Eastland Port

Eastland Port Twin Berths Project
Little Penguin/ Kororā (*Eudyptula minor*)
Assessment of Ecological Effects

For Eastland Port

August 2022

REPORT INFORMATION AND QUALITY CONTROL

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EXECUTIVE SUMMARY

Eastland Port Ltd (Eastland Port) are seeking resource consents from the Gisborne District Council (Council) for Stage 2 of the Twin Berths Project (TBP). The development will enable up to a 185 m and a 200 m long ship to each berth at Eastland Port simultaneously, enabling greater capacity for bulk freight and potential options for container freight in the future. Stage 1 of the TBP was consented in December 2020.

The scope of this report is to assess the effects of Stage 2 of TBP on little penguin (*Eudyptula minor*, referred to as kororā). Kororā inhabit the coastal area of the Kaiti Beach shore and are present within the vicinity of the Eastland Port site. Kororā have high ecological value based on their New Zealand threat classification, which is 'At Risk - Declining'.

Specifically, this report assesses the effects of the proposed reclamation next to the Southern log yard, which requires the building of a new outer revetment/seawall and deconstructing the existing structure. The existing seawall is potential kororā habitat and its ecological value is dependent on the use of this structure by kororā, notably during their breeding and moulting season.

A Twin Berths Kororā Management and Monitoring Plan (TBKMMP) is proposed to avoid effects on kororā and manage effects on kororā habitat. The TBKMMP will:

- outline proposed monitoring of kororā within the construction footprint,
- identify measures to avoid adverse effects on kororā, including:
  - the timing of deconstruction works to take into account periods of the year when nesting and moulting is/is not occurring,
  - during construction, interventions to discourage use of the works area by kororā to avoid adverse effects,
  - the necessary requirements to avoid adverse effects if active burrows are identified in the works footprint at the time deconstruction is planned to occur, despite the interventions,
- outline protocols to manage non-breeding or moulting kororā within the works area during the construction period, and
- detail offset/compensation enhancements for the loss of any active burrows[1] within the construction area, should that be unavoidable.

The assessment of effects is premised on the implementation of the TBKMMP, which outlines how the actual and potential adverse effects identified will be avoided, remedied, mitigated. Where these approaches are not possible, options for offsetting and enhancement are provided.

The assessment of effects has been conducted for the construction and operational phases of the TBP on both kororā themselves and their habitat. Potential effects on kororā resulting from noise are addressed in the noise assessment (Marshall Day Acoustics, 2022).

Overall, considering the protocols outlined in the TBKMMP, ecological effects on kororā are expected to be **Very Low,** with all effects being assessed as 'negligible', with the exception of disturbance during construction, which is 'low but temporary'.

If there are no active burrows within the TBP outer seawall immediately prior to the deconstruction works occurring, the overall level of effect on kororā habitat is **Low**.

If active burrows are identified in the TBP Outer Seawall, appropriate management of the kororā will be necessary, in which case the overall level of effects on habitat will be **Moderate** and will require appropriate management and offsetting/compensation of the loss of habitat. There are sufficient enhancement opportunities in the Buffer Seawall section, adjacent to the TBP Outer Seawall. Such enhancement will be addressed and described in the TBKMMP. If required, after enhancement measures have been implemented, it is anticipated that the overall level of effects on habitat would be **Low**.

[1] Defined as locations that have had active burrows in the previous breeding or moulting season.

1 INTRODUCTION

Eastland Port Ltd (Eastland Port) is preparing resource consent applications to the Gisborne District Council (Council) for the Twin Berths Project (TBP). The development will enable a 185 m and a 200 m long ship to each berth at Eastland Port simultaneously, unlocking greater capacity for bulk freight and potential options for container freight in the future. Stage 1 of the TBP was consented in December 2020. Stage 1 remediated the former slipway to reduce the footprint within the port to enable more manoeuvring space for ships, and rebuilt part of Wharf 6 and all of Wharf 7 (Numbers 1 and 2, on Figure 1).

Stage 2 provides for the remaining works required to complete the TBP (Figure 1), and comprises the following elements:

- Extension of the existing Wharf 8 structure into the area of the inner breakwater (see 3 on Figure 1),
- Reclamation next to the southern log yard (4, Figure 1),
- Rebuilding the outer breakwater structure (5, Figure 1),
- Deepening access channels in the outer port to accommodate larger Handymax vessels (6 and 7, Figure 1); and
- Improving stormwater collection and treatment facilities in the Southern log yard (not shown on Figure 1).

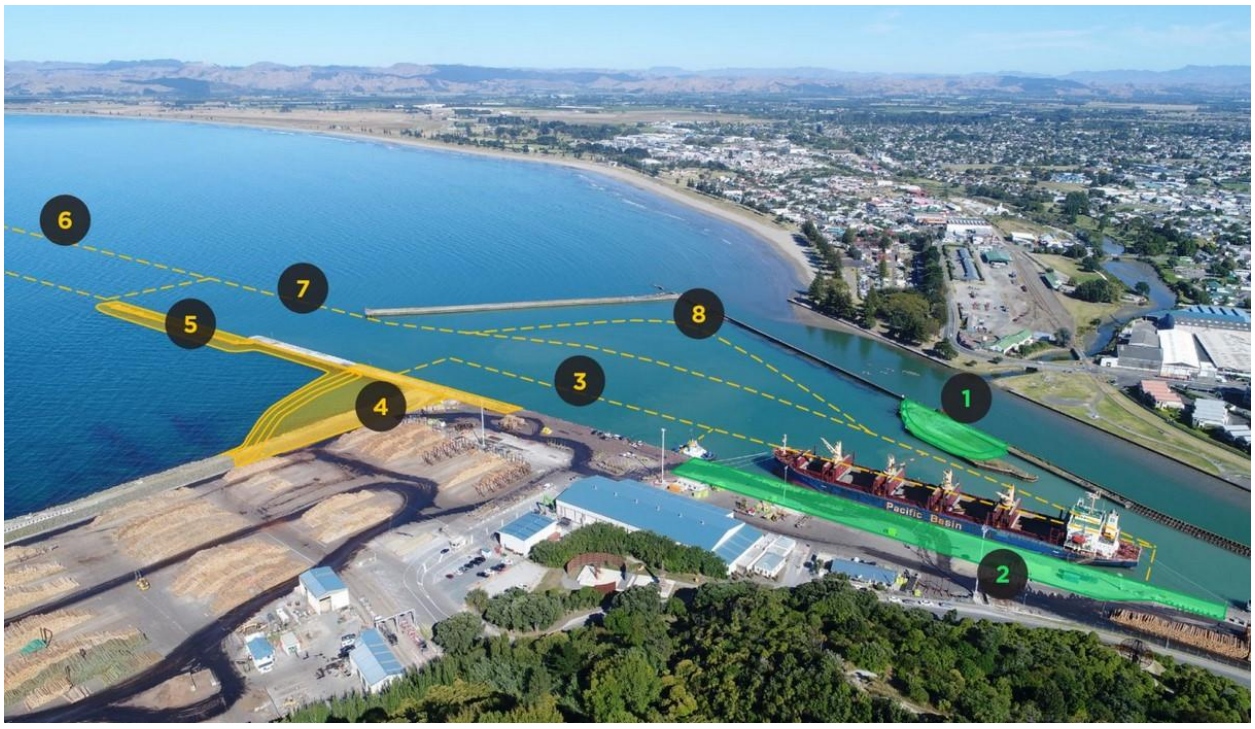

Figure 1: Eastland Port Twin Berths Project Illustrative Plan (refer text re numbering).

2 SCOPE OF REPORT

The scope of this report is to assess the effects of Stage 2 of the TBP on little penguin (*Eudyptula minor*, referred to as kororā). Specifically, this report assesses the effects of those part of the TBP works that have the potential to impact kororā, being specifically the proposed reclamation next to the southern log yard, which requires the building of a new outer seawall (140m long) and the deconstruction of the existing seawall (130m long), including the removal of 240 m of the existing internal seawall (Figure 2 and Figure 3).

The southern log yard was established on reclaimed land in the 1990s and covers an area of approximately 6.7 ha. Its seaward side is protected by a seawall approximately 550 m long. In 2021, the southern half of the seawall was reconstructed as part of the Seawall Maintenance Project (Figure 2). Presently, the northern 25% of the seawall which will be encapsulated in the proposed reclamation comprises mostly large rock spalls and concrete units (Figure 3). The southern seawall can be divided into the following sections for clarity (Figure 2):

- TBP internal seawall (shown in pink),
- TBP outer seawall (shown in orange),
- Buffer/gap seawall (shown in purple),
- Southern log yard seawall enhancement area (shown in teal),
- Waikahua seawall (shown in blue).

This report complements the full assessment of ecological and water quality effects of the TBP prepared by 4Sight Consulting (dated 14 July 2022).

This report is limited to a consideration of actual and potential impacts on kororā and their habitat. It identifies the TBP elements that have a potential to impact kororā and kororā habitat during construction and operational phases of the project, the nature and significance of the impacts and assesses the potential to avoid, remedy and mitigate effects during construction and operational stages, where possible.

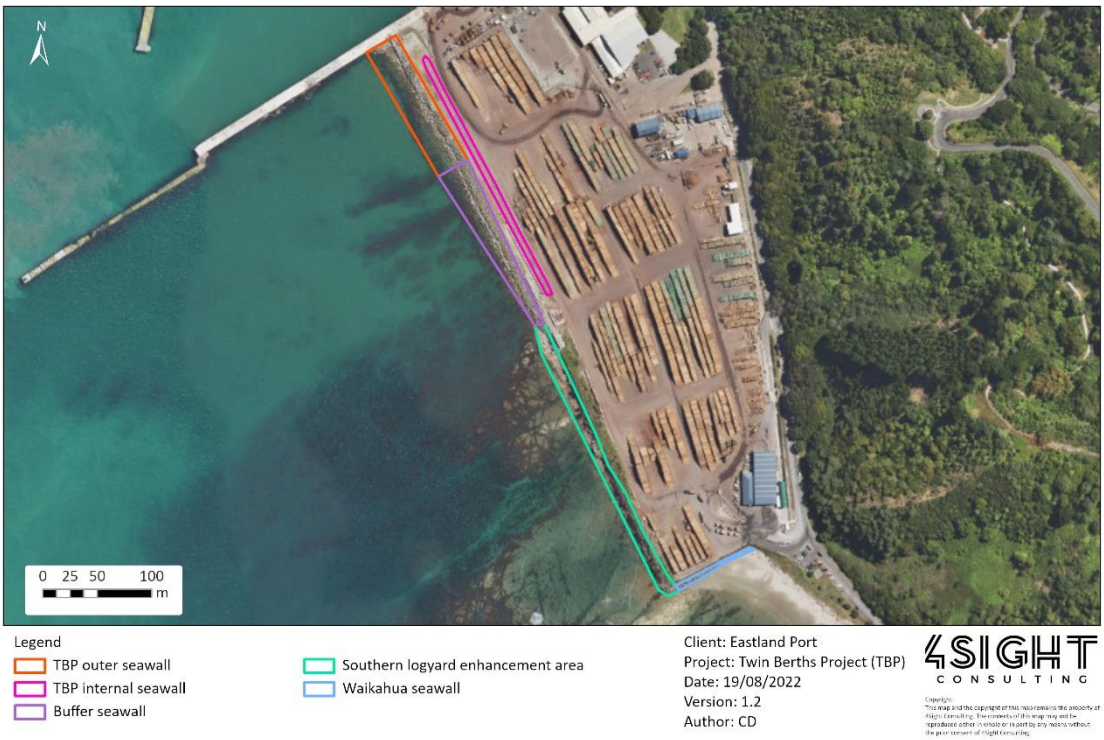

Figure 2: Site overview of the southern seawall to the Southern log yard.

Figure 3: The southern seawall at Eastland Port, looking north towards the Southern Logyard and Gisborne central business district. The area of circled in teal is approximately 130 m of the seawall to be deconstructed as part of the Twin Berths Project (TBP).

3 BACKGROUND

This section provides an overview of the conservation status, breeding biology and ecology of kororā. It also provides a summary of kororā surveys along the southern log yard seawall at Eastland Port and background on the management approach.

3.1 Kororā Conservation Status, Breeding, Biology and Ecology

Kororā are known to inhabit the coastal area of the Kaiti Beach shore and within the rock seawalls of the Eastland Port. Their New Zealand threat classification is At Risk-Declining, and because of this, they have a high ecological value (Roper-Lindsay *et al*., 2018 and Robertson *et al*., 2021). This classification is applicable to species with populations that are declining based on existing information but are still moderately common.

Detail on kororā biology and life history can be found in the Kororā Conservation Management Plan (KCMP; Ecoworks, March 2022; Appendix A). The following details are relevant to the assessment in this report:

- There is debate on the taxonomy of *Eudyptula* genus however there is some consensus that a north island sub-species exists, northern blue penguin (*Eudyptula minor iredalei,* Mattern and Wilson, 2018),
- There are estimations that there are approximately 5,000 to 10,000 individuals in the north island; however, the population size in Gisborne is largely unknown (Landcare Research, 2010).
- Kororā inhabit a range of habitat types including natural dug burrows in sand dunes, coastal forest, rocky coasts, in crevices of tree roots, natural rock formations or caves as well as artificial structures including on breakwaters, under buildings, culverts or in other urban structures,
- Kororā have been shown to breed in nest boxes successfully, particularly in the Oamaru penguin colony which was established in 1993[2]. The Department of Conservation (DOC) has a standardised nest box design which specifies entrance tunnel length, size, and other design details.[3]
- Nest materials include a range of material types including dried seaweed, sticks, twigs, leaves and can include rubbish materials including plastic chip packets and fishing line.
- On land, kororā are generally nocturnal and come ashore just after dusk, generally from 8:30 pm onward depending on the season. However, they can be found on land at all times of the year, often resting on land after storm events or long foraging trips when food availability is scarce (Mattern and Wilson, 2018, Boffa Miskell, 2022).
- Kororā are most vulnerable to land-based threats during their breeding and moulting period (Table 1), which is summarised below:
  - Egg laying occurs from July through to November in Gisborne and incubation can last approximately 36 days (Table 1);
  - Chicks remain on land approximately 36 to 55 days before they fledge/exit the burrow;
  - Individuals have high site fidelity, returning to the same colony or vicinity of their natal burrow to nest when they are adults;
  - Breeding success can vary annually and is dependent on several environmental factors including age and experience of birds, viruses, land-based threats (human disturbance, dogs, predation by rats/stoats), as well as climate, food availability and nest factors (Mattern and Wilson, 2018);
  - Replacement clutches can occur which means that a colony can have asynchronous breeding seasons;
  - Breeding pairs are often faithful to their mate and nest however divorces and change of nest site can occur (Bull, 2000);

[2] https://www.penguins.co.nz/about-us/conservation

[3] http://www.doc.govt.nz/Documents/conservation/native-animals/birds/nest-box-design.pdf

– During moult, birds remain on land where all feathers are replaced over a period of 2 – 3 weeks. Moulting birds fast during this time as they cannot enter the water and can lose up to a 50% of their pre-moult body weight (Kinsky, 1958).

Table 1: Summary of breeding and moulting period for Kororā (from Ecoworks, 2022).

Table 1: Summary of Kororā Annual Activity												
Activity	month											
	J	F	M	A	M	J	J	A	S	O	N	D
Moulting		■	■	■								
Egg Laying							■	■	■	■	■	
Chick Rearing	■	■						■	■	■	■	■
Potential Burrow Occupancy	■	■	■	■	■	■	■	■	■	■	■	■

3.2 Identification of Kororā at/near the Site

In 2021, the Southern Log Yard Seawall Maintenance Project completed the reconstruction of approximately 350 m of the southern seawall/revetment that protects the Southern log yard (see enhancement area in Figure 2, Figure 5 and Figure 6). Prior to that, the Waikahua restoration work to install concrete block seawall was undertaken (see Figure 2 and Figure 6).

During the Southern Log Yard Seawall Maintenance Project, a population of kororā was identified along the seawall and Kaiti beach. In response, Eastland Port prepared a 10-year Kororā Conservation Management Plan (Waikahua KCMP), which has a purpose to '*develop a protected coastal habitat which protects and supports visiting and breeding kororā into the future*' (Ecoworks, March 2022). The Waikahua KCMP is exclusive to the Southern log yard seawall section (referred to as the Southern log yard seawall enhancement area, see teal area in Figure 2) and it aims to:

- Protect the species from predators (stoats and rats) and port operations via predator control and a port exclusion fence (Figure 4),
- Provide habitat enhancement with rock reinstated with crevices suitable for kororā, and
- Provide planting for shade and at least 20 nest boxes (Figure 4).

The Waikahua KCMP provides important background information and objectives to avoid impacts, enhance the habitat, and contribute to positive effects on the kororā population living in the Port's southern seawall. The Waikahua KCMP report has therefore been cited throughout this report.

A Kororā Construction Monitoring & Management Plan was recently prepared by Boffa Miskell for the Kennedy Point Marina development by a penguin expert, Dr Leigh Bull (Boffa Miskell Limited, 2022). 4Sight's ecologists are a part of this project and have been involved in the discussions regarding scrutiny, iteration, and review by stakeholders.

The Kennedy Point Marina development on Waiheke Island involved the removal and reinstatement of rocks on a seawall which was known to be utilised by kororā. Construction activities on the rock wall were completed in May 2022 where the management and monitoring protocols along with a skilled construction team contributed to a successful outcome. This successful outcome was no kororā mortalities as a result of the works, retaining two burrows on the edge of the construction area (that were occupied by a pair of kororā after construction activities were completed and show on-going use) and the establishment of new active burrows (parents with eggs) within the reinstated section of rock wall (as per the monthly monitoring session in August 2022). As such, the Kennedy Point Kororā Construction Monitoring & Management Plan has informed current best practice approaches to kororā management and used as resource when assessing the effects of coastal construction on local kororā populations.

A Twin Berth Kororā Management and Monitoring Plan (TBKMMP) will be developed for the construction and operational phases of the TBP and will compliment and draw on existing management protocols from the KCMP and Kennedy Point Kororā Construction Monitoring & Management Plan. The outline of this management plan can be found in Section 7 of this report.

Figure 4: Southern Log Yard Enhancement Area showing indicative nest boxes and Kororā exclusion fence (Source: KCMP Ecoworks 2022).

Figure 5: Southern seawall area following reconstruction as part of the Southern Log Yard Seawall Enhancement Project.

Figure 6: Kaiti Beach and the completed Waikahua seawall.

4 PROPOSED WORKS

The proposed works for TBP relevant to this assessment include:

- Construction of a new outer seawall with Accropode or X-Bloc units (Figure 7),
- Reclamation out from the southern log yard (see Figure 2 yellow area in Figure 1),
- Deconstruction of the northern section of the existing inner and outer seawalls (see Figure 2),
- Improving stormwater collection and treatment facilities in the Southern log yard (not covered in this report),
- On-going operational use of the Twin Berths by vessels in the port.

4.1 Staging of Proposed Works

Sections of the existing seawall have failed, with areas of the rock wall within the TBP now below Mean High Water Springs (MHWS; Worley, March 2022). An engineering report states that some seawall material has subsided into the surrounding seabed making it unstable and some material has been dislodged from the structure by wave action (Worley, March 2022). The TBP outer seawall section is more exposed than others, as it does not have the Kaiti Reef in front of it, which protects the very southern section including the southern log yard enhancement area (which is not within the TBP footprint), from wave energy (see Figure 2). Accordingly, the outer seawall requires refurbishment to enable use of this area of the port by vessels.

The proposed reclamation works will initially require the construction of a new outer revetment/seawall followed by the deconstruction of a section of the existing seawall. This sequence is to provide a more sheltered zone in which to deconstruct the existing seawall section and progressively reclaim the area. The external and internal revetments of the existing seawall that fall within the reclamation footprint will be removed as part of a staged construction programme.

