin Biologist, Wellington Airport Wildlife Management Officer, Taranaki Whānui representative and penguin management officers will implement the penguin management plan for the project.

The Project Penguin Biologist (Dr Cockrem) has more than 35 years of experience in penguin research, and has worked with kororā, hoiho, Adelie penguins and emperor penguins. He has established new kororā nestbox colonies at seven locations around New Zealand, including Mana Island off the Porirua coast, studies kororā breeding biology and foraging and diving behaviour, and has extensive experience in writing and implementing penguin management plans for coastal construction projects. The Wellington Airport Wildlife Management Officer (Jack Howarth) has experience with handling a range of wildlife species, has worked with kororā on Mana Island, and has achieved level 2 competency for microchipping of kororā. Charlie Rudd, from Taranaki Whānui, has over three years of experience working with kororā across major coastal construction projects in Te Whanganui-a-Tara. Mandated by Port Nicholson Block Settlement Trust, he leads kororā monitoring and handling on behalf of mana whenua.

People to be designated as penguin management officers for the project will receive training for this role. They will be familiar with kororā biology, have experience in handling of kororā, and will implement protocols in the Penguin Management Plan.

A penguin management officer, the Project Penguin Biologist, or the Wellington Airport Wildlife Management Officer, will be present on the seawall construction site at all times when construction work is occurring.

Wildlife Act authority
A Wildlife Act authority to handle and move penguins will be needed for the project, and is being sought through the Fast-track Approvals Act. This Penguin Management Plan will apply both to resource consents and to the Wildlife Act authority for the Project.

Site checks at start and end of each work shift
A site inspection will be conducted by construction staff at the start of each work shift. The inspection will check for penguins, including evidence of presence such as dropping, under and around plant and machinery, in and around stored materials and equipment, within excavations or trenches, within and around stockpiles, and under any elevated temporary sheds, offices or ablutions. Exclusion fences will be checked to determine if they are in good condition with no holes or repairs required.

A site inspection will be conducted at the end of each work shift. The inspection will check for penguins within the exclusion fences, check that all machinery and equipment is stored within the exclusion fences, and check that the exclusion fences are closed and in good condition with no holes or repairs required.

The results of the inspections at the start and end of each shift will be recorded and signed off by the site supervisor.

Kororā briefing
A kororā briefing will be included in the site induction for all staff before they begin work on the seawall site or at a kororā colony.

8.2 Exclusion of penguins from construction works

Penguins could come into construction areas at night and be out of sight, so it will be important to exclude penguins from construction site machinery, equipment, construction materials, and stockpiles of rock and concrete armour units. Exclusion measures will be applied at all Moa Point construction areas.

Exclusion methods
Penguins can be excluded from a location either by a fence around the location or by netting that completely covers the location. Kororā can push through very small gaps, and penguin exclusion barriers must not have any gaps greater than 50 mm in diameter.

Chainlink mesh netting
Chainlink mesh netting (50 mm mesh) can be moulded to fit over rounded surfaces, and chainlink mesh netting can be placed over surfaces to exclude penguins.

Temporary exclusion fences
Temporary exclusion fences could consist of wire mesh netting (25 mm mesh) attached to steel crowd control barriers. The top of the mesh should be at least 400 mm above the ground. The mesh should be folded to form a horizontal footing at least 300 mm wide, with a continuous line of sandbags placed on the horizontal footing.

When a temporary exclusion fence is installed on a concrete surface, either a continuous line of sandbags will be placed on the horizontal footing, or a wooden board placed on the footing and bolted into the concrete.

Permanent exclusion fences
Permanent (for the duration of the works) exclusion fences could consist of wire mesh netting (25 mm mesh) attached to steel construction site fences, with the top of the mesh at least 400 mm above the ground. The mesh should be buried in the ground to a depth of at least 300 mm.

Exclusion fences can also be built by digging a trench, placing wire mesh to a depth of at least 300 mm in the trench, backfilling the trench, then holding the top of the mesh at least 400 mm above the ground with wire attached to waratah steel posts.

When a permanent exclusion fence is installed on a concrete surface, wire mesh netting (25 mm mesh) can be attached either to steel construction site fences or to steel crowd control barriers. The top of the mesh should be at least 400 mm above the ground. The mesh should be folded to form a horizontal footing at least 300 mm wide, with either a continuous line of sandbags placed on the horizontal footing, or a wooden board placed on the footing and bolted into the concrete.

