Project Number: 5-P1472.00

Ratana WWTP

Revised Ecological Impact Assessment

December 2023

wsp

150 YEARS IN AOTEAROA

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Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for [Rangitikei District Council] ('**Client**') in relation to the discharge of wastewater to a site in Ratana ('**Purpose**') and in accordance with the methodology dated 3 February 2022 and 21 November 2022. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

1 Introduction

1.1 Background

WSP have been engaged to prepare an ecological impact assessment (EcIA) in relation to the proposal by Rangitikei District Council (RDC) to irrigate an area of land with treated wastewater from the Ratana Wastewater Treatment Plant (WWTP). The proposed irrigation site contains 14 wetlands and discrete areas of duneland.

To date, multiple assessments of the proposed discharge site have been completed to determine the presence of Schedule F habitat types on the site. This report also responds to matters raised in the further information request.

These assessments have identified areas of Schedule F Stable Duneland and 14 discrete areas of wetland habitat; on closer inspection it has been determined that only one of the wetland areas meets the criteria of Schedule F and may be influenced by the proposed wastewater discharge. This differs from the original EcIA prepared for the site to support the consent application. The wetlands were delineated on site and confirmed as meeting the definition of natural wetlands under the National Policy for Freshwater Management 2020 (NPS-FM 2020).

The site is located at the end of Whangaehu Beach Road, approximately 1km from the west coast of the North Island and is located within the Foxton Ecological District (Ravine 1991). The land parcel is situated between the flow paths of two large rivers, the Whangaehu River to the north, and the Turakina River to the south, which are located approximately 750m and 1km from the site respectively.

The topography is variable across the site, with parabolic dunes and dune plains in between including a number of small natural depressions.

The site for the proposed discharge is shown below (Figure 1).

Figure 1: Location of the site in relation to the surrounding area.

1.2 Purpose and Scope

The purpose of this assessment is to determine the existing ecological values of the site and to provide an assessment of the ecological effects of the proposed discharge to land.

The scope of this report comprises of the following:

- A description of the flora, fauna, and ecological features found on-site.
- An assessment of the existing ecological values.
- An outline of the nature and magnitude of potential adverse effects from the proposed discharge.
- Proposed measures to avoid, remedy or mitigate adverse ecological effects where necessary.

1.3 Proposed Activity

RDC proposes to pipe treated wastewater to the land within the application site, where a combination of deficit and non-deficit irrigation will occur. Up to 31,000m^3 of storage will be provided at the land discharge site. It is not planned to irrigate the treated wastewater to land during winter months (May to August) except if required due to emergency situations or if conditions allow.

The following flows, from the wastewater treatment plant, have been used in the initial design of the irrigation system.

Table 1: Current and future flows used to inform preliminary irrigation system designs on-site.

	Nitrogen (kg N/yr)	Area available (ha)	Nitrogen loading (kg N/ha/yr)
Current flows	839	22	38
Future flows	1549	22	70

1.3.1 Irrigation

The following key assumptions have been made when considering the initial irrigation design:

- The system design criteria allows for deficit irrigation during a median year. During a wet year, deficit irrigation will be restricted to a shorter period of time and shoulder months (September, October, November and April) would receive non-deficit irrigation.
- Irrigation will generally not occur during the winter and early spring months (May – August), unless ground conditions are suitable or required for wet weather contingency situations. Storage will be provided to hold treated wastewater volumes over these periods.
- The site will have different irrigation management zones, each zone would be managed differently.
- Irrigation to dunelands present on the land is sought
- It is proposed to irrigate to the western dune plain wetlands to generally maintain water at a prescribed level. For the Southern Ecological Enhancement Area only deficit irrigation is proposed.

The proposed **average maximum daily volume**:

- 1,603 m^3/day – based on maximum monthly application of 34,827 m^3/month based on a peak average application of 5 mm/day, emergency contingency applications would be additional to this.

- The proposed daily maximum application rate;
  7mm/day (average 3.5mm). Except as required for contingency situations which will be outlined in the irrigation management plan.
- Nitrogen will be managed so as not to exceed 150kgN/ha/year.
- 28,500 m^3 buffer storage is required.