TBP works will include the deconstruction of the existing seawall, then placement of the reclaimed material to join the outer and inner breakwaters together to form a total area of approximately 0.89 ha of which 0.26 ha is existing revetment footprint (Figure 7, Worley, March 2022). Once the reclamation area is completely enclosed by the outer revetment/seawall, the reclamation area will be constructed from the land using a rushed rock platform so that construction activities can occur from the land (Worley, March 2022). The reclamation involves multiple stages that will extend the construction over a period of up to 3 years or more depending on detailed design staging.

The reclamation will include placement of imported rocky granular fill held in place by a new southern revetment wall comprising a crushed rock core, a secondary armour layer of 0.3–1 tonne rocks and outer primary armour layer of 10 tonne Accropode or X-Bloc units (Figure 7). The internal top surface will be paved suitable for logging trucks and other vehicles to access the extended Wharf 8.

The Worley engineering report (Worley, March 2022) indicates a revetment core and toe protection (bund) will be required to protect the works area during construction. This bund will subsequently be ‘incorporated into the revetment (Appendix B). An Erosion Sediment Control Plan (ESCP) to be prepared by contractors will describe how sediment control will be achieved.

Figure 3-5 – Left – X-bloc® (4 m³/9.6 t, Port Oriel, Ireland). Centre – Accropode units (6.2 m³/14.9 t, Scarborough UK). Right – Core-loc® (15 m³/36 t, Kaumalapau Harbor, Hawaii). (Reedjik & Muttray, 2009)

Figure 3-6 – Examples of typical random placement of X-bloc® units

Figure 7: Examples of the X-bloc units which will form the armouring of the external TBP seawall (Worley, March 2022).

5 ASSESSMENT OF EFFECTS METHODOLOGY

The following documents and data sources have been used to inform the assessment of effects on kororā and resulting management responses:

1) Eastland Port Twin Berths Assessment of Ecological and Water Quality Effects (4Sight, 14 July 2022).
2) Review of eBird and iNaturalist databases to understand kororā presence and sightings in the local and wider Poverty Bay area.
3) The conservation status of kororā as per the NZ Threat Classification List (Robertson *et al*., 2021) and ecological value (EIANZ, Roper-Lindsay *et al*., 2018).
4) GIS data and memo from the conservation dog survey conducted at the site by DabChickNZ in November 2021 (Simm, 2021).
5) Waikahua KCMP prepared for the southern section of the southern log yard Enhancement Area (Ecoworks, March 2022, Appendix A).

A site visit was conducted on 11 July 2022 by a 4Sight ecologist experienced in kororā surveys. The purpose of this site visit was to become familiar with the site by completing a walkover of the potential habitat for kororā over a low tide period. Although kororā signs (guano, feathers) were observed and recorded, the inspection did not involve a specific survey for the presence of kororā. Correspondence with Ecoworks during the site visit was that the breeding season had not started at the Young Nicks Head colony, on the opposite headland within Poverty Bay, Gisborne (pers. comms, Steve Sawyer, Ecoworks). At the time of this report, in August 2022, egg laying at the Young Nicks Head colony commenced in mid – August (pers. comms, Steve Sawyer, Ecoworks).

5.1 Ecological Impact Assessment

The assessment of potential effects has been conducted based on the Ecological Impact Assessment Guidelines for New Zealand (EIANZ, Roper-Lindsay *et al*., 2018).

The EIANZ classification system includes criteria for assessing the 'ecological value' of species (Table 2) and habitats separately. The use of this methodology for assigning value to a habitat was not directly relevant in this report as the habitat being assessed is an artificial structure and does not fit with the criteria outlined by the EIANZ guidelines, so our professional judgement, guided by the EIANZ (2018) principals, has been used in this case.

Descriptors from EIANZ (2018) are also used to assess the 'magnitude of ecological effects' (Table 3). It uses both these metrics (value and magnitude) to derive an overall 'effects level' from the matrix (Table 4). Overall level of effects are derived for the kororā themselves and for the potential kororā habitat.

Table 2: Criteria for assigning ecological value to species (EIANZ, 2018).

Ecological Value	Species Classification
Negligible	Exotic species, including pests, species having recreational value.
Low	Nationally and locally common indigenous species.
Moderate	Species listed as any other category of At Risk (Recovering, Relict, Naturally Uncommon) found in the zone of interest (ZOI) either permanently or seasonally; or Locally (ecological district) uncommon or distinctive species.
High	Species listed as At Risk – Declining found in the ZOI either permanently or seasonally.
Very High	Nationally Threatened (Nationally Critical, Nationally Endangered, Nationally Vulnerable) species found in the ZOI either permanently or seasonally.

Table 3: Criteria for describing effect magnitude (EIANZ, 2018).

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

Table 4: Matrix combining magnitude and value for determining the overall level of ecological effect (EIANZ, 2018).

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

6 EXISTING ENVIRONMENT

The existing ecological environment relevant to the TBP is described in detail in the 4Sight AEE. The ecological values relevant to this assessment of effects include the following:

- Kororā as a species,
- Potential kororā habitat within the TBP footprint, including the:
  - **TBP Outer Seawall** that will be deconstructed as part of the TBP (130 m), and
  - **TBP Inner Seawall** that will be deconstructed and reinstated as part of the TBP (245 m);
- Potential kororā habitat areas outside the TBP footprint, including:
  - **Buffer Seawall** in the gap between the TBP and the Southern Log Yard Seawall Enhancement Area (170 m);
  - **Waikahua Seawall** adjacent to Kaiti Beach; and
  - **Southern Log Yard Seawall Enhancement Area** (250 m).

6.1 Kororā

Kororā as a species have a threat classification status of "At Risk – Declining" so are assigned an ecological value of **High** (Robertson *et al*., 2021).

There is documented presence of kororā within the Poverty Bay coastal environment from the citizen science databases (eBird and iNaturalist), community and news articles online (Figure 8). Community and school projects for nest boxes, signage, and other local initiatives for advocacy of the protection of kororā demonstrates known nesting areas on Wainui and the Tatapouri coast[4].

Closer to Eastland Port, along Kaiti Beach, local kororā protection groups have erected pou (wooden posts) to signify the area where kororā were reportedly killed by dogs earlier in October 2021[5].

A search of iNaturalist supports our knowledge of the presence of kororā on Kaiti Beach and within the outer seawall that will be deconstructed as part of the TBP (Figure 9 and location shown on Figure 10). An eBird observation from 2019 records a group of seven individuals floating together (rafting) offshore west of Tuamotu Island in Poverty Bay (30/04/19, from Sponge Bay[6]).

A survey of the entire outer breakwater (from the deconstruction area to the south including the southern log yard enhancement area and the Waikahua seawall) in November 2021 by DabchickNZ and her conservation dog identified 13 positive dog detections of kororā (Figure 10). One of these detections was within the outer seawall that is proposed to be deconstructed.

[4] Gisborne Herald article, accessed on 13/07/22 - https://www.gisborneherald.co.nz/local-news/20210827/help-to-protect-korora/

[5] Gisborne Herald article, accessed on 13/07/22 - https://www.gisborneherald.co.nz/frontpage-featured/20211202/rallying-for-korora/

[6] eBird observation from 30/04/2019 - https://ebird.org/checklist/S55580244

Figure 8: Presence of kororā within the Poverty Bay/Wainui Beach coastal environment (Graphic source: Ecoworks, March 2022).

Figure 9: Observations from iNaturalistNZ of kororā footprints[7] and kororā guano observed on 4Sight site visit on Kaiti Beach in July 2022.

[7] Observation ID 98962455 – access on 13/07/22 from iNatualistNZ - https://inaturalist.nz/observations/98962455

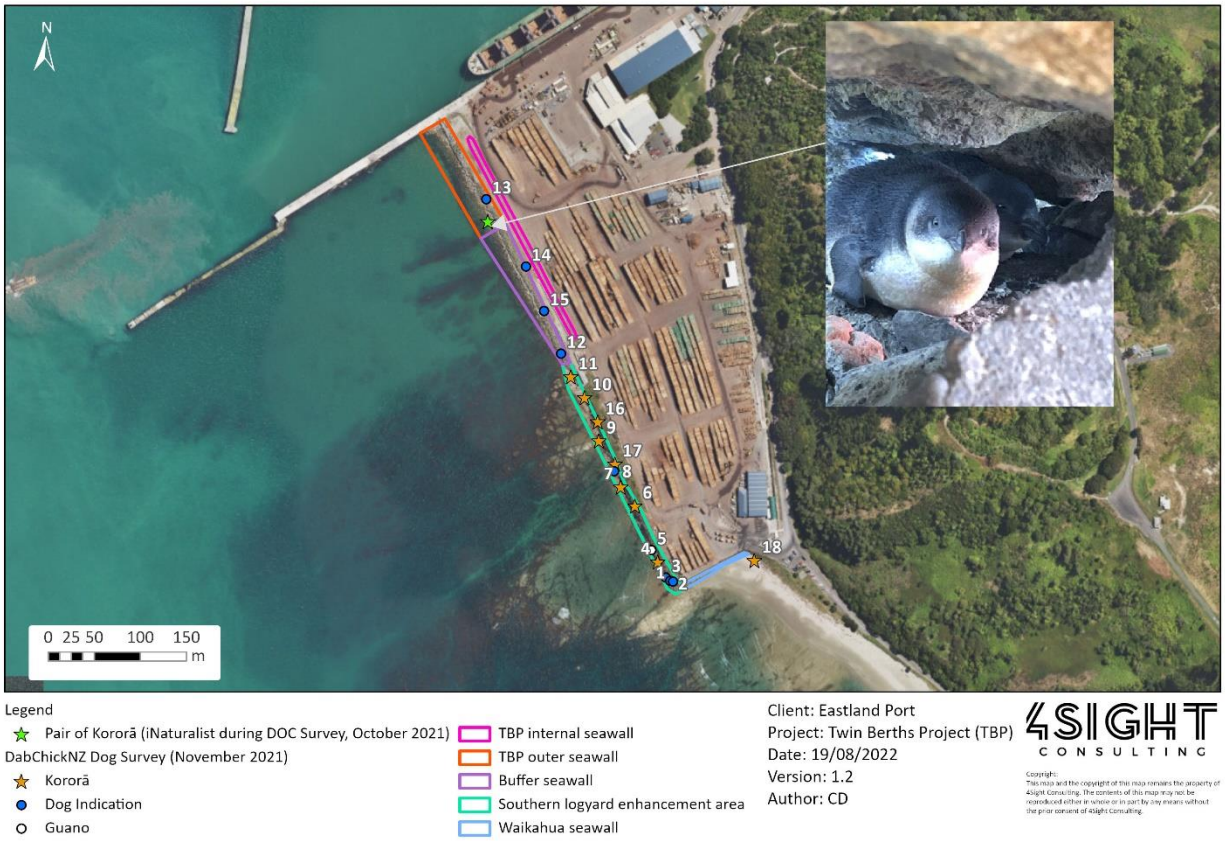

Figure 10: Conservation dog survey and iNaturalist observations of the Southern log yard seawall at Eastland Port.

6.2 Habitat within the TBP footprint

6.2.1 TBP Outer seawall

The 130 m of outer seawall within the TBP construction footprint is constructed from a mixture of informal concrete blocks, riprap, and rebar (Figure 11). Sections of the existing seawall have failed and areas of the rock wall below MHWS were exposed to swell at the time of the July 2022 site visit (Figure 11 and Figure 14). There is a gradient of wave exposure which increases towards and is greatest along the TBP section of the seawall, as the rest of the seawall is protected to some extent by the Kaiti Reef (Figure 13).

To understand the frequency of overtopping, wave action and volume of water on the existing structure (assumed crest at 7.0 m Chart Datum), Worley engineering undertook an assessment of potential wave height using the EurOtop manual (2018[8]) combined with available wave statistics at the site (Mulgor, 2018). Further high-level analysis (by 4Sight) was undertaken using inundation levels were obtained from recent regional inundation studies against a range of levels up the existing wall (NIWA, 2014). These provided a range of storm tide, wave setup and runup scenarios to provide an insight to the degree of wave run up acting upon the upper sections of the existing seawall.

Waves overtopping the existing structure are expected to occur approximately 3.5% of the time which equates to roughly 13 times a year. Waves approaching the crest would occur more often i.e., storm surge events of a 1-year Annual Exceedance Probability (AEP[9]) are estimated to have waves running up toward the top of the wall.

[8] http://www.overtopping-manual.com/

[9] AEP describes the chance of an event reaching or exceeding a certain water level in any one year.

This analysis supports the anecdotal evidence from Eastland Port and the engineering report by Worley (2022) that this section of the seawall is frequently overtopped (*pers. comms.* Eastland Port and Worley, 2022) and are likely to occur several times in a breeding or moulting season. Higher wave exposure and frequent overtopping may explain the limited use of this section of seawall by kororā, with indications of use by kororā only identified in the southern section of the TBP outer seawall.

The TBP outer seawall section had one dog indication in the 2021 dog survey. The kororā was not seen but was considered likely to present within the wall at the time of survey (Simm, November 2021). A pair of kororā resting underneath a concrete structure close to the dog indication was also recorded in iNaturalist in October 2021 (Figure 10).

The dog survey findings and the wave exposure indicate that the TBP outer seawall is less populated by kororā when compared to other sections of the seawall. There are at least two sites at southern end of the section within the TBP reclamation footprint (i.e., approximately southernmost 20% of the outer seawall) that have been used by kororā and may potentially be used by in the future. It is not known whether these are burrows where breeding or moulting occurs or whether there are other additional unrecorded sites. Further surveys of this area are required to understand this.

The primary reason for the ecological value of this habitat is that it is potentially used by kororā to breed and moult, even though it may be considered marginal habitat. Considering that this habitat is an artificial structure, is exposed to high wave energy and storm surge, and limited number of kororā indications, its ecological value is considered to be **Moderate**.

Alternatively, if monitoring confirms that the TBP outer seawall does not contain any active burrows within the expected breeding/moulting season, the ecological value of the TBP outer seawall would be **Low**.

Figure 11: The seawall within the TBP reclamation area is exposed to sea swell and is dominated by large rock spalls and concrete.

Figure 12: Southern seawall including area affected by the Twin Berths Project.

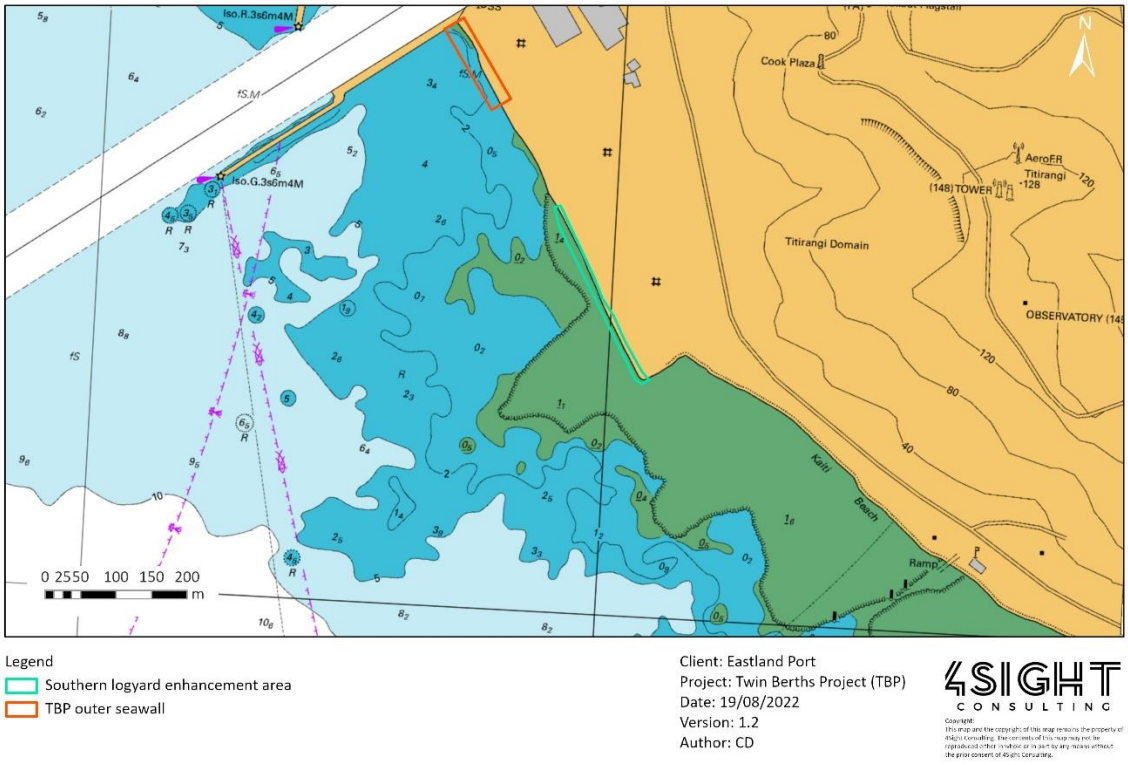

Figure 13: Location of Kaiti Reef shown in green and gradient of wave exposure along the southern seawall at Eastland Port.

6.2.2 TBP Inner seawall

The TBP inner seawall separates the logyard, road and outer seawall from wave exposure (Figure 14). This section of seawall will be deconstructed and reinstated as part of the TBP reclamation. It is protected from storm surge; however, kororā must transverse over the road through existing port operations to reach this area and the crevices were not as deep when compared to other seawall areas. DabchickNZ did not include the internal seawall in their survey (Simm, November 2021) but did note that while the area appeared to be habitat that penguins could utilise, such areas were unlikely to support large numbers of kororā.

Given the findings above, it is considered that this section of seawall is of **Low** ecological value. If monitoring surveys of this area were to find active burrows this area, then the ecological value would be **Moderate**.

Figure 14: Inner seawall that separates the logyard from the road and the outer seawall.

6.3 Habitat outside the TBP footprint

6.3.1 Southern Log Yard Seawall Enhancement Area

Thirteen dog detections of kororā were recorded in the Enhancement Area section during the November 2021 survey (Simm, 2021). This area is not affected by the TBP. During the 4Sight July 2022 site visit, incidental observations of kororā confirmed positive signs along this section (Figure 15). The Southern Log Yard Seawall Enhancement Area section of the seawall is more sheltered from waves due to the presence of the Kaiti reef (Figure 13). This enhances its potential for kororā access and use. The habitat value has been increased by the recent reinstatement of the rock wall with crevices suitable for kororā along with the associated conservation efforts (predator control, planting and nest boxes) by Ecoworks and Eastland Port.

Overall, the Enhancement Area seawall section has **High** ecological value and more favourable kororā habitat compared with the northern part of the seawall, which falls within the TBP footprint.

Figure 15: Incidental observations of fresh kororā signs (guano) along the seawall.

6.3.2 Buffer Seawall

There is an approximately 170 m section of the seawall that will not be deconstructed or otherwise affected by the TBP. This lies between the TBP outer seawall and the Enhancement Area (purple section in Figure 2). It effectively provides a transition and 'buffer zone' between the higher level of kororā activity associated with the Enhancement Area and the area of TBP footprint. The 2021 conservation dog survey recorded 3 indications of kororā in this zone (Figure 10).

This area has some protection from the edge of Kaiti Reef however has had no conservation or crevice enhancement works undertaken. Based on this, it is considered that this section has **Moderate** to **High** ecological value.

6.3.3 Waikahua seawall adjacent to Kaiti Beach

This section of seawall is constructed from solid concrete blocks that do not provide suitable crevices for breeding or moulting kororā to protect them from predators and the elements. However, kororā have been observed using this area, perhaps as a resting platform before they move onto Kaiti beach or onto the other sections of the seawall. Based on this, the seawall in its current state is of **Low** ecological value.

6.4 Ecological value summary

The ecological values of species and habitat at the existing TBP footprint and surrounds relevant to this assessment are summarised in Table 5 below. Note that habitats with the highest ecological value are located outside of the TBP works footprint.