Installation of penguin exclusion fences, or covering with chainlink netting, for equipment, construction materials, and stockpiles of rock and concrete armour units that are not within an area surrounded by a permanent penguin exclusion fence
Penguins could come into construction areas that are not surrounded by a permanent penguin exclusion fence. For these construction areas, measures to exclude penguins will be implemented at the end of each working day during daylight hours. Construction equipment, construction materials, and stockpiles of rocks and concrete armour units, that will not be

used during the night, will either have temporary exclusion fences installed around them, or chainlink mesh netting will be placed over construction materials and rocks. These measures will ensure that penguins could not get into any of these locations during the night. If a penguin exclusion fence is opened at night for the removal of rocks or concrete armour units, then at the end of the work period, the penguin exclusion fence will be reinstated.

Penguin checks wherever penguins could be present and out of sight at locations where penguins have not been excluded

Locations where penguins could be present and out of sight, including underneath machinery, will be visually checked before items or machinery are moved. If a penguin is found then work at that location will stop until a penguin management officer has moved the penguin to a kororā colony.

8.3 Work at night

Construction activities for the new seawall will occur at night as well as during the day. Penguins are active on land at night, and could come into the construction area at night. A penguin management officer, or a site safety officer with penguin training, will be on site at night to check for penguins.

Checks of exclusion fences and netting, and of machinery, rocks and concrete armour units, will be conducted as described in section 6.1. If a penguin is found at night then work within 10 m of that location will stop until a penguin management officer has moved the penguin to the kororā colony.

8.4 Construction of stage one kororā colony

Construction of the stage one kororā colony will involve the installation of a precast concrete underpass beneath the road from the shoreline to inside the fence around the colony, placement of rocks along the shoreline next to the underpass entrance to help protect the existing road against erosion, removal of introduced vegetation such as gorse from the colony site, and minor earthworks to improve kororā access.

While penguins are not present at the colony site, there are penguin nest sites in vegetation on the seaward side of Moa Point Road to the south of the colony site.

Measures described in sections 8.1 and 8.2 will be followed for the construction of the stage one kororā colony. Particular attention will be given to the exclusion of penguins from construction work areas, with temporary and permanent (for the duration of the works) exclusion fences installed.

8.5 Site establishment at Moa Point Yard

Measures described in sections 8.1 and 8.2 will be followed for site establishment for the Moa Point Yard.

Penguin exclusion fence

A penguin exclusion fence will be installed, in two stages, around the perimeter of the Moa Point Yard at the beginning of site establishment. The fence could consist of wire mesh netting (25 mm mesh) attached to construction site fences, with the top of the mesh at least 400 mm above the ground. The mesh should be buried in the ground to a depth of at least 300 mm. Exclusion fences can also be built by digging a trench, placing wire mesh to a depth of at least 300 mm in the trench, backfilling the trench, then holding the top of the mesh at least 400 mm above the ground with wire attached to waratah steel posts.

The first stage penguin exclusion fence will be installed around the existing open gravel area. The second stage penguin exclusion fence will be installed around the area of earth mounds and hollows, to the east of the gravel area, after the earth mounds and hollows have been cleared of vegetation (see below).

Gate to yard

The gate to the yard should have wire mesh netting (25 mm mesh) attached to the bottom of the gate so that penguins could not get under the gate. The gate should be shut at night other than when a vehicle is entering or leaving the yard.

Vegetation removal during formation of Moa Point Yard

The area where the Moa Pont Yard will be formed, between Moa Point Road and the top of an eroding earth bank along the beach, currently consists of a gravel area at the top of the informal seawall, and vegetated earth mounds and hollows that extend eastwards. Formation of the yard will include the removal of vegetation from the mounds and hollows, then earthworks to create a flat area of gravel.

Several kororā sites are present in vegetation in hollows and on slopes of mounds. At least two penguin dog surveys of the area will, subject to availability of a penguin dog team, be conducted in the six months before the removal of vegetation. Before vegetation is removed, a thorough search will be conducted to check for the presence of penguins. If a penguin dog team is available, then a penguin dog survey of an area of vegetation will be conducted before vegetation is removed. If any penguins are found during searches, they will be moved to nestboxes in the stage one kororā colony (see below).