1.3.2 Irrigation Management

The site has been divided into five irrigation management zones/types. Each irrigation zone will be managed differently, in accordance with the specific objectives for that zone. It is proposed to allow for input to development of objectives (during ongoing consultation and from the regulatory authority). These will be developed and confirmed in the irrigation management plan (which would be certified), once more detailed irrigation design is undertaken. At a high level the management zone draft objectives are as follows:

General Management Zone

- Soil moisture monitoring.
- Deficit irrigation is preferred.
- Non-deficit irrigation when required.
- Range of vegetation options, pastural or woody vegetation can be considered, the preferred options will likely provide additional benefits aside from phytoremediation.
- Ongoing monitoring including groundwater monitoring.

Dune Management Zones

- Higher rate irrigation and controlled delivery to avoid slumping of the dunes
- Soil moisture monitoring.
- Non-deficit irrigation when required.
- Woody vegetation to be maintained to assist with dune stability to be maintained on the central dune plain.
- Harvesting of pine trees on the central dune plain in longer term in accordance with a harvest management plan.

Western Dune Plain Mitigation Area

- Planting and ongoing maintenance undertaken in accordance with a management plan using indigenous species that benefit from low-medium levels of nutrient enrichment.
- Specific groundwater monitoring.
- Water levels in wetlands to be maintained to prescribed level.
- Increased permanence of wetland area via sustained hydrological inputs.
- Increased indigenous biodiversity species and habitat value.
- Potentially allow for harvesting or use of the native species to be planted in this area

Edge Management Zone

- Irrigator choice to minimise potential for spray drift.
- Deficit irrigation.
- Range of vegetation options, pastural or woody vegetation can be considered.

Southern Ecological Enhancement Area

- Likely deficit irrigation only.
- Enhancement of existing wetland
- Creation of a native dominant offset wetland.(no direct irrigation)
- Dune enhancement through irrigation of Schedule F dunes.