Table 5: Summary of ecological values at the existing site.

Species or habitat	Ecological value
Kororā	High
Habitat areas within the TBP footprint:	
TBP Outer seawall	Moderate or Low (depending on presence or absence of kororā)
TBP Inner seawall	Moderate or Low (depending on presence or absence of kororā)
Habitat areas outside the TBP footprint	
Southern Log Yard Seawall Enhancement Area	High
Buffer Seawall	Moderate to High
Waikahua seawall adjacent to Kaiti Beach	Low

7 TWIN BERTHS KORORĀ MONITORING AND MANAGEMENT PLAN (TBKMMP)

The development of a TBKMMP is recommended to avoid adverse effects on kororā and to manage adverse effects on potential kororā habitat. This plan should be prepared for certification by Council prior to the commencement of the deconstruction and reconstruction of the TBP outer seawall. The assessment of effects in this report have been conducted taking the following recommended management controls below into consideration.

The TBKMMP should include management controls and protocols for the following components:

- Pre-construction monitoring (section 7.1),
- Construction management and monitoring (section 7.2), and
- Post-construction management and enhancement (section 7.3).

7.1 Pre-construction monitoring and management

The TBKMMP will define the area for monitoring as well as the appropriate objectives, methodology, and frequency to conduct pre-construction monitoring. A suggested monitoring area is shown as minimum area to be surveyed as a part of the pre-construction, construction and post-construction works (orange and pink areas in Figure 10). The northernmost 20 m of the Buffer Seawall (closest to the deconstruction footprint) should be included to identify any active burrows that may be in this location. Restrictions on the deconstruction of the seawall apply within 20 m of any active burrow.

7.1.1 Monitoring Objectives and Area

The objectives and purpose of the monitoring will be defined in the TBKMMP, these should be practically achievable within a seawall and with the frequency and monitoring methodology. The aim of these pre-construction surveys should be to establish a baseline, considering that season and annual variations due to environmental factors can occur and can be difficult to distinguish from construction activities without a control site. Importantly, pre-construction monitoring will identify how many kororā are actively using the area.

7.1.2 Monitoring Methods

There are multiple kororā monitoring methods that are available and have limitations and benefits depending on circumstances. These methods include:

- Specialist seabird conservation dog survey,
- Surveys by a Suitably Qualified and Experienced Person (SQEP[10]) using the following methods:
  - Surveillance or trail cameras on site,
  - Observations and records from port staff which are then approved/review by a SQEP,
  - Burrowscope or phone camera into the entrance of potential locations of interest (potential burrows),
  - Visual check of site for the presence of birds and their sign (guano, feathers, smell).

At a minimum, pre-construction surveys should include breeding and moulting season surveys using conservation dog or Suitably Qualified and Experienced Person (SQEP[11]) surveys. Monitoring should look to record kororā activity including:

- Dog indications and/or,
- Signs including guano, feathers, smell and/or,
- Presence of birds.

7.1.3 Monitoring Frequency

The frequency of these surveys should be defined in the TBKMMP however, at least one should be conducted during breeding season to confirm locations and number of potential breeding locations and at least one during moulting (refer to Table 1, i.e., at least twice per year).

The timing of the proposed seawall construction/deconstruction work is not finalised, but it is unlikely to begin prior to 2024. The intervening period provides sufficient opportunity to undertake additional surveys to establish kororā presence in the works area beyond the current indications of the presence of kororā in the TBP works area. These additional surveys, their location, timing, frequency, and methods will be detailed in the TBKMMP and certified by Council as being in accordance with the TBKMMP objectives which will include appropriate preconstruction monitoring of kororā.

7.1.4 Preconstruction Management

Pre-construction monitoring will clarify the management and mitigation requirements prior to deconstruction and construction of the TBP Outer and Inner Seawalls. If kororā are found to utilise the inner and outer TBP seawalls, it is recommended to modify this habitat prior to the TBP outer seawall deconstruction/construction outside of the nesting and moulting season to make it uninhabitable the following season.

Once kororā absence or presence (including population size estimate) is confirmed, specific actions can be taken or planned to reduce and ideally prevent recolonisation of the area prior to the works starting. For example, such measures include identifying active burrow locations and rendering these areas inaccessible following completion of the breeding or moulting season prior to the TBP works. Options for management controls will be covered in the TBKMMP, including options for offsetting the loss of previous active burrows, if they were identified in the works area.

[10] SQEP is defined as a person with tertiary ecology qualification and experience working with kororā (Source: Boffa Miskell Limited 2022. Kennedy Point Marina: Kororā Construction Monitoring & Management Plan. Report prepared by Boffa Miskell Limited for Kennedy Point Boatharbour Ltd.

7.2 Construction Management and Monitoring

The TBKMMP will identify a range of construction management and monitoring measures including:

- Monitoring of the kororā as appropriate and as defined in the TBKMMP.
- Moving birds from active burrows is not recommended.[12] Kororā are most sensitive to disturbance when they are breeding and moulting (active burrows) as they become resident on land for extended periods. These seasonal activities typically cover the months of July to March but can be variable year on year and site specific (Table 1).
- Protocols around the requirements for contractors to interact with a SQEP in respect of deconstruction of the seawall including:
  - A survey using conservation dog or SQEP should be undertaken immediately before rock removal works to confirm either the absence of any active burrows within 20 m and/or kororā within the works area.
  - If the area has been cleared by surveys, or by other actions, best efforts should be made to exclude or make the specific area unsuitable for kororā in advance of the deconstruction works. This may include fences and removal of all rocks that provide crevices for kororā to inhabit.
  - Storage of rock and other construction materials in a way that makes it unavailable for kororā to temporarily inhabit (offsite or below MHWS).
  - Protocols including exclusion fencing and appropriate storage of rock material to protect kororā from the entering construction once it is established and regular monitoring by Port staff to ensure that protocols is fit for purpose.
  - Following similar protocols for rock removal in the absence of active burrows within 20 m rather than a set time of year (Figure 16).
- Identifying appropriate types and use of fencing and exclusion devices to exclude kororā from future areas of work, as identified above.
- Protocols for seeking a DOC Wildlife Act Authority (where necessary), including protocols required to handle kororā in advance of the requirement arising.
- Review of and input as necessary to the development of Erosion Sediment Control Plan (ESCP) to minimise sediment discharge into the coastal environment.
- Controls to enable appropriate works below MHWS in breeding/moulting season (given kororā occupy areas on land above MHWS,) including making such works subject to:
  - A SQEP survey confirming that there are no active burrows that are likely to be affected by the works, and/or
  - If rock shifting is required, confirmation it will not compromise the integrity or stability of the seawall above MWHS.
- Regular reporting to summarise construction works completed and present the findings from the monitoring. The report should include the methodology, breeding, and moulting status (if possible), and locations of all identified burrows as well as areas of sign within the monitoring area.

[12] Any intention to handle or move birds at any time requires appropriate authority under the Wildlife Act (1953) from the Department of Conservation.

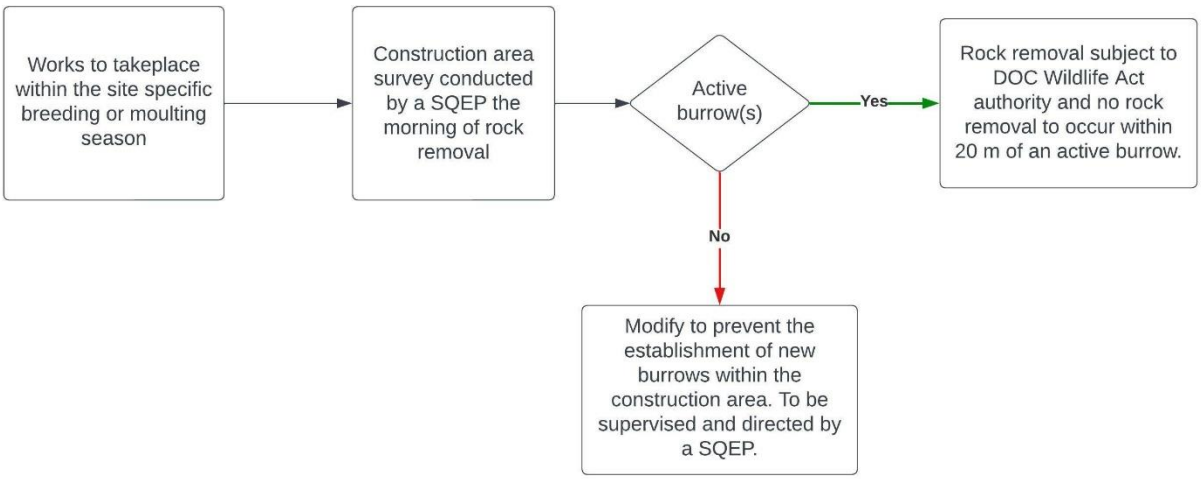

Figure 16: Management option for active burrows during breeding or moulting season.

7.3 Post-Construction Management and Enhancement

The TBKMMP will identify a range of post-construction monitoring, management and enhancement measures including:

- Post construction monitoring and reporting to summarise the seawall deconstruction/construction works completed and present the findings from the monitoring. The report should include the methodology, breeding, and moulting status (if possible), and locations of all identified burrows as well as signs of kororā activity within the monitoring area.
- If required, implementation of habitat offsetting/compensation and habitat enhancement for kororā which is to be defined by the TBKMMP. This would include consideration of:
  - Enhancement of the buffer seawall area with predator control, nest boxes and planting,
  - Extension of kororā exclusion fencing to encompass the entire southern seawall i.e., include the buffer seawall to the TBP area (Figure 10),
  - Public signage at the Port end of Kaiti beach to create awareness for kororā and encourage dogs to be on lead and under control.
  - Installation of nest boxes designed and placed in consultation with the Department of Conversation (DOC) as per the DOC guidelines[13].

8 ASSESSMENT OF EFFECTS

The assessment of effects is split into effects on kororā as individual birds during construction and operational phases of the TBP and their habitat. Potential effects on kororā resulting from noise are addressed in the noise assessment (Marshall Day Acoustics, 2022). The assessment has been conducted assuming that the TBKMMP has been developed and implemented following the recommendations in Section 7 of this report.

[13] https://www.doc.govt.nz/nature/native-animals/birds/birds-a-z/penguins/little-penguin-korora/

Potential adverse effects on kororā are:

- Kororā mortalities,
- Reduced foraging ability, prey abundance and water quality effects,
- Construction and operational disturbance, lighting, and noise.

Potential adverse effects on kororā habitat are:

- Loss of potential kororā habitat.

These potential effects are discussed in the sections below.

8.1 Potential Effects on Kororā

8.1.1 During Construction

Kororā Mortalities

The construction of the new outer seawall (using X-bloc or similar) has the potential to cause kororā mortalities if the appropriate management actions are not implemented. Kororā are known to rest within crevices in seawalls, within rock stockpiles and under artificial structures and may colonise the new habitat areas as they are created. The TBP could result in mortalities if kororā remain present in an active construction area, given the use of large machinery and other construction activities such as rock movement.

Moving kororā if found within the construction area when they are breeding, or moulting is not recommended. The TBKMMP shall specify how this new seawall and the associated construction site (including concrete and rock armouring storage piles) is monitored for kororā activity as it progresses (see section 7). It will specify management control actions to be undertaken to discourage kororā from entering the working area or establishing active burrows in vulnerable locations over the extended works period. Such management controls may include but are not limited to:

- Exclusion fencing including the use of geotextile or other 'wrapping' to exclude kororā access to crevices in the new seawall or stockpile material;
- Rock storage either below mean highwater spring level or off site beyond kororā access; and
- No movement of rocks within 20 m of an active burrow (as per the TBKMMP, see section 7).

If kororā are successfully excluded from the new seawall construction area prior to works and are managed in accordance with the protocols to be established in the TBKMMP, the likelihood of kororā mortalities is very low and, therefore, the magnitude of effect would be **Negligible**.

Noise

An acoustics report prepared by Marshall Day concluded that "the noise generated by most of the [TBP's] daytime construction works is predicted to be generally comparable to existing port noise levels and character" (Marshall Day, 2022).

It is expected that ambient noise levels which are affected by existing port activities and wave impacts on the shore and seawall will not be changed significantly by construction noise (including the movement of rocks). Adverse noise related effects on kororā behaviour are therefore not anticipated and their magnitude of effect will be **Negligible**.

Sediment

High suspended sediments in the water column have the potential to affect the foraging ability of kororā as they are visual hunters. While foraging distance depends on the season and other environmental factors, it is unlikely that they will forage in one localise area, but rather have been found to have a foraging home range of up to approximately 20 km from their colony (McCutcheon *et al*., 2011 and Poupart *et al*., 2017). Based on this, it is likely that kororā feed out in Poverty Bay, potentially around the Turanganui River mouth at certain times of the year. It is unlikely that the primary food source for the kororā is located within the area adjacent to the southern log yard seawall that could be subject to elevated turbidity during construction works. Any adverse water quality effects of the TBP will largely be short term as a result of relatively localised increases in turbidity and suspended sediment (4Sight, 2022).

Sediment erosion controls following industry best practice methodology will be included in the Construction Management Plan, following a Sediment Erosion Control Plan established by the contractor, and are expected to limit sediment generation and protect receiving environments during construction.

Based on the above, the magnitude of sediment related water quality effects on kororā are likely to be **Negligible**.

Lighting

There is the potential for lighting from construction activities to have adverse effects on kororā. Birds are generally known to be attracted to, and disoriented by, artificial lights (Rich and Longcore, 2006). Kororā burrows are normally shaded and dimly lit within the crevices of a seawall or shaded by the lids of the nest boxes. Furthermore, construction is likely to occur in daylight hours where lighting will not be required. Any additional lighting from construction activities is unlikely to make any material difference to the existing light regime experienced by kororā already living in a location with artificial lights. Accordingly, we consider the magnitude of effects of lighting on kororā to be **Negligible**.

Disturbance

Disturbance effects include temporary or more long-term displacement from an area or habitat, alterations in foraging behaviour and breeding (French *et al.*, 2018, Lindenmayer *et al*., 2018, Dhar *et al*., 2020, Doherty *et al*., 2021 and Schaefer *et al*., 2021). It is expected that the kororā population will be more vulnerable to effects from construction activities during breeding and moulting season. Outside of this season, birds are generally out foraging during the day and return to land at night; however, birds can be found on land all year around. Therefore, the effects of disturbance activities can be reduced if undertaken in the winter/non-breeding season as it is less likely that there will be birds present on land/the seawall during the day.

Recent studies of kororā show that they are resilient to human interactions in comparison to other bird species (Stein *et al*., 2017 and Sievwirght *et al*., 2019). A study of rehabilitated kororā from the Rena oil spill found that post release survival of oiled birds was similar to controls (Sievwirght *et al*., 2019). A study of hoiho/yellow-eyed penguin (*Megadyptes antipodes,* nationally endangered) in Otago Peninsula were resilient to investigator disturbance from the long monitoring programme (which included handling, banding, blood sampling and device deployment, Stein *et al*., 2017). These studies and the presence of kororā within a noisy urban port environment, indicates that they are likely to be generally resilient to human disturbance.

Based on the above and management outlined in Section 7, it is considered that the magnitude of effects from disturbance during construction on kororā are **Low but temporary**.

8.1.2 Post-construction

Following the completion of the works, the operational TBP is not expected to have any increased or altered effects on kororā. Any operational effects are likely to be similar to the existing effects experienced by kororā in the vicinity of the port.

The TBKMMP will require ongoing management and monitoring recommendations that, when implemented, are likely to result in reduced interactions between port activities and kororā activity (refer to section 7).

Post construction, the TBP will enable the berthing of large vessels and could also result increased vessel numbers. There is evidence that kororā are vulnerable to injury from boat strike and this has been found to be more evidence for this in shallow coastal environments where fast recreational vessels are more common (Cannell *et al*., 2020). With slow moving large vessels, the new TBP is unlikely to create more of a risk to kororā then they currently experience in the port environs.

With the effective implementation of the TBKMMP it is expected that operational effects on kororā once the TBP is operational will be no different to the existing threats to kororā living in a port and/or urban environment. That is, the magnitude of effects is **Negligible**.

8.1.3 Summary of Potential Effects on Kororā

A summary of the potential effects on kororā discussed above are presented in Table 6 along with their derived Overall Level of Effect.

Table 6: Summary of potential effect on kororā including the overall level of effect.

Potential Effect	Ecological Value	Magnitude of Effect	Overall Level of Effect
Construction effects			
Kororā mortalities	High	Negligible	Very Low
Noise		Negligible	Very Low
Sediment		Negligible	Very Low
Lighting		Negligible	Very Low
Disturbance		Low (temporary)	Low (temporary)
Post-construction effects			
Ship strike (increase shipping traffic)	High	Negligible	Very Low
Interactions with port operations		Negligible	Very Low

All potential effects other than disturbance have an overall effect level of Very Low. Considering that the disturbance effects are temporary (limited to the construction period), the overall level of effect of the TBP works on kororā is considered to be **Very Low**.

8.2 Potential Effects on Kororā habitat

The TBP will result in the loss of artificial and potential kororā habitat within the following areas:

- TBP Outer Seawall that will be deconstructed and replaced with X-bloc materials (130 m) which has an ecological value of **Low** or **Moderate** (depending on the presence of active burrows).
- TBP Inner Seawall that will fall within the reclamation footprint (245 m) which has an ecological value of **Low** or **Moderate** (depending on the presence of active burrows).

The magnitude of effect of the proposed works is dependent on whether active burrows are identified within the TBP Outer or Inner Seawalls during pre-construction monitoring. Both scenarios are assessed below.

8.2.1 No Active Burrows

If no active burrows are identified within the deconstruction footprint, then the loss of this habitat will have an overall effect of **Low** (Low ecological value and Moderate magnitude of effect, Table 4). Accordingly, no further actions to avoid, remedy, or mitigate would be required. Further, there would be no restrictions on the timing around kororā moulting or breeding for the deconstruction/construction works.

8.2.2 Active Burrows Identified

If active burrows are identified within the TBP Outer Seawall, removal of this structure will result in the loss of kororā habitat (rip-rap) and replaced by habitat of a lower value (X-Bloc or similar). This would be considered a major alteration to the key features of the seawall and, therefore, assigned a magnitude of effect of **High**.

The overall level of effect from the deconstruction and reconstruction of the outer seawall in this scenario would be **Moderate** (Moderate value habitat, High magnitude of effect, Table 4) and result in a net loss of biodiversity value. Due to the Moderate overall level of effect, approaches to avoid, remedy and/or mitigate are recommend where possible. There are limited option to avoid, remedy or mitigate the effects due to the necessity to deconstruct the seawall. Alternatively, offsetting/compensation for habitat effects in the form of habitat enhancement of the Buffer

Seawall section are likely to be available and appropriate to reduce the overall level of effect and achieve no net loss of biodiversity value.

In the event that active burrows are identified within the TBP Outer Seawall, offsetting/compensation is recommended in the form of habitat enhancement within the 170 m Buffer Seawall section (in the gap between the TBP Outer Seawall and the Southern Log Yard Seawall Enhancement Area that will not be changed by the TBP). Encouraging use of this area by kororā is preferred over the new outer seawall in terms of kororā safety as it is less exposed to waves, swell, and storm surge and further away from port activities.

The extent of any necessary offsetting/compensation will be determined in accordance with the TBKMMP consistent with the following principles:

- The extent of offsetting/compensation required is dependent on the number of active burrows located within the TBP construction area.
- It is recommended that the loss of any previously active burrows are replaced with a greater number of nest boxes in an enhancement area. This could be, for example at a 2:1 ratio, i.e., the installation and maintenance of 2 nest boxes within the buffer seawall for every 1 active burrow in the TBP outer seawall in the previous breeding or moulting season. The rationale behind this ratio is to provide a larger number of potential burrows to increase the chance of uptake by kororā.
- Replacement of active burrows should be prioritised in the following order:
  - Minor modifications to rock or artificial materials along the buffer seawall that creates crevices and suitable habitat for kororā. It is expected that this could be done by hand, without machinery.
  - Nest boxes installed and designed and placed in consultation with the DOC and as per the DOC guidelines.