Once the ground surfaces of the earth mounds and hollows are completely clear of vegetation, then a penguin exclusion fence will be installed around this area. Earthworks to create a flat area of gravel will proceed after installation of the penguin exclusion fence.

Avoidance of key periods

In the Wellington region, kororā egg laying can began in July and chicks can be present in nests through January and into February. The main breeding season, when eggs or chicks are very likely to be present in nests, is from August to December. Removal of vegetation for the formation of Moa Point Yard will be avoided during the main breeding season from August

to December. Kororā undergo moult each year, with all old feathers replaced by new feathers. Kororā feed at sea to increase their body weight by up to 50%, then come ashore and stay at a moult site for two to three weeks while old feathers are lost and new feathers grow. Kororā can undergo moult from December into February and occasionally into March. Removal of vegetation will be avoided, where practicable, during the main moulting months of January and February.

Movement of penguins to stage one kororā colony
If any penguins are found during searches, they will be moved to nestboxes in the stage one kororā colony. A penguin would not be moved if it was found with eggs or chicks (see below).

Penguins will be handled by the Project Penguin Biologist, the Wellington Airport Wildlife Management Officer, or a penguin management officer. Penguins will be picked up, placed in a suitable pet carrier box, and carefully transported to the stage one kororā colony. At the colony, penguins will be weighed and flipper length will be measured.

PIT tagging (microchipping)
Penguins will be individually identified using passive integrated transponders (PIT, commonly called microchips). These very small microchips encased in glass are widely used for the identification of penguins. Kororā moved to the colony will be microchipped by a person with DOC certification to microchip kororā, then placed into a nestbox. The nestbox will be checked daily until the kororā has departed for the sea.

Two methods for PIT tagging (microchipping) of kororā are recognised by the DOC Marking Office (formerly the DOC Banding Office). The most widely used method, used by the New Zealand Penguin Initiative (NZPI) and sometimes referred to as "best practice", involves holding a kororā by the neck and by the feet. The second method, developed by Dr Cockrem, is a more gentle approach to handling, and has been used for the microchipping of more than 1500 kororā.

The widely used method involves holding a kororā by the neck and by the feet. Kororā do not like being held by the feet. The bird is held across the legs of the holder, at 90 degrees to the holder's legs, while the person inserting the microchip is facing the holder and has to twist themselves to insert the microchip. The holder and the microchipper are both sitting or kneeling on the ground.

For Dr Cockrem's method, the holder and the microchipper both sit on chairs. A kororā is placed in a cloth bag and is held around the body to restrain the flippers. The bird, in the bag, is placed on the lap of the holder, parallel to the legs of the holder. The bird on the lap of the holder is automatically aligned with the direction of insertion of the microchip, making it straightforward for the microchipper to insert the microchip.

The gentle approach, in comparison with the most widely used method, appears to cause less stress to the birds, and is more readily accomplished by people, especially people not familiar with handling penguins.

The PIT tagging (microchipping) of kororā for the Project will follow Dr Cockrem's protocol for microchipping.

Moulting penguins
If a moulting penguin was found during vegetation removal, then it would be moved to a nestbox at the stage one colony that was within a small, fenced enclosure. The penguin would, after the first night in the nestbox, be able to go outside into the enclosure at night and remain safely in the nestbox during the day, until moult was complete. A water bowl would be provided in the enclosure, with water regularly replenished. The nestbox would be checked daily until the Project Penguin Biologist or the Wellington Airport Wildlife Management Officer, determined that moult was complete. A gate in the fence would then be opened so the penguin could go to sea. The condition of penguins would be visually assessed daily, in relation to a guide prepared by the Project Penguin Biologist. If it was considered that a penguin was losing weight at a greater rate than normal for moulting penguins, then either supplementary feeding at the nestbox would be initiated, or the bird would be temporarily transferred to a wildlife facility for hand feeding, then returned to the nestbox when moult was complete and the penguin was ready to go to sea.

10 m buffer around kororā nest with eggs or chicks
If a kororā nest was found with eggs or chicks, then a 10 metre buffer area would immediately be established around that site. No vegetation clearance would occur within 10 m of the site until the nest was found to be empty with no eggs or chicks present, or was no longer in use.