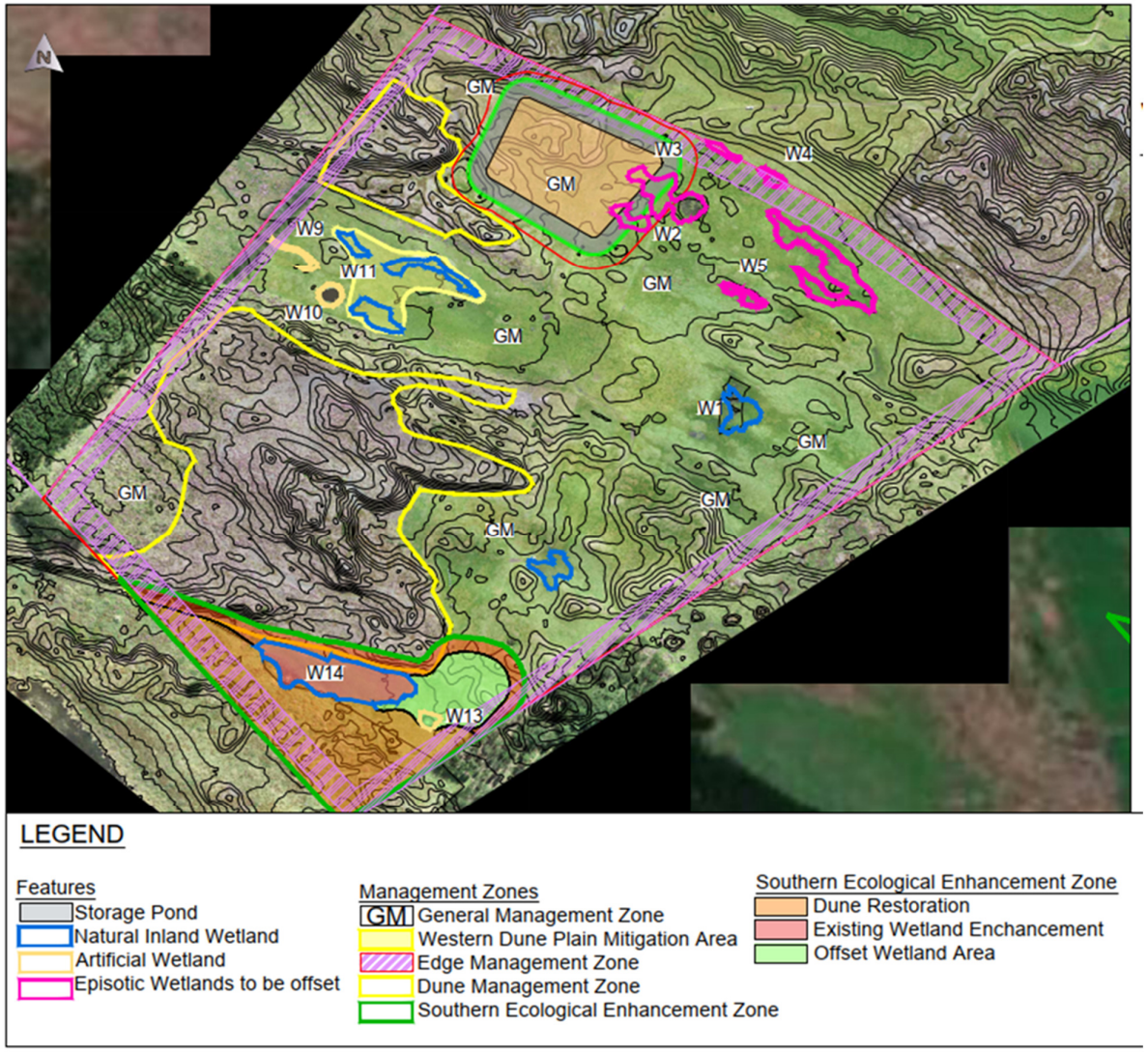

Figure 2: Irrigation management zone map.

2 Methodology

2.1 Overall approach

The overall approach used to undertake the ecological impact assessment was in accordance with the "*Guidelines for undertaking Ecological Impact Assessments (EcIA) published by the Environment Institute of Australia and New Zealand (EIANZ, 2018)*" using data and ecological information gathered by two primary methods:

- A desktop review of existing data and ecological information.
- Field surveys conducted on 11 August 2021 and November 12, 2021.
- A further field survey was conducted on 17 February 2023.
- Wetland values were assessed under the National Policy Statement for Freshwater Management 2020.

2.2 Desktop assessment

The desktop assessment involved the following:

- Review of Rangitikei District Council Operative District Planning Maps and Schedules.
- Review of Horizons Regional Council Planning Maps.
- Search of the Department of Conservation's BioWeb Herpetofauna database for relevant lizard records.
- Search of the Department of Conservations Bat Bioweb Database for relevant bat data.
- Search of the New Zealand Freshwater Fish Database (NZFFD) for relevant fish records (Crow, 2017).
- Search of site specific eBird data (Sullivan et al, 2009).

2.3 Field surveys

The field surveys on 11 August 2021 and November 12, 2021, were undertaken by Melanya King and assessed the effects on the wetlands, dune land area, existing vegetation, and birds.

The field surveys comprised of the following:

- Site walkover.
- Wetland delineation of the two wetland sites.
- Assessment of Schedule F dune land areas.
- Recording all bird species observed or heard.
- Assessment of habitats for their potential to support bats and lizards.
- General assessment of vegetation values and survey for rare or threatened plant species.

The vegetation survey involved mapping and describing vegetation types and recording plant species present, as well as recording weed species and their relative abundance.

The initial assessment of the site with regards to providing suitable habitat for bats and lizards was done via a desktop study, this was revised subsequent to a further site visit.