Following implementation of offsetting/compensation in the manner proposed above, the overall level of effect is considered to be **Low,** and with the enhancement likely a small net gain in biodiversity value due to the implementation of predator control fencing, nesting boxes and pest management along the buffer seawall section.

8.2.3 Other Habitats

The other habitats described in Section 6.3 of this report (Southern Log Yard Seawall Enhancement Area and the Waikahua seawall adjacent to Kaiti Beach) will be unchanged by the proposed works (with the exception of the Buffer Seawall which may be enhanced if required to offset/compensate for any habitat effects on identified active burrows). Accordingly, there will be no effects on these habitats.

8.2.4 Summary of Potential Effects on Kororā Habitat

A summary of the potential effects on kororā habitat discussed above is presented in Table 7 along with their derived Overall Level of Effect.

Table 7: Summary of potential effects on kororā habitat including the overall level of effect for three scenarios.

Potential Effect	Habitat Ecological Value	Magnitude of Effect	Overall Level of Effect
No active burrows identified within TBP Outer Seawall			
Loss of habitat	Low	High	Low
Active burrows identified within TBP Outer Seawall – no offsetting			
Loss of habitat	Moderate	High	Moderate
Active burrows identified within TBP Outer Seawall – with offsetting/compensation			
Loss of habitat	Moderate	Low	Low

9 CONCLUSIONS

The assessment of effects considers both effects on kororā and effects on their habitat during construction and operational phases of the TBP.

The development of a TBKMMP will be necessary to avoid adverse effects on kororā and to manage adverse effects on potential kororā habitat. This plan should be prepared for certification by Council prior to the commencement of construction/deconstruction works of the TBP outer seawall. The assessment of effects in this report have been conducted taking the recommended mitigation and management controls below into consideration.

The TBKMMP should include management controls and protocols for the following components:

- Pre-construction monitoring (section 7.1),
- Construction management and monitoring (section 7.2), and
- Post-construction management and enhancement (section 7.3).

The TBKMMP should define the area for monitoring and whether a control site is practical and appropriate for achieving the monitoring objectives.

Overall, considering the protocols outlined in the TBKMMP, ecological effects on kororā are expected to be **Very Low,** with all effects being assessed as 'negligible', with the exception of disturbance during construction, which is 'low but temporary'.

If there are no active burrows within the TBP outer seawall immediately prior to the deconstruction works occurring, the overall level of effect on kororā habitat is **Low**.

If active burrows are identified in the TBP Outer Seawall, appropriate management of the kororā will be necessary, in which case the overall level of effects on habitat will be **Moderate** and will require appropriate management and offsetting/compensation of the loss of habitat. There are sufficient enhancement opportunities in the Buffer Seawall section, adjacent to the TBP Outer Seawall. Such enhancement will be addressed and described in the TBKMMP. If required, after enhancement measures have been implemented, it is anticipated that the overall level of effects on habitat would be **Low**.

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Appendix A

Kororā Conservation Management Plan by Ecoworks (March, 2022)

Kororā Conservation Management Plan 2022 - 2032

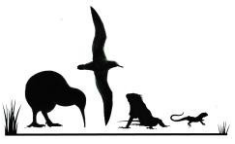
Onepoto, Turanganui a Kiwa - March 2022

Eastland Port

1048 Waimata Valley Road
Private Bag 7438
Gisborne

www.ecoworks.co.nz

Biodiversity Management Services



Contents

Cover Photos – Kororā at Oamaru Penguin Colony (photo supplied), Kororā at Te Kuri a Paoa, Young Nicks Head, Onepoto Beach & Tuamotu, Gisborne.

1.0 Kororā Overview

The Kororā, or little blue penguin (*Eudyptula minor*) is widespread around the New Zealand coastline and is recorded nesting within a wide range of mainland coastal habitats and offshore islands from the northern Three Kings Island group near Cape Reinga to the sub-Antarctic Snares Islands including Rakiura -Stewart and the Chatham Islands group where they appear to be abundant.

Kororā are the smallest of the world's 18 species of penguin, standing at 300-330 millimetres in height and weighing 1000 grammes. They are native to New Zealand and are also found in southern Australia where they are referred to as the fairy penguin.

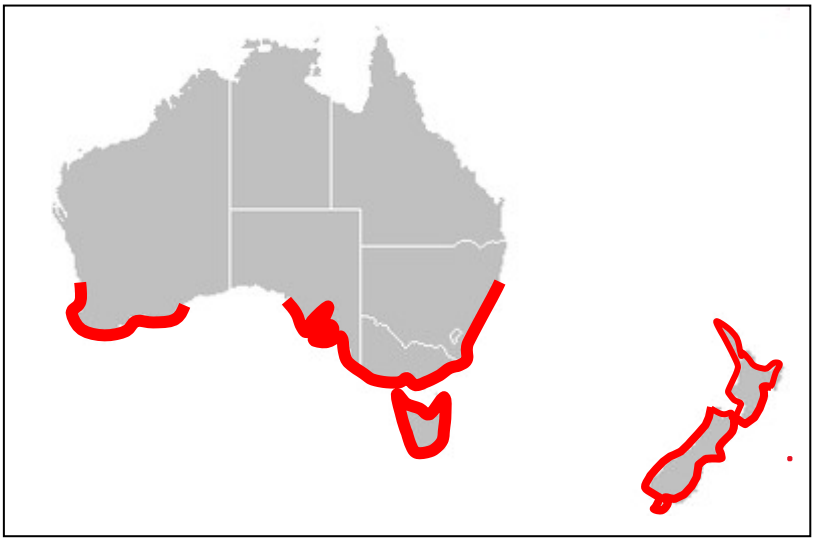


Figure 1: Kororā distribution New Zealand and Australia.

There has been considerable debate regarding the taxonomy of the *Eudyptula* genus across New Zealand. Kinsky and Falla 1976, suggested that up to six sub-species were present within the genus which has been supported by others (Davis & Renner 2003, Taylor 2000). The Ornithological Society of New Zealand checklist for New Zealand birds (2010) recognises just the one species, *Eudyptula minor,* however the DOC Threat Classification system 2016 describes multiple sub-species.

The New Zealand Department of Conservation THREAT CLASSIFICATION SERIES 19 -Conservation Status of New Zealand Birds, 2016, Robertson *et al.* describes the threat status of the Northern (*E.minor iredalei*) and Southern (*E. minor minor*) blue penguin as 'DP' or Data Poor and as category A(1/1). This references a 'moderate to large population' and low ongoing or predicted decline with 5,000–20 ,000 mature individuals, a predicted decline of 10–30% occurring.

Birds on-line describe the current threat status for this species as 'Declining'.

The current world population estimate stands at c.500,000 individuals (Birdlife International 2022). Population estimates appear to vary considerably however between organisations and between decades, robust survey or population trend data is not available for the majority of New Zealand. Most populations are thought to be in decline across New Zealand (K.J Wilson & T. Mattern 2019). Breeding populations which were present within Otago up until 1990 are no longer present (Dann,1994). Blue penguin were common on Banks Peninsula during the late 19th and early 20th centuries however since then have declined markedly (Challies & Burleigh 2004).

Our experience within Tairawhiti to date indicates that kororā mortality; besides natural mortality, has largely been attributed to both domestic dogs and ferret. This has also been recorded at other sites within New Zealand. A study carried out between 1994 -1998 necropsied 213 Otago blue penguin to identify the causes of mortality. A total of 9.4% of deaths were caused by ferret (AG. Hocken, *Cause of death in blue penguins in North Otago,* 2000). No stoat or cat predation was recorded during this study.

Te Kuri a Paoa - Young Nicks Head Eco-Sanctuary recorded the deaths of 3 adult blue penguin during late 2010 to a ferret at Orongo Beach. Ferret guard hairs were found on the plumage of the dead birds which were found outside of their breeding burrows and a classic cervical vertebrae puncture wound was recorded on all three birds consistent with other mustelid predation events seen on brown kiwi and weka (S.C Bull *pers. comm.*). No other predation events have been recorded at Nicks Head on blue penguin chicks or adults between 2005-2022. Stoat and feral cat are regularly recorded at this site on camera traps, however no kororā predation events have been recorded during the last 17 years from either of these two pest species.

Three kororā deaths were confirmed by the Department of Conservation on Onepoto Beach, Kaiti during 2021. All three were necropsied at Massey University and were confirmed to be caused by dog (J. Quirk, Department of Conservation Ranger, *pers. comm.*). Stoat and feral cat prints have also been identified on the high tide mark at this location. No mortality to date has been attributed to either stoat or cat at Onepoto that we are aware of.

Both anecdotal and empirical data suggest that stoat or feral cat are not a significant predator of blue penguin. As with kiwi and weka; stoat and feral cat are not primary predators of these robust flightless birds, however ferrets will kill large adult birds such as blue penguin, kiwi and North Island weka with ease. As will domestic or feral dogs. Flightless, nocturnal New Zealand endemic birds such as Kororā, kiwi, weka and pateke have a strong scent signature which appears to be highly attractive to dogs.

Fortunately for kororā, kiwi and weka the Tairawhiti region does not currently support a large rabbit population. Our climate combined with the uplifted marine mudstone-sandstone and clay soils geology combined with a moderate rainfall (>900-1000 mm mean annual rainfall, NIWA, 2012) does not provide optimal habitat to support a large feral rabbit population. Rabbits effectively get too wet and do not build to high densities as is witnessed within Otago, Wairarapa, Canterbury and Hawkes Bay. High rabbit densities support an abundant ferret population. Other sites such as eastern Hawkes Bay receive <800-900mm mean annual rainfall and with hard packed marine sediment geology provide impermeable and water-proof den sites which keep rabbits dry. This in turn supports high rabbit numbers and therefore ferrets which in turn decimate kororā, kiwi, weka and other species.

During the early 1980's the fitch (ferret) farming industry ended. It became unfashionable to wear authentic fur and the viability of this industry collapsed. Many of the farmed ferrets were literally released into the Gisborne District. Many others over the years had escaped from poorly managed farming operations. "It was not uncommon to lose 90 ferrets in a night and be asked to come and help round them up" – Guy Tomlinson, Matawai (*pers. comm.*).

This also appears to have coincided with the loss of weka in the Motu-Matawai-Rakauroa and greater Turanga area and probably had major consequences for other endemic species such as brown kiwi however at the time were not monitored and were considered relatively abundant.

It is highly likely that blue penguin have suffered the same fate within our region as kiwi, weka and many other flightless endemic bird species. They were likely to have been abundant along the Tairawhiti coast and over the years as we have recorded at various sites such as Te Kuri a Paoa -Young Nicks Head. We have recorded intermittent predation events from ferret and roaming dogs, i.e. Onepoto, which over time removes valuable breeding adults. This can have a significant impact by destroying in-situ eggs and or chicks and subsequently requiring any remaining adults to find another breeding partner. As blue penguin are largely philopatric nesters, both sexes incubate eggs and raise offspring and also maintain a strong pair bond fidelity for many years this is likely to be a challenging task and therefore predation events have a significant impact on small remnant populations. As we witnessed at Young Nicks Head it took years to recover from the loss of just 3 adult blue penguin in 2010. This impacted annual reproductive success significantly for many years post this event occurring (S.C Bull, Young Nicks Head Seabird Project, *pers. comm.*)

2.0 Kororā Ecology

The following information summarises the basic ecology of kororā – Blue Penguin.

-Kororā come ashore just after dusk, generally from 8.30 pm onward depending on the season.

-Kororā breed as individual pairs or in colonies 2-4 metres apart. Nest/roost burrows are either within caves, under boulders, burrows are excavated under flax or hidden under dense coastal vegetation and dense grass sward. Penguin have been found nesting under sheets of corrugated iron and will readily use nest boxes provided or nest under coastal buildings. They can nest up to 300 metres inland and 100 metres vertically above the coastline.

Kororā are monogamous and both sexes share incubation and chick rearing.

Kororā can produce more than one clutch per season. Unique among penguins.

Eggs are generally laid in Gisborne from mid-July through to late November.

Incubation lasts c.36 days.

Chicks are brooded for c.56 days when they fledge (exit) from the burrow.

They are generally a philopatric species returning to the same area to nest as adults.

Breeding begins at 2-3 years of age and lifespan can be over 25 years.

Kororā can be present at any time of the year as they will often come ashore to rest particularly after large swells or storm events.

Moulting generally occurs between February -April. Kororā stay within their nest/roost burrow until moulting is completed.

Table 1: Summary of Kororā Annual Activity

Activity	month											
	J	F	M	A	M	J	J	A	S	O	N	D
Moulting												
Egg Laying												
Chick Rearing												
Potential Burrow Occupancy												

3.0 Kororā Distribution within Turanganui a Kiwa

Several anecdotal reports from Gisborne suggest that blue penguin were once more common than they currently are. During 2004 Ecoworks NZ carried out a blue penguin survey between Te Kuri a Paoa – Young Nicks Head and Tatapouri, Gisborne. Initial plans included working with DOC towards the possible translocation of blue penguin chicks from northern Gisborne beaches to Te Kuri to establish a novel and protected colony site, however survey work during summer 2004-05 carried out by Dr Sarah Boyle -Ecoworks NZ, indicated that so few pairs remained on the mainland that this was not a feasible option. Approximately 10 breeding pairs were identified during the survey and it was decided that the best option for the survival of this remnant population was to protect in-situ pairs and nest sites.

Ecoworks NZ staff carried out maildrops and visited people known to have penguins roosting under their homes between Onepoto – Kaiti Beach and Tatapouri. The majority of the breeding birds were found at Tatapouri. Dean Savage and his team at Tatapouri Dive had built artificial penguin boxes and placed them along the shore to help protect the birds. Two pairs were nesting under the cottage 100m west of the Tatapouri boat launch ramp and 2 pairs were found within the rock wall south of Tatapouri Dive. Another pair had burrowed into the eroding sand wall at the top of the beach between the boat ramp and Savages property. Several pairs were located at Wainui and Makarori nesting under houses. A pair was located at the whale grave at Wainui and another single bird recorded by Jed McKenzie below the pied shag colony at south Makarori Beach.

Fig 3: Dr Colin Miskelly, Te Papa Curator of Birds with a kororā chick found by 'Tui' an Ecoworks NZ detector dog.

Overall blue penguin numbers in these coastal residential and city boundary-farmland sites appears to be low which is not a surprise as domestic dogs owned by Wainui and Makarori residents are found off lead and wandering these beaches at all times of day. This would have had a significant impact on blue penguin accessing moulting roosts or breeding burrows over the years. Anecdotal reports support this also.

During the 2004 survey several Gisborne beachside residents recalled that blue penguin were common under houses 10-20 years ago but are no longer seen or heard. Blue penguin were once common at Tatapouri however during 2004 now appear to be rare (Bevan Waghorn, *pers. comm.*).

During 2004 Kim Dodgshun, Station Manager, Young Nicks Head mentioned that blue penguin were also once found on Young Nicks Head however they had become extirpated (prior to the current penguin recovery and pest control programme commencing). Seabird detector dog and spotlight searches were undertaken on Te Kuri a Paoa with no result during 2004. A likely result of habitat loss, burrow collapse from cattle grazing and predation by ferret.

During 2021 a mail out survey was undertaken by teachers Jodie Saunders and Leah Wilkie and students from Wainui Beach School. Fifty-eight residents between Wainui Beach and Pouawa replied to a series of survey questions to understand how abundant kororā were within the Wainui area and the immediate surrounds. The questions asked included:

-Have you seen a Little Blue Penguin:
-What time of year/ day did you see it?

-Where did you see it?
-What kind of condition was it in?
-Approximately how long ago did you see it?

The results were mixed. Most penguin observations were of dead individuals on Wainui and Makarori Beaches. Comments that 'penguin were once under our house but are no longer heard or seen' were common. Several residents collected penguin and moved pairs to other areas such as Waikanae Beach. One pair was translocated to Mahia! The consistent theme from this survey was that dead penguin were found on beaches regularly and over multiple years. Indications were that roaming pet dogs had killed these individuals. Several have been recorded dead on the road at Tatapouri resulting from vehicle impact.

Fig 4: A kororā on Oneroa Beach on 13/2/22. A juvenile suffering from exhaustion which could easily have been mauled by a dog if not collected. This bird was sent to Napier Aquarium for rehabilitation (Photo Credit–Manu Caddie).

As with the Ecoworks NZ survey during 2004 the Tatapouri Dive site and adjacent area appeared to be the location where blue penguin were most successful however at this stage this is still a very small breeding group of c.7 pairs (resident's comment). The general indication is that blue penguin numbers had reduced between Wainui and Pouawa since 2004 and we believe this is likely due to the number of roaming domestic dogs which are prevalent on Wainui and Makarori Beaches all year. This added to low levels of ferret predation on coastal farmland between Okitu and Pouawa which is not trapped. Some trapping is underway on Turihaua Station which will assist any remnant kororā.

During 2002 John and Amy Griffin of New York purchased Nicks Head Station (Te Kuri a Paoa). Ecoworks NZ was asked to work in coordination with Thomas Woltz (Woltz & Byrd LLC) to design an environmental restoration programme. This included the restoration of over 26 native species including blue penguin which was once present at this historic site.

Coastal beach zones were stock fenced for the first time and planted with eco-sourced indigenous tree species. Extensive predator control for mustelids, feral cat, lagomorphs, possum and rodents was initiated and artificial nest boxes were installed for blue penguin. During 2004 solar powered acoustic playback was installed at Orongo Beach. Up until this date no breeding had been recorded and only occasional penguin presence was recorded during the annual moult phase.

Once the social attraction system had been installed blue penguin remained onsite and began to breed the following season. The development of this world first project has taken 18 years and building blue penguin numbers has been a slow process. We believe at least 20-25 pairs now breed on Te Kuri and with the extensive coastal planting which has included over 600,000 native trees, the protection of over 11 kilometres of coastline, total stock exclusion from coastal beach areas and 1500 hectares of intensive pest control and working alongside our Ngai Tamanuhiri whanau a blue penguin sanctuary has been created which will continue to build in size over time. Dogs are also excluded from these penguin nesting areas.


Figs 5-6: Te Kuri a Paoa – Young Nicks Head Coastline now protected with over 600,000 eco-sourced trees, pest control and predator exclusion fencing holds seven pelagic seabird species including Kororā, sooty shearwater, grey-faced petrel and fairy prion– Ecoworks NZ.

Ngati One One and the Whaia Titirangi Team with support from GDC and DOC have also undertaken fantastic work to protect this taonga species, the kororā. Both habitat restoration on Titirangi and the deployment of predator control and public relations efforts around managing domestic dogs will continue to support kororā recovery.

The local ferret population also appears to have reduced over time which will benefit blue penguin. Ferret capture rates appeared to be higher within mustelid trap sets within the Motu Kiwi Recovery Programme and Turihaua Weka Project during the late 1990-early 2000's. We now see 1-2 ferrets captured per annum at Motu throughout the same 1000- hectare trapping kiwi protection zone. The same trapping area, trap design and baiting regimen as used during the late 1990's. Rabbits are uncommon now and the ferret population appears to have followed suit.

On Nicks Head Station ferrets are an uncommon catch, 486 kill traps currently operate producing 15,000 trap nights per month. Between January 2003 and December 2020, 35 ferrets had been captured, 421 stoats, 482 weasels and 1,008 feral cats. A total of 35, 995 pests in total had been removed from 1500 hectares. This has allowed multiple species to recover within a coastal landscape setting.

These projects combined with the current work undertaken by Ngai Tamanuhiri at Te Wherowhero and Kopua Farm and other projects coming on stream will potentially see an increase in blue penguin numbers within the Muriwai-Kopua coastal zone (right).