8.6 Removal of rock from the rear slope bank beside Moa Point Road

The rear slope bank (area B in Fig. 3.1) is an earth bank at the north end, then consists of large rocks extending from the crest of the seawall down either to gabion baskets containing rocks, or down to the edge of Moa Point Road. Kororā are present in the rocks on the rear slope bank. Rocks on the bank will be removed, then the exposed bank will be reinforced with concrete.

Measures described in sections 8.1, 8.2 and 8.3 will be followed for the removal of rock from the rear slope bank beside Moa Point Road.

Avoidance of key periods
Removal of rock will be avoided during the main kororā breeding season from August to December, and avoided where practicable during the main moulting months of January and February.

Penguin dog surveys
At least two penguin dog surveys of the rear slope bank will, subject to availability of a penguin dog team, be conducted in the six months before the removal of rocks. A penguin dog survey of the rear slope bank will, subject to availability of a penguin dog team, be conducted immediately before rock removal work begins.

Removal of rocks
One or more of the Project Penguin Biologist, the Wellington Airport Wildlife Management Officer and a penguin management officer will be present at all times when rocks are being removed.

Removal of rock, concrete and steel in penguin habitat is a slow process that requires close coordination between a penguin management officer and a digger driver. In brief, an area is very closely inspected, especially if a kororā site has previously been identified in the area, as long as it is safe to do so. The penguin officer identifies a rock or concrete block to be picked up, taking into account that movement of one rock or concrete block can lead to another rock falling and potentially crushing a penguin that cannot be seen, and taking into account that loose material could fall down and smother a penguin. As the rock or concrete block is lifted, or immediately afterwards, the penguin officer looks closely to see if a penguin is present. If so then the penguin is picked up and moved to a nestbox in the kororā colony.

This process is continued one rock or concrete block at a time until an area has been cleared of rocks and concrete so there are no remaining cavities within which penguins could be present.

Movement of penguins to stage one kororā colony
Procedures described in section 8.5 will be followed to move penguins to the stage one kororā colony.

10 m buffer around kororā nest with eggs or chicks
If a kororā nest was found with eggs or chicks, then a 10 metre buffer area would immediately be established around that site. No rock removal work would occur within 10 m of the site until the nest was found to be empty with no eggs or chicks present, or was no longer in use.

8.7 Removal of rock and other materials from the rock area beside the Lyall Bay breakwater

The rock area beside the Lyall Bay breakwater slope bank (area A on Fig. 3.1) has rocks of varying sizes, and some concrete pieces, spread across a shallow slope above MHWS (mean high water spring tide level). On the landward side of this area there is an earth bank, with rocks and concrete in the bank, and some low groundcover vegetation. Kororā are present in the rocks, underneath concrete, and in the earth bank. Rocks and concrete pieces will be removed from the rock area, then the area and the bank will be reinforced with concrete.

Measures described in sections 8.1, 8.2 and 8.3 will be followed for the removal of rock from the rock area beside the Lyall Bay breakwater.

Avoidance of key periods
Removal of rock will be avoided during the main breeding season from August to December, and avoided where practicable during the main moulting months of January and February.

Penguin dog surveys
At least two penguin dog surveys of the rear slope bank will, subject to availability of a penguin dog team, be conducted in the six months before the removal of rocks. A penguin dog survey of the rear slope bank will, subject to availability of a penguin dog team, be conducted immediately before rock removal work begins.

Removal of rocks
Procedures described in section 8.6 will be followed for the removal of rocks and concrete. to move penguins to the stage one kororā colony.

Movement of penguins to stage one kororā colony
Procedures described in section 8.5 will be followed to move penguins to the stage one kororā colony.

10 m buffer around kororā nest with eggs or chicks
If a kororā nest was found with eggs or chicks, then a 10 metre buffer area would immediately be established around that site. No rock removal work would occur within 10 m of the site until the nest was found to be empty with no eggs or chicks present, or was no longer in use.

8.8 Removal of rock and other materials from the existing informal Eastern Area rubble seawall

This seawall (area D in Fig. 3.1) has a mix of concrete, rocks and steel resting on an earth bank, with rocks and pieces of concrete in the earth bank. The top of the bank is well above MHWS. The bank is steadily eroding, with concrete and rocks being washed from the earth bank and along the beach to the east of the bank. Kororā are present in the rocks and concrete of the rubble seawall. Rocks, concrete and steel will be removed from the informal seawall, then the area will be reinforced with concrete.