An additional site survey was undertaken by Nicholas Singers and Reuben Rorrison on 17 February 2023, following review of this report by Lorraine Cook (Manawatu-Whanganui Regional Council

wetland ecologist). Lorraine considered the Project Area to contain more wetland habitat than identified in 2021. Additional survey work was undertaken to address the questions put forward in the further information request. This site visit occurred four days after heavy rainfall associated with Cyclone Gabrielle which was preceded by above average summer rainfall. Within low lying dune depressions surface flooding was still present.

Wetlands were initially assessed using protocols outlined in the National Policy Statement for Freshwater Management (NPS-FM. 2021; Appendix B; Figure 9) to determine wetland status. The boundaries of the potential natural inland wetlands were delineated following the New Zealand Wetland Delineation Protocols (MfE, 2020). This involved using:

- The Vegetation Tool for Wetland Delineation in New Zealand (Clarkson, 2013) supported by the Dominance Test and Prevalence Index underpinned by the New Zealand wetland plant indicator status ratings for 2021 (Clarkson et al., 2021). The potential wetland area for each wetland covered less than 2 ha so one representative plot was established in each major vegetation type. 12 plots were established in total across the site visits.
- Hydric Soils – Field Identification Guide (Fraser et al., 2018). In 2021 five test pits were dug, two around each of the vegetation plots. A further test pit was dug at wetland W14 on 17 February 2023.
- Artificial wetlands such as stock water ponds and drains were identified for completeness.

As there are no other existing waterbodies within the area of the proposed works a survey was not undertaken to assess any additional freshwater effects.

2.4 EIANZ Guidelines Assessment of Effects Methodology

2.4.1 EIANZ Guidelines

Guidelines for undertaking Ecological Impact Assessments (EcIA) published by the Environment Institute of Australia and New Zealand (EIANZ, 2018) were used to aid assessing ecological impacts of the Project. The guidelines assist in assessing values and effects in a consistent and transparent way. However, sound professional judgement is still required when applying the framework and matrix approach recommended.

The approach involves assigning values for vegetation, habitats or species using the criteria in Table 2 and then assigning a magnitude of effects rating using the criteria in Table 3. An overall level of effects is then determined by combining the value of an ecological feature or attribute (Table 2) with the rating for the magnitude of effect (Table 3) using the matrix in Table 4.

2.4.2 Assessment of Ecological Values

The first step of the EcIA guidelines approach requires ecological values to be assigned on a scale of 'Low', 'Moderate', 'High', or 'Very High' to each ecological feature (Table 1). Species were valued according to their conservation status; those 'At Risk' or 'Threatened' were valued at a higher level than those classified as 'Not Threatened'. Threat classifications have been sourced as follows: bats (O'Donnell et. al., 2018); birds (Robertson et al., 2021); herpetofauna (Hitchmough et al., 2021); aquatic fauna (Dunn et al., 2018; Grainger et al., 2018) and plants (de Lange et al., 2018).

Horizons Regional Council One Plan identifies Schedule F habitats of Indigenous biological diversity, that are rare, threatened, or at-risk habitats, this has also been taken into account. These criteria have been used as the basis for assigning value to vegetation and habitat.

Table 2: Assignment of values to vegetation, habitats, and species (adapted from EIANZ, 2018).

Value	Species Value Requirements	Vegetation/Habitat Value Requirements
Very High	Nationally 'Threatened' species occur or expected to occur regularly within the Project footprint on a permanent or seasonal basis.	Meets the majority or all of the ecological criteria outlined in Regional Policy Statement for the Manawatu-Whanganui region (Policy 6).
High	Nationally 'At Risk' species occur or expected to occur on a permanent or seasonal basis.	Meets some of the ecological criteria outlined in the Regional Policy Statement for the Manawatu-Whanganui region (Policy 6).
Moderate	No Nationally 'Threatened' or 'At Risk' species occur, but locally uncommon or rare species, or keystone species (that are considered important for ecological integrity and function) present on a permanent or seasonal basis.	Habitat does not meet the ecological criteria outlined in the Regional Policy Statement for the Manawatu-Whanganui region (Policy 6) but does provide locally important ecosystem services (e.g., erosion and sediment control, and landscape connectivity).
Low	No species present that are Nationally 'Threatened', 'At Risk', locally uncommon or rare, or considered keystone species.	Nationally or locally common habitat that does not provide locally important ecosystem services.
Negligible	Exotic species, including pests, and species with recreational values occur or are expected to occur within the project area either permanently or seasonally.	Limited ecological values other than as a local habitat.