3.1 Eastland Port Limited - Onepoto – Current Status.

During November 2021 a canine detector dog survey was undertaken by Eastland Port Limited who contracted experienced conservation dog handler Joanna Simm and her dogs 'Rua' and 'Miro' to search the port revetment wall for penguin sign. Jo has been involved with kororā management and dog searching at Napier Port for many years and has worked on some of the worlds most endangered seabird species at sites such as Great Barrier Island and Maui, Hawaii.

A total of 18 detections were recorded by Jo and Rua. Detections were made across all sections of the revetment wall. Upper and lower tiers and both old and new sections of the wall. Nine individual

kororā were sighted. Jo believes others were onsite, however were well hidden amongst the rock wall.

Fig 8: Locations at EPL southern log yard where kororā were identified by Jo Simm and search dogs Rua and Miro (Map Courtesy of Dabchick NZ -Jo Simm).

It is possible that more kororā were utilising this site prior to the de-construction of the old revetment wall and the associated vegetation cover. It appears that this site had established as an excellent blue penguin habitat due to reclamation debris being deposited many years ago, it was also a site largely protected from human and domestic dog disturbance. It is impossible to tell how many pairs have been disturbed since 2020 as a standard baseline survey was not undertaken prior to the de-construction work occurring. Pelagic seabird species such as kororā and petrel often have considerably larger numbers of individuals utilising a site than is often recognised by site managers. Napier Port is an excellent example of this with many more kororā present than they realised early in the project possibly due to the cryptic nature of visiting nocturnal seabirds. Petrels can be similar, the number of leg banded individuals visiting a site often far exceeds the known number of breeding pairs as differing age cohorts and breeding status individuals are utilising sites alongside resident breeding pairs. Kororā can nest in high densities within optimal rocky coastal sites, as has been recorded at many locations around New Zealand. They can be colonial nesters and pairs will happily nest only metres from each other if nesting cover is suitable, i.e. Motuhora Island and Young Nicks Head.

It appears that the significance of blue penguin at this site was overlooked throughout the resource management consenting process. Eastland Port Limited staff should have had the appropriate conservation management advice and operating procedures provided to them from the outset by experts. This would have ensured that this species was fully protected during the revetment de-construction phase.

By following standardised and well recognised survey methodology which has been in place for many years, and the inclusion of experienced seabird managers from the commencement of the project; the information flow and processes would have been in place to ensure full protection of resident kororā. Particularly as this species is fully protected and categorised as 'Threatened' by the

Department of Conservation and has a status described as 'Declining'. In fact this threat status is in our view, a 'best guess' for our region as we have no population trend data for a very large part of the Tairawhiti and in fact much of the New Zealand coastline. Therefore with this data deficient situation we are currently in; the kororā maybe significantly more threatened than we realise on the East Coast.

When we accumulate the potential threats facing blue penguin; including climate change, natural sea temperature variations and seasonal food availability, ferret predation, domestic dog predation, loss and modification of habitat, human interference, and natural mortality it is obvious that the kororā are threatened and will become increasingly conservation dependent over time.

4.0 Eastland Port Limited Aims and Objectives

This project aims to provide ongoing protection for visiting and nesting kororā as well as other protected species at the EPL -Onepoto site. This may include visiting fur seal, white-fronted and Caspian tern, cormorant spp., black-billed and red-billed gull or other native or endemic protected species.

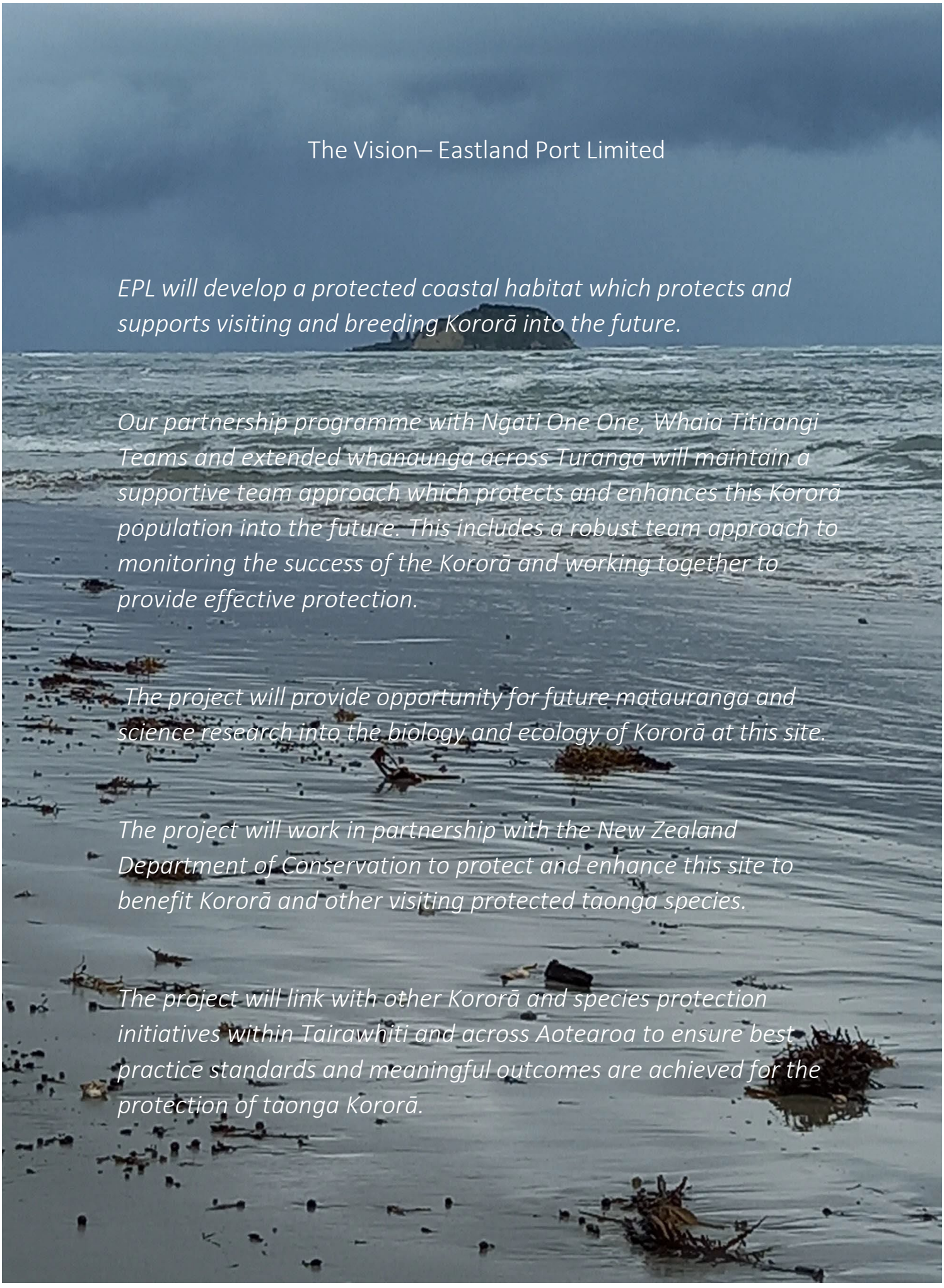
This project aims to contribute to the recovery of kororā within the Tairawhiti region by increasing the extant number of nesting penguin pairs at EPL – Onepoto. This site has the potential to make a significant contribution to Kororā protection and recovery within Turanganui a Kiwa.

The project aims to record a 5-10% increase in the number of nesting pairs per annum and achieve a >90 % fledging success rate for kororā chicks.

This will occur by:

a. Implementing best practice pest control.
b. Implementing best practice seabird management methodology, including experienced seabird specialist's and undertaking the field management and monitoring of this species and passing this experience onto our taiao kaimahi rangatahi teams.
c. Working alongside hapu, whanaunga and community groups across Tairawhiti to ensure information flow continues, matauranga opportunities exist and project inclusion continues within the management of this site. To ensure these key factors are ongoing into the future.
d. Linking with the Department of Conservation to manage wildlife authority permissions guidelines and management processes going forward.
e. Working with Gisborne District Council, DOC and the community to ensure local by-laws pertaining to dog control are strengthened and maintained within the Onepoto area.
f. Linking with seabird management specialists and other projects across New Zealand such as Napier Port Penguin Project and Oamaru Penguin Project to share and contribute to kororā recovery.
g. To work with local communities to promote kororā conservation and their protection at Onepoto and at other sites within Te Tairawhiti.

Fig 9: Kororā Location Summary - Anecdotal and confirmed recent kororā sightings documented by Ecoworks NZ, Wainui School, Jo Simm, Jordan Hawaikirangi-Tibble and Department of Conservation, Gisborne Office within the Turanga-Tatapouri Area.



The Vision– Eastland Port Limited

EPL will develop a protected coastal habitat which protects and supports visiting and breeding Kororā into the future.

Our partnership programme with Ngati One One, Whaia Titirangi Teams and extended whanaunga across Turanga will maintain a supportive team approach which protects and enhances this Kororā population into the future. This includes a robust team approach to monitoring the success of the Kororā and working together to provide effective protection.

The project will provide opportunity for future matauranga and science research into the biology and ecology of Kororā at this site.

The project will work in partnership with the New Zealand Department of Conservation to protect and enhance this site to benefit Kororā and other visiting protected taonga species.

The project will link with other Kororā and species protection initiatives within Tairawhiti and across Aotearoa to ensure best practice standards and meaningful outcomes are achieved for the protection of taonga Kororā.

5.0 Management Action Plan

The ongoing protection and management of kororā at Eastland Port requires a number of key actions. Some of these actions were instigated during 2021. Most of the following action points will be implemented during 2022 and ongoing collaboration will occur with key project partners.

The following table outlines these key actions and the associated timeline which is required to achieve optimal outcomes. These actions are described in further detail on pages 15-40.

Table 2:

Action	Notes	Timeline
1. Community Partnership Programme	Working with Ngati One One, Whaia Titirangi, Department of Conservation, Gisborne District Council, Local Residents, whanaunga across Turanga.	2021 -Underway and Ongoing
2. Kororā Population Survey & Monitoring	Seabird detector dog teams contracted annually to monitor penguin densities along port seawall and Titirangi toe slope. Camera trap monitoring.	September-Oct + if revetment development is occurring
3. Collection and Necropsy of Kororā Mortalities	Any mortalities are collected to be necropsied by Massey Wildlife & Veterinary Hospital to determine cause of death.	Ongoing when and if required
4. Management Plan	To guide the protection and recovery process following national best practice standards.	Completed by 1/4/22
5. Obtain DOC Permissions Authority Permits	Allow translocation of potentially at risk kororā to safe burrows and to allow chick productivity monitoring of Kororā at Eastland Port.	Submitted to DOC Permissions June 2022
6. Penguin Fence Construction	Penguin & ferret proof fence to prevent ingress of kororā into Southern Log yard and possible ferret access to the kororā colony site.	Completed by 15/7/22
7. Penguin Access	Ensure penguin access at low tide is possible at multiple locations.	Completed by 1/7/22
8. Predator Management & Monitoring	Deploy predator management hardware in the field. Ecoworks NZ to assist with operational training, sourcing and deployment with Whaia Titirangi Camera trap monitoring and tracking tunnel indices to record pest densities.	Equipment deployed June 2022
9. Installation of Penguin Nest and Roosting Boxes.	Installation of protected breeding burrows which are insulated against over-heating, vehicle and human interference.	Installed June 2022
10. Future Construction Operations	Managing Kororā pre and post construction, repairs or upgrade.	Ongoing if and when required.
11. Seasonal Kororā Monitoring	Pair distribution, camera trap monitoring, record reproductive success of extant pairs both within wild and artificial nest locations.	Commencing July 2022
12. Annual Reporting	Summary of penguin productivity, community involvement, population monitoring, predator management summaries, penguin chick productivity and survivorship.	Ongoing

5.1 Community Partnership Programme

This programme will be ongoing into the future and will expand and extend multiple relationships and therefore the positive benefit for both the kororā population at Eastland Port and surrounding coastal areas. This programme will have significant benefit for our community including kura within Turanga and the many rangatahi involved within the mahi o te taiao programmes currently underway within Turanga and the wider Tairawhiti Region.

Taonga species such as kororā are significant to our region and contribute to a species ecosystem richness which was once abundant across Tairawhiti prior to the arrival of humans approximately 800 years ago. The majority of indigenous habitats across Tairawhiti are now either functionally extinct or at best highly modified. The introduction of vertebrate pests beginning with the kiore and kuri and followed later by Norway rats, mustelids, feral cat and ungulates has created an alien landscape for most of our native species.

Protected micro-habitats such as the breakwater and rock-wall log yard construction at Eastland Port unintentionally become biodiversity hot-spots or 'Ark's' for species such as Kororā.

This project will protect and enhance this site by implementing operating procedures around Kororā , reducing predator impacts, i.e. ferret and by providing safe roost and nesting habitat for Kororā within the structure of the port. By working closely with Ngati One One, the Department of Conservation, seabird ecologists, local kura, hapu and whanaunga within the region there are multiple opportunities to link our community into meaningful and hands – on marine and biodiversity conservation.

Having a thriving Kororā population linked with the collective mahi undertaken on Titirangi and other nearby sites by our communities we rapidly build pride, ownership, mana and respect for the people, places and the taonga species within them. This exciting project has the ability to achieve this outcome.

A wide range of opportunities will build with this project over time as we have seen with the Napier Port Project. This will include engagement from kura, the opportunity for Ngati One One to oversee the in-situ management of this species, build species management skills and experience and hold wananga which will bring others into the programme. These projects build knowledge around biodiversity management, matauranga values and experience for the wider community and whanau.

Fig 10: Linking communities with the protection and recovery of taonga species such as Kororā, kiwi and tuatara has incredibly positive benefits not only for the species you are protecting but also the people. Tipare Wharepapa with a Tairawhiti kiwi.

How will this happen?

March 2022 – Advice will be sought from Ngati One One representatives regarding kororā management, the history and significance of kororā at Onepoto as well as within Titirangi ngahere and any local knowledge, experiences and future aspirations for this taonga. This input will form a key baseline for direction going forward into the future. The values and expectations from Ngati One One

and other whanaunga across Turanga which will contribute to the development of this kororā programme.
May 2022 – Detector dog monitoring programme during minor excavator works to be completed prior to the installation of new and improved roost and nest boxes.

June 2022- Titirangi Kaimahi for Nature personnel will be involved with the deployment of mustelid and rat control equipment with Ecoworks NZ which links into the current vertebrate pest operation on Titirangi.

June 2022 – Titirangi Kaimahi for Nature personnel will be involved with the installation of 20 kororā nest and roost boxes extending along the upper rock-wall working with Ecoworks New Zealand.

October -November 2022 – Deployment of remote camera monitoring and detector dog search monitoring to identify and record nesting blue penguin pairs. This will add valuable information to the baseline data set and allow us to record population trends over time.

April 2023 onward - Annual Pakeke hui and updates as well as a summary report on Kororā productivity, pest control summaries and general kororā management activities.

Fig 11: Muriwai Kura Kaupapa students install Kororā nest boxes at Te Kuri a Paoa – Nicks Head, Gisborne (*Photo* -Ihipera Whakataka, Principal, Muriwai Kura)

5.2 Kororā Population Survey & Monitoring

Annual population monitoring is vital. This allows us to measure whether the conservation management effort is successful or not. It also allows us to record the rate of population expansion and what we can do to enhance or ensure that what we are doing is as effective and efficient as possible in terms of methodology, labour effort unit and financial investment.

Monitoring will include:

a) Detector Dog Searches
b) Camera Trap Monitoring

5.2.1 Detector Dog Survey and Monitoring

Detector dog monitoring will be undertaken annually during September-October to identify and GPS waypoint (NZTM) nesting pairs and individuals amongst the rock wall structure. Detector dogs are trained to sit or indicate when a target has been located. Over time we should begin to record an increase in the total number of pairs nesting along the seawall.

Pelagic seabirds have a strong scent signature which is easily detected by a dog's nose. Often single or pre-breeding penguins will be located by the dog however further inspection by the handler with a headlight or camera phone can often determine whether a breeding pair is present or not. Trail cameras can also be deployed at a later date to assess the breeding status of individuals in difficult to access locations, burrow-scopes are an additional and effective tool.

Due to this site being a largely dog, vehicle, ferret and human free zone we should record a steady increase in penguin pairs. Pre-breeder survivorship in blue penguins is low (c. 70% mortality, DOC 2010) however over time it is likely we will see an increase in penguin density.

Figs 13-14: Conservation dogs are a highly effective way of determining penguin presence and density without human search bias. Above Left – Tui (Ecoworks NZ) locates a blue penguin burrow in dense grass sward 100 metres above the coast on Mana Island, Jo Simm working in lava fields at 10,000 ft asl on Mt Haleakala, Hawaii searching for Hawaiian Petrels (*Ecoworks NZ Photos*).

5.2.2 Camera Trap Monitoring

Camera monitoring is an effective observation tool for blue penguin and other seabird species. Penguin however do seem to know the cameras are there. Petrels, penguins, shearwaters and prions arrive at their burrows after dark therefore observing behaviour and estimating population densities can be challenging.

Fig 12: A kororā using a communal access track on Young Nicks Head Station, Gisborne.

Often blue penguin will use a primary access route to enter and exit a colony site to and from the tide line. In some areas these tracks are used over many generations, and we have recorded significant tracks cut into hard bedrock formed by many generations of seabird using the same access route.

Camera trap monitoring used at specific times of the year and over a consistent period can provide a relative index of abundance for a variety of species. This is often difficult to gauge over 1-3 years, however consistency over multiple years will start to form an indices of abundance for your selected target species, in this case kororā.

Camera trap monitoring should be carried out at five locations on the sea wall between mid-September and mid-October annually. These sites should be permanently marked so they can be located easily in consecutive years with the photo-point bearing recorded. Setting up remote cameras can be quite an art form! So some advice from an experienced person is advisable so that effort is not wasted.

Another option which allows for excellent observation of pelagic seabirds is to use thermal imagery. This has been used by Ecoworks NZ at a number of sites within Tairawhiti and in Hawaii and has been an effective tool to record grey-faced petrel, sooty shearwater, blue penguin and kiwi activity at remote sights and when no moon is present.

Fig 15: A group of pre-breeding grey-faced petrel (*Pterodroma macroptera*) at Young Nicks Head, Gisborne, July 2021. Observations made using a thermal camera allow us to estimate number of individuals present which is otherwise impossible with fast flying nocturnal procellariiformes.

5.3 Collection and Necropsy of Kororā Mortality

Under the Wildlife Act 1953 the kororā is a protected species. The Wildlife Act is administered by the NZ Department of Conservation. Anyone wishing to handle, catch or hold, release or kill, hold for rehabilitation or hold kororā in captivity is legally required to hold a Wildlife Authority Permit from the Minister of Conservation.

We expect that there will be very few threats to kororā safety once the penguin fence is installed and predator control is deployed. However in the event that a dead kororā is located the project will continue to work closely with staff from the Department of Conservation, Gisborne Area Office to monitor, record and notify within 24 hours any recorded kororā deaths within the scope of the project itself.

The Department of Conservation will forward any recovered kororā for necropsy to Wild-Base Hospital, Massey University.

Kororā Death – what to do?

Contact the Project Manager - Daniel Kingsford at Eastland Port +64 6 868 5129
Cell - +64 27 883 0068
Eastland Port Limited Office - No. 2 Crawford Road, P.O. Box 1048, Gisborne 4040 | eastland.nz

Collect the bird ensuring personal protective equipment (PPE) is used to protect yourself.

Collect and or photograph any evidence in the area which may indicate cause of death. Treat it much like a crime scene. Often dogs, cats and mustelids will leave sign of their presence, i.e. fur balls, hair, footprints in the sand and bite marks to the rear of the cranium etc. which indicate possible cause of death. The softer pelvic bones such as the cranium and sternum will often reveal dentition patterns which can help identify the predator species involved. This can be difficult to do in the field so collect all available evidence at the site.