Measures described in sections 8.1, 8.2, 8.3 and 8.6 will be followed for the removal of rock, concrete and steel from the existing informal Eastern Area rubble seawall.

8.9 Penguin exclusion from Southern Seawall

The Southern Seawall (area C in Fig. 3.1) has gabion baskets containing rocks at the top of the seawall, with a wave trap behind the gabion baskets. The gabion baskets have concrete

on their top surfaces. Rocks of varying of sizes rest against the seaward side of the gabion baskets. Concrete akmons sit on the rocks, and extend downwards into the sea to form the main protective structure of the seawall.

Measures described in sections 8.1, 8.2 and 8.3 will be followed during works to exclude penguins from the Southern Seawall.

The Southern Seawall is difficult for kororā to access, and kororā sites have not been found in the main area of the seawall. While it is unlikely that kororā are present in the main area of the seawall, kororā will, as far as practicable, be excluded from this area before construction work begins.

It is likely that there are cavities underneath some of the gabion baskets. In principle, work to exclude penguins from the Southern Seawall will involve removal of a section of gabion baskets at the top of the seawall, excavation to open up any voids that are found underneath the gabion baskets, then removal of adjacent rocks and some akmons. Any cavities found under the gabion baskets will be filled, then rocks will be replaced. Chainlink netting (50 mm mesh) will be installed over the rocks, to exclude penguins. Particular attention will be paid to ensuring that sheets of netting are tied together with wire, and that the edges of netting sheets are tightly secured to rocks, with no gaps greater than 30 mm, to ensure that penguins could not get underneath the netting. Any akmons that had been removed will then be replaced. This process will then be followed for another section of gabion baskets.

Movement of penguins to stage one kororā colony
Procedures described in section 8.5 will be followed to move penguins to the stage one kororā colony.

Avoidance of key periods
Work to exclude penguins from the Southern Seawall will be avoided during the main breeding season from August to December, and avoided where practicable during the main moulting months of January and February. For clarity, penguin exclusion measures may be established before the main breeding season and remain in place during the main breeding season and during the moulting season.

Penguin dog surveys
It is not possible to conduct comprehensive penguin dog surveys along the Southern Seawall as access is not physically possible other than along the gabion baskets, with occasional access to rocks adjacent to gabion baskets. Two penguin dog surveys, to the limited extent possible, and subject to availability of a penguin dog team, will be conducted in the six months before work in the Southern Seawall begins.

Removal of gabion baskets, adjacent rocks and some akmons, followed by installation of chainlink netting
One or more of the Project Penguin Biologist, the Wellington Airport Wildlife Management Officer and a penguin management officer will be present at all times when gabion baskets, adjacent rocks and akmons are being removed.

Procedures described in section 8.6 will be followed for the removal of gabion baskets, adjacent rocks and some akmons, with modifications as appropriate for the Southern Seawall site. For the removal of gabion baskets, rocks within gabion baskets will be removed in a way that prevents rocks from the baskets from falling down in between rocks or Akmons at the edge of the seawall.

If voids are found in the fill material underneath the gabion baskets, then it might not be possible to safely check for the presence of penguins in the voids. In this case, opening of the void should start with the excavation of a ditch well away from the void. The removal of fill can proceed from the ditch towards the void. The purpose of the ditch is to enable fill to be pulled away from the void, to ensure that fill could not fall and smother a penguin that was present in the void. A penguin management officer would stand at the site where the excavator would dig, to check the void and to check for the presence of penguins before and after each bucketful of fill has been removed.

Movement of penguins to stage one kororā colony
If a penguin was found, then work would stop within 10 m of the penguin. Procedures described in section 8.5 will be followed to move penguins to the stage one kororā colony.

10 m buffer around kororā nest with eggs or chicks

If a kororā nest was found with eggs or chicks, then a 10 metre buffer area would immediately be established around that site. No rock removal work would occur within 10 m of the site until the nest was found to be empty with no eggs or chicks present, or was no longer in use.