Fig 16: Kororā killed by roaming dogs. DOC Ranger, Nicky Armstrong, with five dead blue penguins, West Coast, (*Photo Credit – Department of Conservation*).

If the kororā has been killed only recently, swab the area around the wound with a cotton bud and store the cotton bud in a clean plastic bag because the DNA in the saliva of the killer may identify the culprit down to species level. Individual dogs can also be identified (e.g. to determine if one dog or ferret is decimating a population). These saliva swabs can be analysed by Ecogene - ecogene@landcareresearch.co.nz; (09) 574 4225. DNA swab kits are available from Ecogene.

Discuss with DOC staff regarding who will contact Wildbase Veterinary Hospital and arrange shipment of the bird to Massey for necropsy. Also fill out and email a wildlife submission form. This is available at:
www.massey.ac.nz/massey/fms/NZ%20Wildlife%20Health%20Centre/huia_submission_form.pdf

All kororā deaths will be necropsied. This is a tool which can provide valuable information regarding cause of death and whether the project can do anything to prevent this from occurring again in future.

5.4 Management Plan

This management plan will link closely with the DOC Wildlife Act Authority and therefore this plan should be reviewed and updated at ten yearly intervals which is consistent with the term of the wildlife authority.

This should include a review of the project with Ngati One One Iwi, hapu and whanau which includes discussion on the successes and failures recorded and any fine tuning which may be required in future. The Department of Conservation or other seabird specialists should also be included within this process.

5.5 Obtain DOC Permissions Wildlife Act Authority

A key aspect of any species recovery work is information flow to project partners and liaison with iwi and hapu, DOC species management specialists, landowners and community.

During the initial project set-up and permitting process, consultation is undertaken with iwi and hapu, Department of Conservation staff, landowners, project sponsors and a range of other interested or involved community groups and individuals. It is important to remember as the project progresses and time goes on that these key people that were supporting the project initially need regular updates and involvement going forward.

We are basically all after the same result - great conservation outcomes for our biodiversity. By involving community the project will continue to maintain a robust support base, community ownership and support the kaitiakitanga of this and other species.

An 11a Wildlife Authority outline and application will be submitted to DOC Permissions, Hamilton during 2022. This will seek a maximum 10-year permit to ensure that project managers have the ability to work with the Department to re-locate any individual kororā which is potentially at risk, to a safe penguin roost box on the port rock wall. This should be an uncommon occurrence however there maybe instances in future where kororā have transited outside the revetment wall area, around the fence or port area and are found within the log-yard, on Kaiti Beach Road or have been injured by wandering domestic dogs. This translocation authority will give project managers the ability to work with DOC Gisborne and local veterinarians to coordinate the re-location of these individuals into a safe artificial nest box during daylight hours so that they can then exit back out to sea the following night. The key here is good communication between key people and good advice from DOC staff and seabird specialists.

To ensure the project has a continued team approach to managing kororā the project will maintain the following:

1. Annual Summary Report to DOC and Ngati One One– As part of the initial permit sign-off process with the Department of Conservation and Ngati One One it is important that the project produces a summary report for kororā each year. The best time to complete this is April. This is between seasons and a time when nesting and moulting effort is generally completed. The summary report will include all aspects of kororā management and include plans for the following season. This should be a team effort between the project advisor and Whaia Titirangi staff.

2. Annual Planned Kororā Hui with DOC Staff and Ngati One One– This should take place once the annual report is completed and prior to the commencement of the following season. This meeting will take place during the first two weeks of May each year. This is an opportunity to review the annual report, project progress and to discuss the overall direction for the up-coming season and any longer-term future plans.

3. Ongoing Korero with Key Partners - This ensures ideas, aspirations and opportunities all have the ability to link with the project. A team approach to protecting this taonga species is very valuable.

5.6 Penguin Exclusion Fence Construction

One of the key steps to protecting kororā at Eastland Port is the installation of a penguin proof fence to ensure kororā do not access into the southern log yard where heavy machinery is operating or where they have access under stored log piles which are then transported to waiting ships for export.

Two options were considered regarding the alignment of this fence. Figure 17, pg 21 outlines the preferred option. Option 1 considered running the line long the top of the grass bund wall. However there is high risk involved here which would impact the integrity of the fence when logs are being stored or moved within the yard there is potential for logs to damage the fence at this location. There are also access ramps and gates from the log storage yard up onto the wall. Overall this was determined to be an impractical line to establish the fence.

Fig 17: Penguin exclusion fence proposed line at Eastland Port.

The penguin exclusion fence will extend 260 lineal metres, along the top of the rock wall and will be located 1.5 metres out from the top of the revetment rock. This will allow suitable width to install 20 penguin nest boxes in year one positioned on the seaward side of the road at the top of the wall. This fence will run parallel with and along the south-west side of the existing access road (Fig17).

Fig 18: Aerial view of the Southern log yard revetment wall and proposed location of the penguin fence.

This penguin habitat area is largely limited to the 260 lineal metres at the southern end of the Southern Log Yard seawall. Korora have been detected within the northern portion, or remainder of the seawall however this area is not an optimal site to establish permanent penguin habitat due to its susceptibility to storm surge and exposure to increased wave activity from the open sea. The northern portion of the seawall frequently experiences wave overtopping throughout the year. This area is identified as the portion which has protection rock on the log yard side of the wall to prevent scour and sediment erosion from these waves.

The southern portion of the seawall is largely protected from increased wave height due to the buffer effect of the Onepoto wave platform which is exposed at low tides and extends out into the bay approximately 100 metres. This area does not experience large wave activity or over topping and consequently vegetation is able to be established here along with protected korora nesting and roosting habitat.

The full length of the revetment wall will be managed in accordance with the relevant Wildlife Act Authority to ensure full protection is given to blue penguin throughout this site.

The existing road access will be used during the development phase of the new reclamation area at the northern end of the yard throughout 2023. Once completed this access road will be used only for occasional maintenance and access to the kororā colony area for monitoring and maintenance (D. Kingsford, *pers. comm.*)
The penguin fence design will be very similar to the successful design used at Napier Port (right). After discussion with Paul Rose, Napier Port Environmental Advisor, this design has worked very well and is proven to work well for kororā.

The design will include 50mm galvanised capped pipe frame with a 25 mm aperture mesh. This will extend from ground level to c.800mm in height. The fence will also have a UV resistant shade netting attached which acts as a visual barrier for Kororā , similar to the Napier Port design. Paul Rose mentions that the shade netting is very effective and creates a visual barrier therefore eliminating the need for kororā to try and push through the fence. This will contain kororā on the seaward side of the EPL access road. The fence will also have a 400mm wide apron which will be covered with road metal to reduce any potential entry by ferrets and ensure no digging under the fence is possible by kororā. Ferret traps will be run along the outside (southern log yard side) of the fence where penguin can not gain access to trap boxes.

Figs 19-20: Napier Port colony site showing the penguin fence which prevents kororā exiting the colony and entering vehicle access areas (*Photos Supplied – Paul Rose, Napier Port*)

Mustelid double set traps and DOC 250 single sets will be run along the road side of the Gisborne penguin fence in the event that ferret or stoat pass through the predator trap halo outside the port area to the kororā nesting area. Permanent and lockable rodent bait stations will also be run along the seaward side of the fence at 50 -metre spacing to maintain Norway and ship rats at low densities. Feral cat control may be required at times (refer pg 23) and wandering dogs will be excluded as the new perimeter fence is constructed by Eastland Port.

5.7 Penguin Access

Kororā are excellent climbers and jumpers. We have recorded this species accessing very difficult boulder coastline habitats on Motuhora and the Chatham Islands where sea conditions are generally extreme.

We have recorded kororā accessing steep mudstone faces at Orongo Beach on Nicks Head Station (right) and climbing over 100 metres in height to the top of southern Mana Island in Wellington to access nesting burrows. Some nesting colonies have only 1-2 access points and many individual kororā will use the one entry point and then walk several hundred metres to access their burrow.

Fig 21: Kororā prints on an almost vertical face at Orongo Beach, Tairawhiti. Many kororā use only three entry points to the colony site.

Currently kororā appear able to access the upper parts of the Eastland Port rock wall. Approximately seventeen penguin detections were made by Jo Simm and seabird dog 'Rua' during November 2021 along the length of the wall. Nine kororā were seen by Jo, Rua indicated another 9 locations where kororā were either hiding or had been residing recently.

Fig 22: Eruera Ria from Ecoworks NZ measures the front face of the akmon toe blocks at low tide.

Some additional remedial work will be carried out at the base of the Akmon blocks to ensure kororā access is as simple and safe for the birds as possible. This would entail re-positioning boulders at strategic locations and monitoring this as part of the overall project to ensure particularly at low tide that kororā can access from the wave platform up and over the concrete pre-cast akmon blocks. These inter-locking pre-cast concrete blocks have a mean face height of c.500 mm. Between the blocks however there is area for kororā to jump and gain access from the wave platform up onto the rock wall.

Additional remedial work will be undertaken throughout this site to remove some of the old steel. Some of this work will take place during May 2022. This is a safety issue for both staff, detector dog teams and the penguins themselves.

5.8 Predator Management

The last thirty years has seen a major shift in ecosystem and species management. We have a much greater understanding regarding the impacts of vertebrate pests on our endemic biodiversity, how to control these pests and what level of control is required to protect many threatened species and ensure recruitment of progeny into breeding populations.

Conservation managers across Aotearoa lead the world with their pioneering island eradications, endangered species translocations and general ecosystem and species management.

We have a much greater understanding of vertebrate pest ecology, density and dispersal and what level of control or ongoing population management is required to maintain pest densities at specific target levels, i.e. ship rat indices at 10% to increase North Island robin. There have also been major advances in the development of trapping technology, bait design and its presentation to the target pest species. This research and development is ongoing, i.e. Goodnature, SA traps, Spitfire, Pest Free NZ, ZIP Foundation etc. Modern pest control programmes have to be flexible and willing to adapt to changing best practice methodologies being developed worldwide but largely here in New Zealand as we aim for predator free status in 2050.

The following information outlines the current recommended methodology for pest control projects, with site specific controls and targets for kororā at Onepoto managed by Eastland Port Limited in association with Ngati One One.

5.8.1 Feral Cat

Feral cats pose a significant threat to New Zealand's endemic wildlife. They prey on a wide range of species including forest birds, petrels, skinks, geckos, saddleback, weta, native fish and are considered a threat to Kororā chicks (Port Taranaki 2016).

Cats are long lived and can hold a large territorial range. Radio tagged male cats in the Whitikau Valley near Opotiki were recorded to have a territory of c.350 hectares (*Ecoworks NZ Ltd*., 2004). The largest feral cats captured at Motu have been recorded to weigh well over four kilogrammes. One caught at Lake Waikaremoana during 2003 weighed 6 kilogrammes (P.Hodgson *pers. comm.* 2005).

Live Capture Cage Trapping

Cage trapping is an effective tool and optimal where sensitive non target protected species are present. Cage trapping should be undertaken using either a large Havahart 'treadle' trigger design trap or a large standard possum trap with a bait hook. The bait used should include pilchard or an oily fish bait equivalent inside a leg stocking and tuna fishing lure oil applied to the bait. The tuna oil should also be applied to an adjacent high point where the wind will carry scent. Pre-feed using the same fish or cat biscuits should also be used in the area within twenty metres of the cage trap. This pre-feed builds the target cats confidence until it gets to the mouth of the cage where he gets an additional feed and then into the trap.

Cage trapping is preferable at this site due to the number of EPL staff and possibly members of the public present. When feral cats are detected by remote camera or are sighted by EPL staff an SA kill trap on a raised ramp or a live-catch cage trap could be deployed to ensure inquisitive kororā are in no way injured. Some feral cats will not enter a cage trap therefore an SA trap is an effective option.

Fig 23: A feral cat enters a 'Havahart' cage trap with a disguised floor treadle trigger which ensures a humane catch method for feral or domestic cats.

Steve Allen (SA) Trap

Traps are set at the top of a wooden ramp. The ramp is an 800mm length of 150 x 25mm H3 radiata. It runs at a 5-10º angle and extends from the tree with the lower end bugle screwed into the top of a 50 x 50mm tanalised wooden fence batten driven into the ground to a depth of 200mm (Refer photo attached).

Fig 24: A correctly positioned raised feral cat set.

Baits include either finely chopped pilchard, minced chicken pet food; seafood flavoured tinned cat food, or minced rabbit/hare. Another option includes peanut butter and dry cat food such as 'biscats' (Steve Allan, *pers. comm.*). The fish-based baits should have tuna fish oil applied to them. A small quantity of bait is positioned in front of the trap as a pre-feed and lure. The majority of bait is positioned behind the trap trigger.

Pre-feed must also be laid on the ground below or in front of the trap and on the ramp leading up to the raised set itself. These traps are approved for use on feral cat by the DOC Animal Ethics Committee.

Warning Signage

Warning signs must be visible at public access points into the control area to warn visitors regarding the presence of cat control operations.

Trap Catch Recording

All trap catches must be recorded. Preferably on a trap catch Application. The data to be recorded must include:

1) Date Caught

2) Trap No. & Location

3) Sex

4) Any other relevant details, weight, colour, gut content etc.

Monitoring

Cat presence-absence monitoring is a simple task. Camera traps are ideal and will notify by cell phone when a cat is present and triggers a photo capture. Cat interaction frequency recorded via camera traps will be used at this site as a monitoring tool to record feral cat abundance and changes over time.

Outcome measures would include annual reproductive output of penguin pairs and whether feral cat impacts were recorded onsite.

Our experience with kororā suggests that cats are not a major threat, however some locations throughout Aotearoa have recorded cats being a significant issue for kororā.

Figs 25-26: Camera traps at Cape Sanctuary and James Camerons Project, Wairarapa detecting feral cats.

5.8.2 Rodents

Species identification

Four species of rodent are found in New Zealand.

- Norway Rat (*Rattus norvegicus*)
- Ship Rat (*Rattus rattus*)
- Kiore (Pacific) Rat (*Rattus exulans*)
- Mouse (*Mus musculus*)

Ship Rat

The ship rat is the most wide spread and abundant rat species in New Zealand. They are generally arboreal (tree climbers) and will nest above ground in the tree canopy where they prey on birds, invertebrates and reptiles. They also consume large volumes of seeds, berries, fruit and shoots. They are voracious predators and have been recorded attacking mature forest bird species such as kereru and kokako as well as seabirds, reptiles and invertebrates.

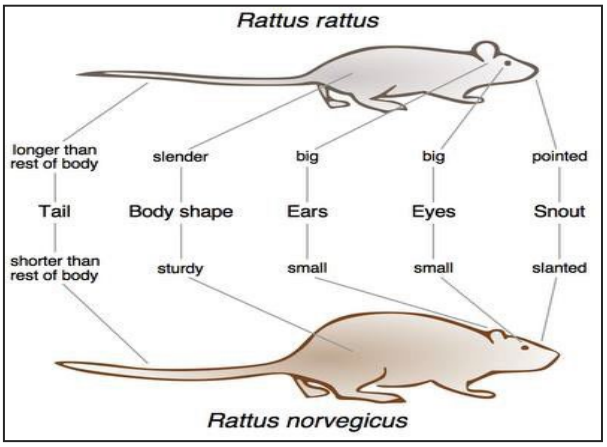
Norway Rat

The Norway rat is also known as the water rat. They are burrowers and can grow to over 500 grammes in weight and will likely be the most prevalent species found at Onepoto. They are predatory and feed on invertebrates, worms, gastropods etc. in or around waterways. They are poor climbers and are most abundant in warmer climates to about 400 metres a.s.l. They are avid consumers of bird's eggs and generally make up a large percentage of mustelid tunnel bi-catch species in coastal areas. They are distinct from ship rats in that they are generally larger and have a brown coat with crème belly fur.

They have small ears which hardly reach the eyes if pulled forward, the blunt nose profile and the thick tail which is less than the length of the rats body.

This species is thought to be one of the main reasons for the loss of many species on mainland New Zealand such as tuatara, saddleback and seabirds.

Fig 27: Norway rat –small ears, blunt nose, thick tail, a burrowing rat species.



House mouse

The mouse is most abundant in rank grassland sites where grass seed and invertebrates are plentiful. Though the mouse is small (c.30 g) it is a major predator of native skinks, weta and other invertebrates. The mouse does not pose a significant threat for Kororā.

Rat Control

Poison Baiting

Bait stations are the optimal control method at Onepoto. Baiting needs to be consistent and varied every 2-3 years with a mixture of bait types, i.e. Diphacinone, cholecalciferol, etc. Targeted control is undertaken to protect key biodiversity sites. The aim at Onepoto is to maintain low rat densities across the site to prevent potential impacts on eggs or young chicks. Cereal based poison blocks would be used within bait stations. No kororā would have access to rat bait directly or would be secondary poisoned. No 1080 (monoflouroacetate) or cyanide would be used.

Trapping

Norway rats (right) are relatively easy to trap and many are captured in mustelid Fenn or DOC traps as they are highly attracted to the holed egg and or meat baits. They also take poison baits extremely readily so they are relatively easy to eradicate from an area.

Ship rats prefer more cereal based baits such as peanut butter and rolled oats. They also take cereal poison baits readily. However as a back-up and to be sure that all resident and transient animals are removed, Victor Professional™ snap traps are also deployed. The most effective trap set design is to position the Victor trap inside a wooden box. This directs the rat more precisely onto the kill plate. The traps should be double spring victors pro traps with a plastic yellow trip tab. These boxes also prevent non target damage, i.e. penguin.

Snap traps should be spaced at 50 metres for rats. Bait stations on a 50 x 50 m grid to ensure <1-2% tracking index. Radio collared ship rats at Maungatautari travelled several hundred metres per night to search for food so they can cover a large area. Ship rats in podocarp forest can reach densities of 20+individuals/ha. High ship rat densities appear to attract stoats to an area so maintaining low rat densities has a number of benefits.

Warning Signs

Warning signs must be visible at public access points into the control area to warn visitors about the presence of toxins, bait and kill traps operating.

5.8.3 Mustelids (ferret, stoat and weasel)

Mustelids have a significant annual impact on wildlife in New Zealand. Their prey includes invertebrates, reptiles, native fish, birds and even our endemic bat species. Stoats in particular are the primary predator of juvenile kiwi and many bird species. They can range considerable distances during their lifetime and stoat populations can grow to high levels following years of beech mast (seed) and subsequent mouse population eruptions.

The ferret (*Mustela furo*) is the most significant mustelid species in regard to impacts on kororā. Stoat and weasel are considerably smaller and prey items therefore are usually smaller also, i.e. passerines, lizards and rodents.

Stoats can swim several kilometres at sea, climb into mature forest canopy and are fast enough to capture a mature rabbit. They are aggressive and determined predators with a high metabolism which means they need a regular food intake. DOC estimates an individual stoat will make over 350 kills per year.

All three species of mustelid are present in Turanganui a Kiwa.

Trap catch rates peak between November and late January when juveniles are dispersing and again during April-May when target prey items are less abundant. Female mustelids in New Zealand breed from September onward. They will give birth to one litter of 4-9 offspring per annum. The females within the litter are impregnated by a male prior to leaving the nest. Therefore mustelid populations (particularly stoats) increase rapidly. During the following autumn and into early winter 90% of the year's offspring will die. Catch rates will generally slow during March with another rise in late May-June with hungry animals more likely to enter traps due to a reduction in invertebrate and rodent availability. Catch rates will slowly tail off over winter and begin to climb again during October the following year.

Trap Type

The most effective control method for use on mustelids at this location is the DOC 200 and DOC 250 kill traps (right). Ferret are the primary target at this site as they potentially have the largest impact on kororā. DOC 250 traps are placed as single sets.