8.10 Reconstruction of Southern Seawall

Reconstruction of the southern seawall will be a complex construction project that will extend over at least two years. The construction site will be established, then ground improvements including micropiling and potentially cement-stabilized hardstanding will be required to support construction equipment. After the ground improvements have been completed, the construction process will include:

- removing existing reno mattresses, gabion baskets, Akmons and rock from the seawall crest area
- excavation of the seawall toe trench
- smoothing rock pinnacles and placement of toe rock
- placement of underlayer rock and reused akmons
- installation of cubipods over the underlayer
- placement of gabion baskets and formation of crest wall, if required
- construction of rock protection on the crest
- replacement of rear slope geotextile, underlayer and rock armour

Measures described in sections 8.1, 8.2 and 8.3 will be followed during reconstruction of the Southern Seawall. Measures described in sections 8.6, 8.7, 8.8 and 8.9 will be followed in situations where they apply to the reconstruction of the Southern Seawall. Measures to be taken in relation to noise from micropiling are described in section 8.11.

Penguin exclusion fences

Initial site establishment will involve installation of a penguin exclusion fence around the perimeter of the construction site (see sections 8.2 and 8.5). Where possible, the fence will be permanent, with temporary exclusion fences installed at locations where fences will need to be moved during construction works, either at the start and end of construction at a location, or at the start and end of work shifts.

10 m buffer around kororā sites from August to December

Kororā sites are locations where a penguin is seen, fresh penguin droppings are seen, or a penguin dog has indicated that it could detect the smell of penguins. The main kororā breeding season, when nest sites are likely to contain eggs or chicks, is from August to December. Kororā sites found from August to December will either be confirmed breeding sites with eggs or chicks seen, sites where eggs or chicks are not present when the site is inspected, or sites that cannot be thoroughly inspected and are presumed to be breeding sites.

Seawall construction works will continue during the breeding season. If a kororā site with eggs or chicks, or a presumed breeding site, was found from August to December, then a 10 m buffer area would immediately be established around that site. No construction work would occur within 10 m of the site until either the site could be thoroughly inspected and found to be empty or no longer in use, a penguin dog check did not indicate the presence of a bird, or the August to December period had ended.

8.11 Noise and micropiling

Noise

Noise generated by construction activities will include noise from micropiling, the movement of large machinery, dumping of rocks from trucks into piles, and placement of rocks and concrete armour units. Kororā currently living in the project area are exposed to varying levels of noise depending on their location, including noise from waves, with especially high noise levels when aircraft are taking off.

Kororā habitat in the construction areas will be modified so it is no longer available to kororā before construction of the new seawall begins. It is thus unlikely that kororā will be exposed to noise associated with construction of the new seawall as they will no longer be present in seawall construction areas. Nonetheless, measures to avoid adverse effects of noise on kororā are described here for micropiling which are activities which generate more noise than other construction activities.

Micropiling

The seawall construction work will include the installation of micropiles to stabilise and strengthen ground along the seawall crest. Micropiling involves drilling a hole down to solid rock, lining the hole with a steel casing of 141 mm diameter, injecting concrete grouting into the hole, then removal of the casing. Micropiling generates sound, with minimal vibration. This is a different process from piling, which is the driving of steel piles into the ground.

Management of sound levels during recent coastal construction projects

Airborne noise limits for sound levels at the entrances to penguin sites have been specified in penguin management plans as integrated sound levels measured over 15 minutes (dB LAeq (15 min)), or as one second measurements (dB LAeq (1 s)). Noise limits used recently have included:

- 70 dB LAeq (15 min) Seaview wharf renewal (Boffa Miskell Limited, 2021)
- 75 dB LAeq (15 min) Eastland Port Twin Berths Project, Gisborne (4Sight Consulting, 2023)
- 75 dB LAeq (15 min) Te Ara Tupua Project (Te Ara Tupua Alliance, 2023)
- 80 dB LAeq (1 s) Kennedy Point marina, Waiheke Island (Marshall Day Acoustics, 2021; Lawrence *et al.*, 2023)
- 80 dB Kaiwharawhara Wellington Ferry Terminal (Boffa Miskell Limited, 2022)

For the Project, a noise limit of 75 dB LAeq (15 min) at kororā sites where kororā are known or presumed to be present will be used for all construction activities.

Measurements of sound levels, and kororā observations, during construction works
Sound pressure levels (dBA), integrated sound levels over 15 min (dBA LAeq (15 min)), and maximum sound pressure levels during the 15 min recording period (LAPeak sound level; dBA) will be measured.