Traps are baited with a single, holed hen's egg, erayz salted rabbit and either fresh rabbit or minced chicken pet food is also added. Single sets have become popular, this is largely because double set DOC traps can set each other off. Many managers have moved to using single sets to avoid this issue.

We believe a double set is more likely to catch the most trap shy mustelids. Particularly in sites containing high value native species such as kororā it is advisable to have the best possible trap design available, well baited and maintained to ensure loss of key adult breeding Kororā does not occur. In this case a combination of single set DOC 250 to control ferret and feral cats and Double set DOC 200's to target stoats and weasels will be deployed at Onepoto.

Wooden Set

The trap set is a wooden tunnel 600mm in length (800mm in weka areas). It is constructed of treated H3 radiata pine. Both 200 x 25mm for the walls and 250 x 25mm rough sawn H3 for the base. The box is screwed together using #2 square drive screws. The lid is made of 17mm plywood and cut 600 x 250mm. A warning sign must be stencilled on the lid with spray paint and in high visitor areas the trap boxes must be painted and presented to a high standard.

A plastic triangular track marker or cattle ear tag must also be screwed to the lid with the trap number on it (above). Cattle tags can be ordered from PGG Wrightsons with the printed number or code required for your traps. The 17mm ply trap box lid is screwed at diagonally opposite corners with a square drive 40mm stainless steel screw to prevent access to anyone other than the trapper. Treated ply is preferred as it does not buckle over time.

Netting Hole Size

In areas where ground nesting species such as kororā are present a double mesh screen is key. These screens also help direct mustelid's onto the 'trip plate'. Twelve- millimetre aviary mesh is stapled to each end of the tunnel using small fence batten staples and another screen is set 150mm inside the tunnel with a second mesh screen. An entrance hole is cut at the bottom corner of the outside screen (right), 5 x 5 squares in size. The inside mesh has a hole 5 x 5 squares also cut into the centre but positioned 3-4 rows high so that mustelids climb through the hole and land directly onto either the fenn or doc200 plate. I would recommend a slightly larger hole size at this site to allow easy access for ferret. It will be impossible for a kororā to access a double mesh screened trap set. An entrance hole aprox 75 x 75mm will allow access to all mustelids (including ferrets) and keep out protected wildlife.

In public areas a warning sign must be posted at entry points to the trapping block and the tunnels themselves should be attached to a tree or fence post with a chain and staple or coach bolt to prevent theft.

Trap and Tunnel Management

(1) Wooden tunnels must be set on a level surface. They must be firmly sitting on the ground and not able to 'wobble', as this discourages wary individuals.

(2) Trap lids must sit flat and firm. Buckled lids must be replaced and lids are screwed with a #2 square drive screw at diagonal corners, stainless steel in coastal areas.

(3) The traps must be set in the centre of the tunnel. They need to be placed on either side of the bait with springs on opposing sides of the tunnel. The traps must be positioned so that trap arms are 20mm away from the bait and sitting square in the box. Correct trap placement in the tunnel is vital when trapping stoats.

(4) A hen's egg is positioned dead centre of the tunnel. The egg sits in a 20mm hole drilled into a small piece of ply or a milk bottle lid and screwed to the floor of the tunnel. A hole must be placed in the top end of the egg before it is placed into the trap tunnel. Eggs should be changed every 2 weeks in summer and monthly in winter. Three bait types must be provided, egg, fresh rabbit and salted dehydrated rabbit (Erayz). Do not use fruit or fish etc. A rotten smelly egg will still catch mustelids.

(5) Trap tunnels need to be scraped clean of rat hair, hedgehog spines and other foreign matter, inside and out. Use a paint scrapper to clean the tunnel floor during each trap check.

(6) If using Fenn Traps the brass 'dog' and the hook must be lightly filed so it is free of corrosion and the trap trips efficiently under the lightest touch, i.e. a weasel.

(7) The galvanised trap plate must also be scraped clean with a wire brush, both top and bottom removing built up grime. The trap plate hinge and underside must be checked and cleared of cobwebs and other debris with a wire brush so that it operates easily. If the trap plate is not sitting flush with the trap arms when set it will require modifying. Even old traps can be maintained and will operate effectively if well managed.

(8) Set all Fenn traps extremely finely and on the very tip of the brass dog so that the lightest touch from a weasel is enough to trigger and catch quickly and smoothly .

(9) Again, the tunnel must be clean and clear of debris including grass at the entrance way, rat hair, hedgehog spines etc. Traps need to be kept clean and free of unwanted debris allowing unrestricted access for mustelids and so that they can see an easy escape route at the opposite end of the tunnel.

(10) Traps will all be painted and presented professionally with a warning stencil.

(11) All kills should be removed from the site. Leaving kills onsite feeds the predators we are trying to trap.

(12) DOC 200 traps do not require screwing to the trap box floor. They should be sitting so that they can be easily removed and cleaned. Wire brushed and reset and tripped to ensure they are catching effectively.

Trap Spacing and Placement

Trap Tunnels need to be spaced at a distance of 50 metres at this location as it is a high intensity management site with at least 15+ penguin detection locations within a 600-metre distance along the sea wall. Use a gps to get this spacing correct.

Traps must be placed in accessible and visible locations. Visual, olfactory and sound senses all play a role in attracting mustelids. Trap tunnels must be positioned on and run parallel with existing access tracks. In this case most sets will be positioned along the access road behind the colony site. Several traps will be placed between kororā nest boxes on the seaward side of the fence. These are natural routes which different animal species in the area will prefer to use.

Trap tunnels must be free of obstacles in and around the tunnel and more importantly the tunnel entrance. Place them where it is easy access for the trapper on a track or beside vehicle access. Walking up or downhill another 30 metres to a single trap is a waste of time and effort.

Also try and keep traps within a 'Trap Site', e.g. at 'Trap site 27' you may have a stoat set, an SA cat trap ramp and a rat bait station. All traps can be maintained by the trapper at one stop. All traps are within 5-6 metres of each other.

It is important to move a stoat trap every few months particularly if it is not catching, moving it just a metre or two can make a difference, strange but it works!

Trap Catch Recording

All trap catches must be recorded. The data to be recorded must include:

1) Species

2) Trap No. & Date

3) Sex & other features, i.e. bait used.

Species Identification

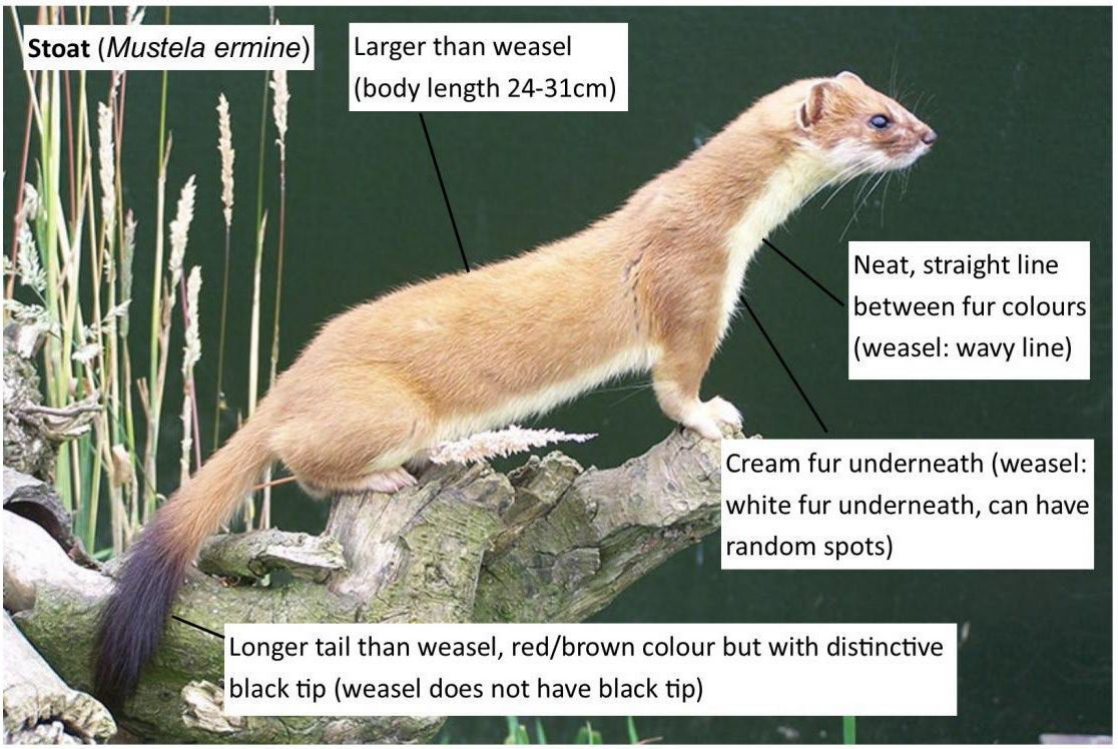
Ensure you can identify the three mustelid species effectively prior to commencing a trapping programme. Ferrets are the largest mustelid reaching lengths of 550 mm and are generally black and cream with a black facial mask.

Stoat (black tail tip)

Ferret

Weasel

Stoats are the next size down, they are chestnut brown with a white-crème belly and have a bushy tail with a black tip. The white belly fur forms a smooth lateral line along the body. Weasels are the smallest mustelid to be introduced to New Zealand they are similar to a stoat but have several discerning features. They are smaller than stoats, the cream-coloured belly fur forms an irregular lateral line along the body, and a weasel does not have a black bushy tail. The ears are also smaller and more rounded in proportion to the head



Mustelid Population Monitoring

Mustelid population indexing has been undertaken with mixed results throughout New Zealand.

Tracking tunnels are used to monitor mustelid presence and abundance. This has been proven to produce variable results (P.Dilkes, DOC, Eglinton Yellow Head Research Project, *pers. comm.*). Currently we measure mustelid control success by outcome monitoring the survival of key species such as our kororā chicks and brown kiwi chicks attaining a 1000 gramme stoat safe weight.

The EPL site is a small management area therefore population indexing is very difficult if not impossible. Camera traps will be used to detect any mustelid incursions. Mustelid traps will run all year, however trap check frequency can be reduced between April and late June each year. Chick productivity rates will provide the outcome monitoring data sets.

Bi-Catch

Several species are captured within mustelid tunnels as bi-catch to any control operation. Hedgehogs are the most common and can be found at a range of altitudes from coastal areas to beech forest, however they should be a rare catch at this location.

Other bi-catch species can include Norway rats, blackbirds, starlings, thrushes, green bell frogs and occasionally young rabbits.

Figs 39-40: Two options using DOC200 sets, the single set box and the double set at right with mesh holes cut to direct the target species onto the trap plate. We believe that single set DOC200's catch less than double set traps (*Photo Courtesy of DOC*).

Right- Occasionally weasels can be caught on peanut butter with Victor pro rat traps.
As a trapper it is vital to look for sign of predators while on the job. The far-right photo is a stoat scat (faeces). Aprox 7 mm wide by 50mm long and jet black. Rat fur is usually present. Hedgehog scat is similar but does not contain rodent fur.



Predator trapping is the foundation of most species protection projects in Aotearoa. The examples above show how a trap should not be set. These traps are not at all effective, will not catch mustelids and therefore a waste of time, labour and resources. Even though the trapper has visited recently (fresh eggs!) no trap maintenance has been done.

Stoats and weasels in particular can be very shy around traps or foreign objects. They will often visit several times prior to becoming confident enough to enter a trap box. It is thought now that some females maybe teaching offspring to avoid trap boxes altogether therefore avoiding capture. Once stoats have been 'spooked' from a trap it is probably very difficult to catch them again. The key is to have well managed and well baited traps running at all times. Even if it means you are able to service less traps on particular days the key is that the traps you have visited are set well. If you as the trapper have done this, then you can sleep easy knowing you have done everything you can to protect endangered species.



Figs 46-48: Cameras are a great tool to monitor mustelid activity. In this case stoats.

Table 5: Vertebrate Pest Management Targets at EPL/Onepoto Kororā Protection Area.

Target Pest Species	Control Method Options	Control or Outcome Target
Mustelids – ferret, stoat and weasel.	DOC 200 and Fenn No.6 Double sets at 200m spacing.	100% survival of juvenile & Adult Kororā at EPL/Onepoto.
Feral Cat	Cage Trap or Steve Allan trap.	100% survival of juvenile & Adult Kororā at EPL/Onepoto.
Ship and Norway rat	Ground based toxin application and Victor Pro snap traps within target areas.	Bi-annual tracking tunnel indexing target rate of <2.5% RTI.

Predator Control Layout – Ferret, Stoat, Weasel and Rat Control

5.9 Installation of Penguin Nest and Roosting Boxes.

Penguin nesting boxes have proven to be a fantastic tool throughout New Zealand to both encourage and protect nesting blue penguin.

The Oamaru Blue Penguin Colony Project is a fantastic example of this and one of the longest running kororā recovery programmes found in New Zealand. The Oamaru site started as a rock quarry and in 1993 a tourism operation and monitoring programme was established. By providing nest boxes, removing and managing vertebrate pests and by reducing disturbance as much as possible to kororā the project has built up a significant blue penguin colony. For example on 21st November 2021, 417 kororā returned to the colony after a day at sea (https://www.penguins.co.nz/). A very successful project indeed.


Oamaru Penguin Project Photo


Napier Penguin Project Photo

The Napier Port Project is another highly successful project which has incorporated habitat development, protection and the provision of nest boxes into the project design. The 2021-22 season fledged 13 penguin chicks after only two years in operation (Paul Rose, Napier Port Environmental Advisor, *personal correspondence*).

The Nicks Head Station Penguin Project has been operating since 2004 and now holds 20-25 nesting pairs at Orongo Beach and started in 2002 with no resident breeding pairs. After several years of monitoring moulting birds an acoustic sounds system was installed and has managed to hold birds onsite where they have stayed and bred successfully. This project has also included pest control, the installation of kororā nest boxes following the Oamuru – DOC recommended design and maintaining a disturbance free site where kororā pairs can breed and moult without interference.


Ecoworks NZ Photo

The Eastland Port-Onepoto site will initially install 20 kororā nest boxes. The specifications for these boxes will be based on current best practice and proven design (400 x 500 x 250 high) Dave Houston, Oamaru.

The EPL boxes will be constructed with 20mm high quality plywood with locked inspection access lids to enable monitoring of chicks to take place. The exterior will be painted with an exterior quality weather-proof coating.

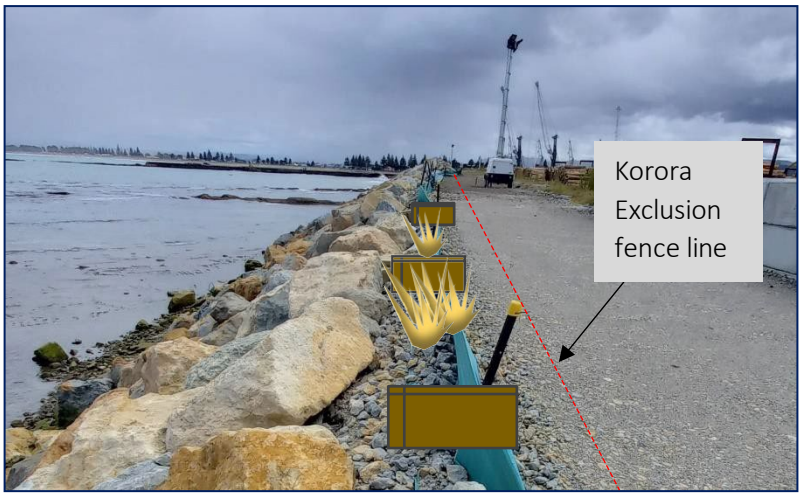
The base course under each nest box will be 75 mm higher than the surrounding ground level and include a free draining fine pea metal over the existing 40-60mm base course. This will then have a 75 mm soil layer and nest material added within each box.

The exterior of each nest box will be layered with 60-100 mm diameter rock cobble which will be mounded around and over each nest box to provide heat protection particularly from the Gisborne summer heat and allow air flow.

Fig 52: General nest box locations above EPL revetment (*Photo Supplied -EPL*).

Approximately 1200-1500 mm will be available between the upper boulders of the revetement wall and the kororā exclusion fence. This will allow ample space to deploy the 400 x 500 mm nest boxes with their corresponding stone/rock protection. There are no guarantees that kororā will readily use these artificial nest boxes and may prefer the rock wall, however we hope over time these will become well used as we have seen at various other locations and will therefore allow the Ngati One One teams to monitor breeding success and the survival of kororā easily at this EPL site.

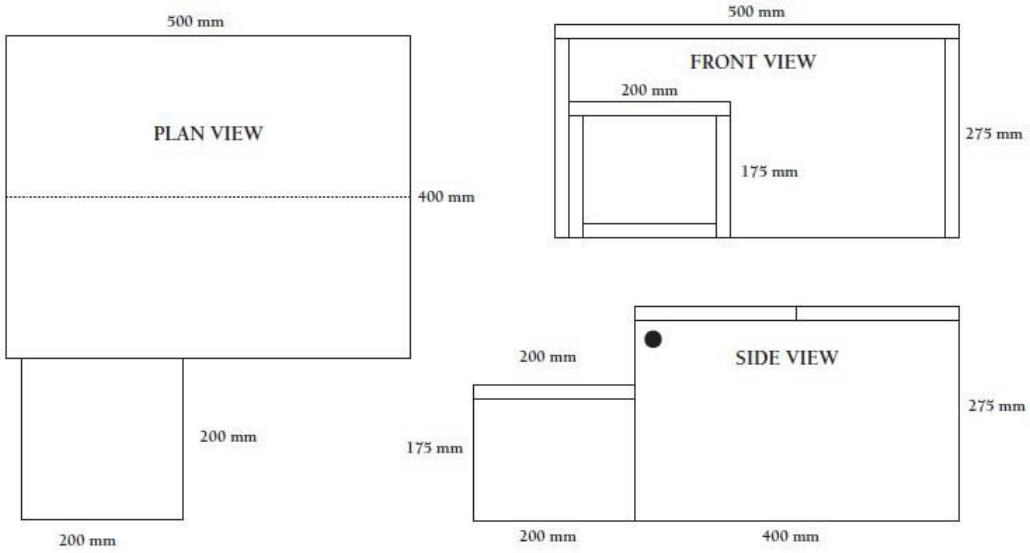
As seen here in Figure 54: the temporary shade netting fence will be removed. The new penguin exclusion fence will be positioned 1.0 metres closer to the centre of the existing access way allowing space to install the foundations and the kororā nest boxes themselves.



An excavator will be provided to supply the appropriate rock, sand and shingle to establish these nest box sites and re-locate any boulders if required to provide additional space for each nest box. A sand tussock or similar low growing coastal plant species will

also be situated between nest boxes to both improve the aesthetics of the site and to provide additional summer shade cover for visiting kororā.

Penguin Nest Box Measurements





https:/ nguin-p

Penguin Nest Box inspection lids made by Ecoworks NZ for petrels, shearwaters, prion, Kororā, kiwi and tuatara. These are waterproof, easy to inspect and can be easily locked if needed. Each burrow is numbered with a cattle tag and GIS mapped. Breeding records relate specifically to that burrow.

5.10 Future Construction Operations at EPL

Any future de-construction, re-design or upgrades undertaken on or around the EPL revetment walls will include a Kororā monitoring plan which aligns with the conditions set out within the term of the Wildlife Act Authority obtained through the Department of Conservation.

As described earlier, Kororā can be resident at any time of the year. Construction action should assume that individuals are present prior to works being undertaken.

Communication with key project partners prior to these operations commencing is paramount.

The following step process will ensure that resident and or visiting kororā will be protected during any construction work being undertaken. The aim of any future site construction works is to ensure that no kororā are injured and that no mortalities are caused to this protected species at this site.