Sound levels will be measured at penguin sites where penguins are known or presumed to be present when the sites are within 20 m of micropiling locations, or within 20 m of other construction activities. Levels will be measured when construction activities begin. If the levels exceed the noise limit at a penguin site, then noise barriers will be installed between the source of the sound and the penguin site. Sound levels will be measured at the site after the installation of a noise barrier. If the sound levels still exceed the limit, then further noise barriers will be added, then sound levels measured again. This process will be repeated until sound levels at the penguin site are at or below the noise limit.

Sound level measurements will be made using a class 1 integrating sound level meter that meets IEC 61672-1 Class 1 requirements and meets the requirements for sound measurements specified in the New Zealand standards NZS 6801 (Measurement of sound), NZS 6802 (Assessment of environmental sound) and NZS 6803 (Construction noise). The noise meter will be calibrated, and calibration certificates will be held on file.

In addition to sound measurements, observations of kororā will be made when kororā can be seen at a kororā site. If the Project Penguin Biologist, or a biologist trained in penguin observations, considers that a penguin or penguins are displaying distress behaviours (see Schaefer and Colombelli-Negrel (2021)), then the construction activity will be stopped. Additional sound barriers will be installed, then the activity resumed, with behavioural observations continued. If penguins displayed distress behaviours again, then either sound barriers would continue to be added until no distress behaviours were observed, or the activity would stop until the penguin site was no longer occupied.

8.12 Construction of Eastern Bank revetment rock wall

A rock revetment wall will be built along approximately 80 m of the Eastern Bank at the seaward edge of the Moa Point Yard. The work will include excavation of earth from the bank, excavation of beach material, stockpiling of earth and beach material, and the placement of rocks to form the new wall.

Measures described in sections 8.1, 8.2 and 8.3 will be followed for construction of the Eastern Bank revetment rock wall, with measures described in section 8.6 followed in situations where they apply to construction of the rock wall.

8.13 Construction of stage two kororā colony

Construction of the stage two kororā colony will involve earthworks to form earth mounds, with a mound surrounding the colony and smaller mounds within the colony. A security fence will be installed around the colony, shrubs will be planted within the colony, and around the perimeter mound, nestboxes will be installed, and rocks will be placed around nestboxes and along paths from nestboxes to the rock wall.

Measures described in sections 8.1, 8.2 and 8.3 will be followed for construction of the stage two kororā colony.

8.14 Injury or death of a penguin

Measures described in this plan are designed to avoid the possibility that a kororā could be injured or die. If this situation were to occur, then the project penguin biologist or the Wellington Airport Wildlife Management Officer, and the Taranaki Whānui representative, would be notified. They would advise, in consultation with DOC, how to proceed. Work at the site of the incident would be halted, and procedures would be reviewed and changed as appropriate.

8.15 Avian influenza

The H5N1 strain of Highly Pathogenic Avian Influenza (HPAI) is spreading around the world and has caused the deaths of large numbers of seabirds (Antarctic Wildlife Health Network, 2024). Thousands of Humboldt and Magellanic penguins (*Spheniscus humboldti* and *Spheniscus magellanicus*) found dead in Peru and Chile in 2022 and 2023 were thought to have died due to HPAI infection (Dewar et al., 2024), and little penguins are at risk from the H5N1 strain (ABC News, 2024).

Guidelines for work with wild birds[2], in relation to avian influenza, will be followed during the Southern Seawall Project. If the H5N1 strain reaches New Zealand, then measures implemented by DOC and MPI to reduce the spread of the disease and to limit contact of people with the disease would be followed as appropriate for kororā management.

8.16 Fencing and netting along seaward side of Moa Point Road

Temporary low fencing, and netting on an existing fence, will be installed beside Moa Point Road before the removal of kororā habitat in the Southern Seawall. The purpose of the installation is to minimise penguin mortality that may result from increased interactions between displaced penguins, vehicles and dogs in areas adjacent to construction works areas. Installation of temporary low fencing and netting will be subject to landowner approval by Wellington City Council.