Kororā Management Plan is completed, consents and relevant authorities are obtained to carry out de-construction, structural/storm repairs or remedial works on revetment wall or other sites likely to contain kororā or other protected species

Work to take place between 1st April and 30th June

Note: Kororā may be present at all times of year

Department of Conservation Area Office and Ngati One One informed of intention to commence revetment construction activity

EPL Safety Management Procedures completed and signed off prior to operation involving all staff & contractors

DOC – Gisborne Area Office and Wildlife Veterinarian Jamie Foxley notified at Eastland Veterinary Clinic 48 hours prior to work commencing. Napier Aquarium and or other penguin specialists will be notified if required

Detector dog search undertaken to include the area impacted by construction activities for that day only. Multiple dog searches may be required depending on the size of the construction area

Human search teams present to assist detector dog team to evaluate the presence of kororā using cameras, burrow scopes and experienced seabird personnel -GPS and mark dog detection sites

Ensure human scent or actions do not disrupt the dog team's ability to locate kororā. Work well away from dog team and down-wind. Work quietly do not communicate with dogs

Are Kororā Present?

Yes

Unknown

No

Work continues with an observer

Experienced and DOC permitted operator extracts korara if possible by hand, using PPE and following DOC permit conditions

Individual cannot be extracted

Excavator carefully removes top layer of rock with an observer present. Dog team on standby to locate birds as material is carefully removed maintaining a watch for kororā or other protected species

Kororā are located

Kororā are carefully extracted and placed within a clean wildlife carry box. Individual is scanned for a micro-chip, checked for wing tag. Condition assessment is undertaken and operation is fully documented. PPE is required as korora bite

Kororā is translocated to a secure and permanent artificial nest box within the same project location where it can be protected and depart to sea when ready. Preferably a nest box not currently used by a known breeding pair

Experienced person or DOC species/seabird person and dog handler to work with excavator operator to carefully extract material following all safety precautions, awareness of all identified and potential hazards whilst working around heavy machinery. Take advice from operator

Continued and careful inspection is made during the operation to ensure more kororā are not present as material is removed or installed

New birds may arrive during the following night therefore search and monitoring maybe required each day prior to construction activities occurring

Follow up check is carried out to monitor the health of all transferred individuals the following day

Note: The seawall has been designed and constructed to protect the Port assets from the natural forces of the sea. Whilst this is a durable structure, on rare occasions the impacts from storm events could result in damage that may require immediate repair. In this situation where emergency works are required, best endeavours will be made to follow all steps of the construction operation

5.11 Monitoring

This is an important aspect of the project and would be undertaken from mid -July through until late February. Monitoring the number of pairs, breeding success and chick productivity to fledging allows us to record and measure overall project success.

Korara begin nesting in Gisborne around mid-late July. The incubation period is generally c.36 days therefore the aim is to reduce disturbance to nesting adults as much as possible, particularly through mid- July to mid –November.

Nest monitoring should not be in any way invasive. Particularly through July until mid-November, monitoring should include using entrance stick hazes, using the classic seabird 'sniff' test, quiet and careful burrow inspection lid checks (if needed), trail cameras, detector- indicator dogs and monitoring for penguin sign, i.e. guano, physical sign of burrow/shelter use, careful searching. Throughout the earlier stages of the season birds are establishing nests, egg laying and have eggs in-situ and it is often possible to tell where active birds are located. We can gather productivity data later when birds are well into incubation or have chicks in burrows. We believe a hands-off policy works well, the birds know what they are doing and too much disturbance is detrimental.

Initially all known wild nest sites including those identified by Jo Simm will be monitored for activity. The twenty nest boxes deployed during June 2022 will also be checked for signs of activity commencing early July each year. Nest monitoring checks from mid-September through to mid-November should be undertaken at 2-3 week intervals with extreme care and with as little disturbance as possible. Kororā are a robust species in comparison with others, i.e. brown kiwi, and generally do not tend to abandon eggs or chicks, however nest monitoring should be carried out only when it is necessary. This avoids disturbing nesting adults and any potential damage to eggs in the nest particularly those at an early and more sensitive stage of incubation.

Sub-adult or pre-breeding individuals (c.2-3 years of age) may also be establishing within new burrows so this disturbance needs to be minimal so that kororā are not overly disturbed and potentially abandon nesting locations. We have recorded this occurring with threatened pelagic seabirds previously where monitoring with best intentions has irrevocably disturbed individuals who abandon the burrow altogether.

Once nesting is confirmed a 2-3 weekly and very brief inspection should take place. Aided with trail cameras some valuable data will be collected from Onepoto over time (Kororā Penguin Recording Sheet example – appendix 1).

A database will be created to record the information collected in the field. Many nest sites will likely be well hidden beneath the revetment wall structure and may be difficult to monitor. This is where trail cameras may help once the site is secure from human disturbance. It will probably take some time before the nest boxes are full and a sample set of nesting boxes can easily be monitored by using inspection lids to record nesting success. Combined with vertebrate pest monitoring this will allow the project to gain a comprehensive picture as to the success of this species at Onepoto. Ongoing annual detector dog monitoring will allow the total number of penguin locations to be recorded over time which should indicate project management success.

At the conclusion of each breeding season the key information required includes:

-Total number of active nest sites & breeding pairs and locations recorded

-Number of nesting attempts – inc no. eggs, no. chicks, clutches produced

-Number of chicks successfully fledged.

-Cause of non-fledged chicks.

-Number of eggs, chicks or adults impacted by predators, human disturbance, domestic dogs.

- Number of eggs, chicks or adults impacted by other disturbance factors.

-Predator density and frequency. Tracking tunnel indices, camera trap records and trap catch data.

-Monitoring frequency.

-Monitoring issues, disturbances and how monitoring aligns with DOC permit guidelines.

-Additional monitoring over time could include banding or pitt tagging juvenile kororā bred at the EPL Onepoto site.

5.12 Annual Reporting

Annual Kororā Summary Report to EPL, DOC and Ngati One One– As part of the initial permit sign-off process with the Department of Conservation and Iwi it is important that the project produces a summary report for Kororā and other protected species each year. The best time to complete this is annually during April. The summary report will include all aspects of kororā management and include plans for the following season and how the project relates to and supports DOC Conservation Management Strategic Plans.

Annual Planned Kororā Meeting with DOC Staff – This should take place once the annual report is completed and prior to the commencement of the following season. This meeting will take place during May-June each year. This is an opportunity to review the annual report, project progress and to discuss the overall direction for the up-coming season and any longer-term future plans. This will link area office staff into the overall direction and how the project links with other kororā projects across the region and maintain consistency across projects. This meeting will include the project advisor and project managers.

Regular Updates or Site Visits – It is important that the project advisor and project staff maintain an excellent working relationship with Department of Conservation staff and Iwi or Hapū representatives. Management by 'cup of tea' is a great tool and allows an opportunity to update and discuss project progress. With iconic species such as Kororā it is important that DOC management in particular know about any issues, particularly deaths or anything that could be perceived as a negative issue. By maintaining high standards and following best practice operating procedures it ensures that if a mortality does occur for example and DOC staff in particular know about it they can provide support when and if needed. Informal meetings and updates should take place at least quarterly with key people.


Figs 56-57: Community site visit to the Waikereru harakeke collection and DOC staff at Whinray Reserve reviewing the Kiwi Recovery Project at Motu. Important aspects of these projects is linking key partners with regular information flow.

Regular Updates to Pakeke

This is a great way to keep whanau informed by way of a power-point presentation or a site visit to the project. Presentation to Iwi or hapu Trustees, Pakeke and others who maybe interested in the progress of kororā in this area is extremely valuable and an important part of this project overall. It sets a strong foundation for ongoing support, respect and the mana of the project.

Involvement with Schools

This has significant benefit and is a form of reporting and linking the community into programmes such as this. Schools such as Muriwai Kura Kaupapa, Kaiti and Wainui Schools all have a keen involvement with marine ecology and kororā management particularly at Young Nicks Head and Wainui Beach. Linking projects with schools has significant benefits across the local community.

6.0 Acknowledgements

Thanks to Daniel Kingsford, Marty Bayley and Mark Richards from Eastland Port Limited for supplying the background information for this report. Also to Jo Simm at Dabchick NZ and Jamie Quirke at the Department of Conservation for supplying information regarding dog search summaries and kororā location data.

Also to Leah Wilkie and Jodie Saunders at Wainui School for supplying penguin survey information.

Thanks to Paul Rose, Ecological Advisor at Napier Port for supplying photos and valuable information regarding the Napier project penguin fence and other management advice.

Thank-you to Jordan Hawaikirangi Tibble, Charlotte Gibson and Tash Irwin for their enthusiasm and input into this project plan.

Thanks also to Dr Philippa Agnew, Science and Environmental Manager, Oamaru Blue Penguin Colony for supplying advice and photos regarding the Oamaru Penguin Project.

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Wilson, K.J, Mattern,T. - Little Blue Penguin/Kororā 2019

Appendix 1 – Nest Monitoring Sheet.

Kororā Nest Site Monitoring Sheet 		
Nest Site ID	NATURAL/NEST BOX	
Date		
Recorder Name (s)		
Date last monitored & frequency	i.e. monthly	
Penguin Presence	(Breeding/Roosting/Moulting)	
No. Penguin Adults Present		
No. eggs Recorded	_____	Egg Status (if Known)
Clutch	First – ☐ Second - ☐	
No. Penguin Chicks Recorded		Chicks Status – (Dead/Alive)
Chick Stage	Guard Period – ☐ Post Guard Period – ☐	
Est Chick Fledge Date		
Est Egg Laying Date	(-90 days from est fledge date)	
Predator Sign		
Notes:		


ecoworks
new zealand

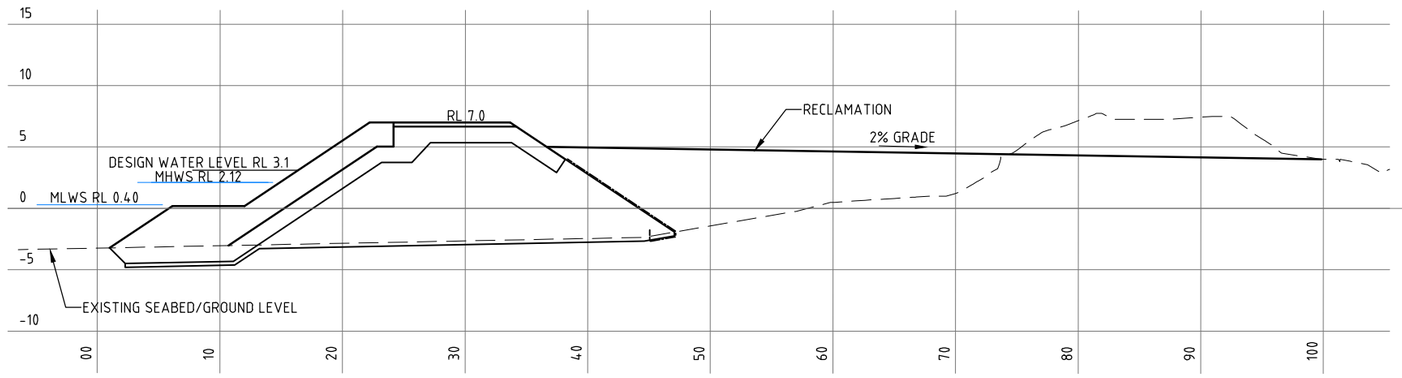
Appendix B

Worley Engineering Eastland Port Reclamation Revetment Typical Section and General Arrangement

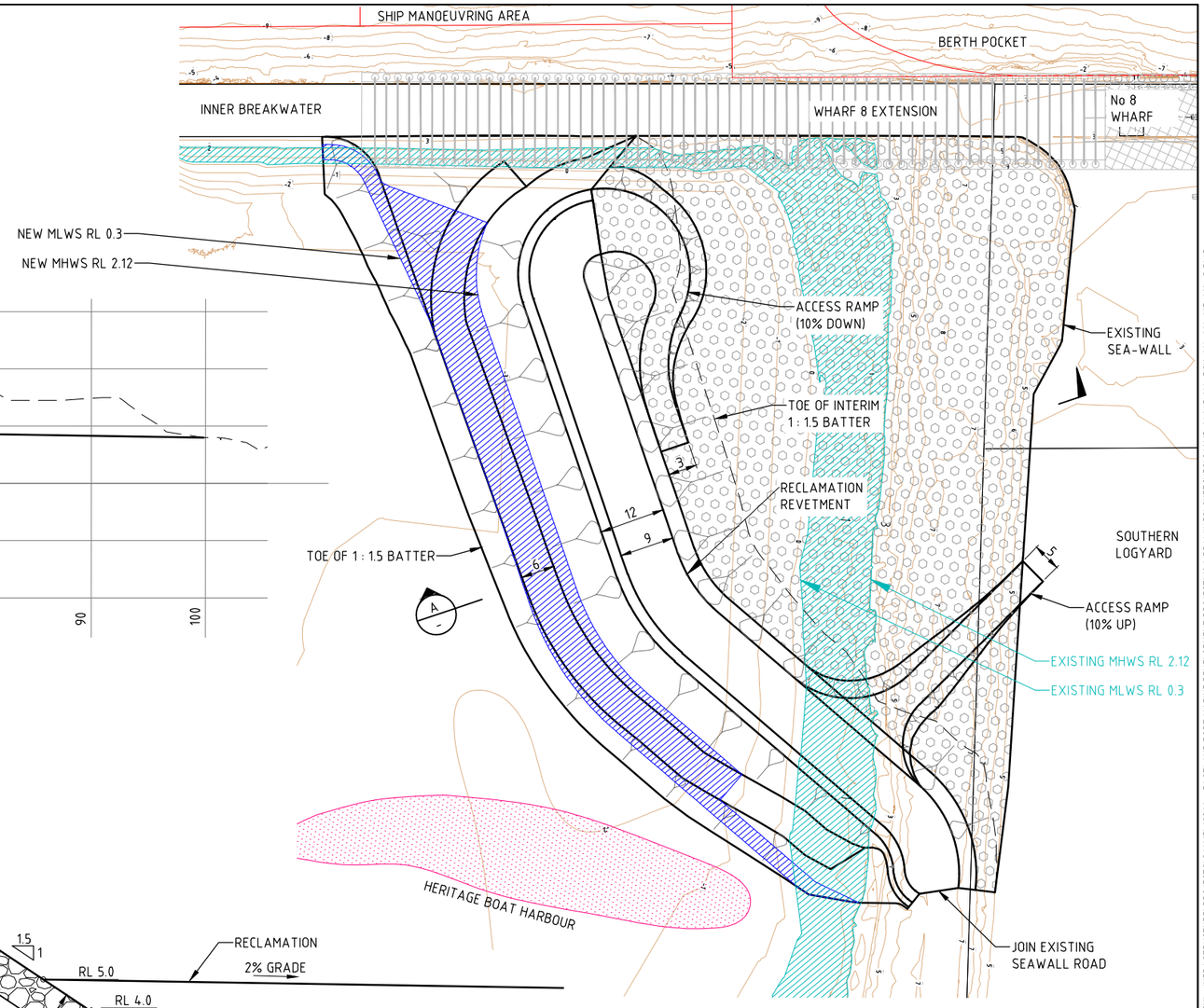
NORTH

LEGEND

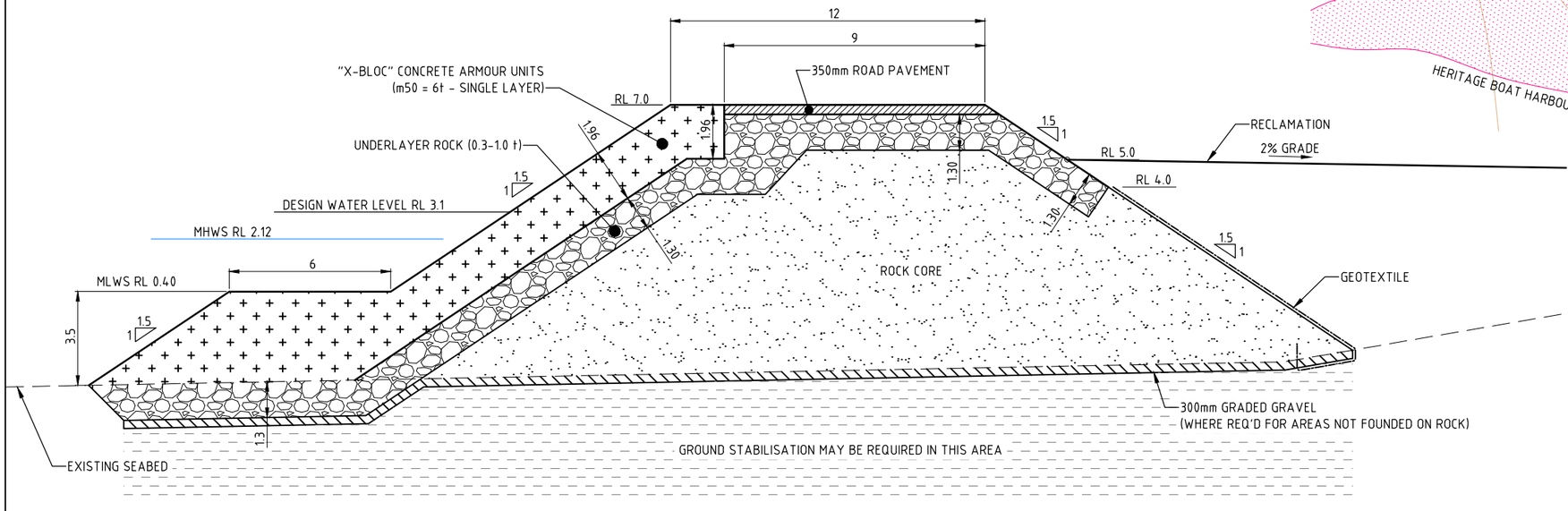
- EXISTING INTERTIDAL AREA (1965 m2)
- PROPOSED INTERTIDAL AREA (1241 m2)
- PROPOSED RECLAMATION



SECTION A
SCALE 1:250 (A1)



GENERAL ARRANGEMENT
SCALE 1:500 (A1)



RECLAMATION REVETMENT - TYPICAL SECTION
SCALE 1:100 (A1)

SURVEY NOTES

a. PROJECTION : NZGD2000
b. CIRCUIT : GISBORNE (G2000)
c. VERTICAL DATUM : GISBORNE CHART DATUM
d. VERT REF : 1.056m BELOW MSL FOR 1926
e. HYDROGRAPHIC SURVEY BASED ON JUNE 2014 SURVEY

2 0 2 4 6 8 10m
1:100 (A1) 1:200 (A3)

5 0 5 10 15 20 25m
1:250 (A1) 1:500 (A3)

10 0 10 20 30 40 50m
1:500 (A1) 1:1000 (A3)

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
B	27.08.21	ISSUED FOR REVIEW	BW	VIP	CA	DA	CT			
A	10.09.20	ISSUED FOR INFORMATION	RP	.	.	.	.			

A1 SHEET SCALE

OneWay™ empowered | enabled | ethical

WORLEY PROJECT No.
301015-04045

ENGINEERING AND PERMIT STAMPS (As Required)

INFORMATION ONLY NOT TO BE USED FOR CONSTRUCTION

CUSTOMER

Eastland Port

Worley energy | chemicals | resources

EASTLAND PORT
RECLAMATION REVETMENT
TYPICAL SECTION
AND GENERAL ARRANGEMENT

DRG No 301015-04045-MA-DSK-014
REV B

WORLEY_A1_REV1

LOCATION: \\AUSTYDWPDFS01V\AU\SYD\WORLEY_INFRASTRUCTURE\PROJECTS\301015\03380 - EASTLAND PORT MARINE DEVELOPMENT PROJECT\12.0 DRAWINGS\SKETCHES\301015-04045-MA-DSK-014-016-017-019_B.DWG
USER NAME: william.watkins
PLOT DATE & TIME: 26/8/2021 3:22:13 PM
SAVE DATE & TIME: 18/8/2021 3:23:00 PM