Low temporary fencing will be installed along the landward edge of the rock revetment beside Moa Point Road, extending at least 300 m north from the Lyall Bay breakwater

[2]Avian Influenza Health and Safety Guidance for Workplaces. April 2025. https://www.tewhatuora.govt.nz/assets/Uploads/Avian-Influenza-Health-Safety-Guidance.pdf

(adjacent to the western seawall). Netting will be attached to an existing low wooden fence beside Moa Point Road, from the eastern end of the Moa Point Yard (approximately opposite Stewart Duff Drive) extending along the road to opposite the eastern end of the houses (a distance of at least 300 m).

8.17 Meetings with DOC and GWRC

WIAL has a collaborative approach to achieving goals for kororā in the seawall project. In order to continue the collaborative approach, WIAL will arrange meetings with GWRC and DOC, to discuss kororā progress on the seawall project, at two-yearly intervals for 10 years after the completion of the stage one colony, then at five-yearly intervals for another 10 years.

9. Monitoring and reporting

9.1 Monitoring

Before construction

Kororā monitoring before construction starts will provide information on locations of kororā sites in construction areas. While work protocols will assume that penguins are present throughout the construction areas, the identification of kororā sites allows for particular care to be taken as those sites are approached.

Penguin dog surveys of construction areas will be conducted, subject to availability of a penguin dog team, in autumn and winter, and during the breeding season, in the years before construction work starts, and during construction works. Repeated surveys will provide information about kororā sites that will inform work to remove penguin habitat.

During construction

Penguin dog surveys of construction areas, subject to availability of a penguin dog team, will continue to be conducted during kororā moulting and breeding seasons until kororā habitat is no longer present in these areas.

Trail cameras will be deployed in areas of penguin habitat, in advance of habitat removal works, to provide information about penguin movements in these areas.

After construction

Monitoring checks of nestboxes at each kororā colony will be continued, with annual summaries of results prepared, until at least 20 years after colony establishment. The frequency of nestbox checks will be at least four times per year. The number of nestboxes provided for kororā and the locations of the nestboxes will be reviewed annually.

The underpass constructed at the stage one korora colony will be monitored and cleared for at least 20 years after colony establishment. Weed control, monitoring of plant survival, replacement of plants if needed, and predator control will also be carried out at both colonies for at least 20 years after colony establishment.

9.2 Reporting

Results of kororā surveys before and during construction, and of kororā moved to the new kororā colony, will be kept, with annual summaries prepared until the end of the construction project. Survey results for each kororā site will include GPS location, description of the site, whether or not a bird was seen, and observations at the site such as the presence of droppings.

When kororā are picked up and moved to the kororā colony, results will include GPS location of site where bird picked up, description of the site, microchip number if bird already has a microchip, new microchip number if the bird did not already have a microchip, name of the person who handled the bird, name of person who microchipped the bird (if applicable), body weight, flipper length, number of the nestbox where the bird was released, results of checks

of the nestbox made in following days until the first day when the penguin is no longer present in nestbox, and notes such as comments on the behaviour of the penguin.

Checks of nestboxes in the new kororā colonies will be continued, with annual summaries prepared, until at least 20 years after the end of the construction project.

Annual reports that summarise results of kororā surveys, movements of kororā from the Southern Seawall to the stage one kororā colony, records of microchipped kororā, and nestbox use in the two kororā colonies, will be prepared until at least 20 years after the end of the construction project.

10. Kororā biology studies at new colonies

The new kororā colonies will provide opportunities for monitoring and tracking studies that will increase knowledge of kororā biology and contribute to conservation of kororā.

Penguins will be individually identified using passive integrated transponders (PIT, commonly called microchips). These very small microchips encased in glass are widely used for the identification of penguins. Kororā will be microchipped when they are first picked up, either when found in a seawall and moved to a nestbox, or when found for the first time in a nestbox. The microchipping proposal remains subject to discussion with mana whenua.

Nestboxes at the new colonies will be checked regularly, with a monitoring programme designed to determine the rate of uptake of nestboxes, and features of kororā biology such as the timing of egg-laying, breeding success and survival. Trail cameras and cameras in nestboxes may be used to obtain data on the behaviour of birds in and around nestboxes at different times throughout the year.

Once penguins are regularly using nestboxes, then small GPS or satellite devices can be attached to kororā to obtain data on foraging locations and diving behaviour. Individual penguins will be tracked (GPS tagged) no more than twice in one year. It is envisaged that there will be up to 30 deployments annually, with discussions with DOC to be held if it was apparent that more than 30 deployments within one year would be appropriate.

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