2.4.3 Magnitude of Effects

In determining a rating for the magnitude of effects on each ecological value consideration was given to the scale of habitat loss relative to the size of the available resource, duration of the effect, likely effect at population level with respect to individual species and degree to which the proposed development was likely to impact on the sustainability of the ecosystem and associated species. The magnitude of the effects is described as 'Negligible', 'Low', 'Moderate', High', or 'Very High' (Table 3). In assessing the magnitude of effects, standard best practice in terms of minimising effects and post works restoration have been assumed to be part of the Project.

Table 3: Criteria for describing the magnitude of effects (EIANZ, 2018).

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

2.4.4 Overall Level of Effects

The last step in the effects assessment process was to determine the overall level of effect using the EIANZ matrix (Table 4).

Table 4: Criteria for describing the level of effects (EIANZ, 2018).

Magnitude	Ecological Value				
	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

The level of effect or risk posed on ecological values ranges from Very High/High to Low level (signified by an effect of Low or Very Low in Table 4). Moderate level effects, or greater, typically require measures to avoid, remedy or mitigate effects, while Low to Very low effects levels are not normally of concern, although care may be required to minimise effects through design, construction, and operation.

2.5 Wetland Values Assessment

Wetlands represent a transition between terrestrial and aquatic ecosystems (Cooke, 1991). As such they are generally slow-moving hydrological systems. Wetlands have five core functions/values these are: geomorphology (erosion control), hydrology (flood control, groundwater supply), water quality enhancement, ecology (habitat, and nutrient cycling) and cultural (Cooke, 1991).

Wetland values were assessed under the National Policy Statement for Freshwater Management (NPS-FM .2020). The NPS-FM has five compulsory wetland values that require assessment. These are:

- Ecosystem health.
- Indigenous biodiversity.
- Hydrological functioning.
- Māori freshwater values.
- Amenity value.

This Ecological Impact Assessment assesses the NPS-F values indigenous biodiversity, ecosystem health and hydrological functioning, using the EIANZ, 2018 methodology. The existing wetlands have no, or negligible Māori freshwater or Amenity values so these were not assessed.

The NPS-F requires an assessment of 'potential value' rather than current value. In the context of this assessment, it has been determined that potential means actions that should occur given the current regulatory environment and societal values in the next ten years. For example, stock exclusion regulations specify that by 2025 stock (meaning cattle, deer, and pigs) must be excluded from wetlands larger than 0.05 ha on low slope land, or those smaller than 0.05 ha where they support a population of threatened species.

On 17 February 2023, five wetlands were measured greater than 0.05 ha — W1 (0.06 ha), W2 (0.14 ha), W5 (0.7 ha), W7 (0.051), W14 (0.302) —so from a regulatory perspective only these are required to be excluded from stock by 2025.

3 Ecological Description

During the two site walkovers the following ecological features were visually assessed:

- Vegetation
- Dunelands.
- Wetlands 1-13 (referred to as water meadows).
- Wetland 14 (schedule F wetland).
- The on-site value for native bats, birds, lizards and frogs.

The assessment of the ecological features on-site was supplemented to varying degrees by a desktop review of relevant sources of information.

The above features are described in the following sections of the report along with an assessment of their ecological value. Figure 3 (below) identifies the location of the key ecological features within the site boundary (red). The assigned value of each ecological feature is informed by Table 4 of the EIANZ Guidelines where the habitat is awarded four values in relation to four specific matters (Representativeness, Rarity/Distinctiveness, Diversity & Pattern and Ecological Context; Appendix E). These four values are then used to assign an overall value in relation to Table 6 of the EIANZ Guidelines (both tables can be found in Appendix E).

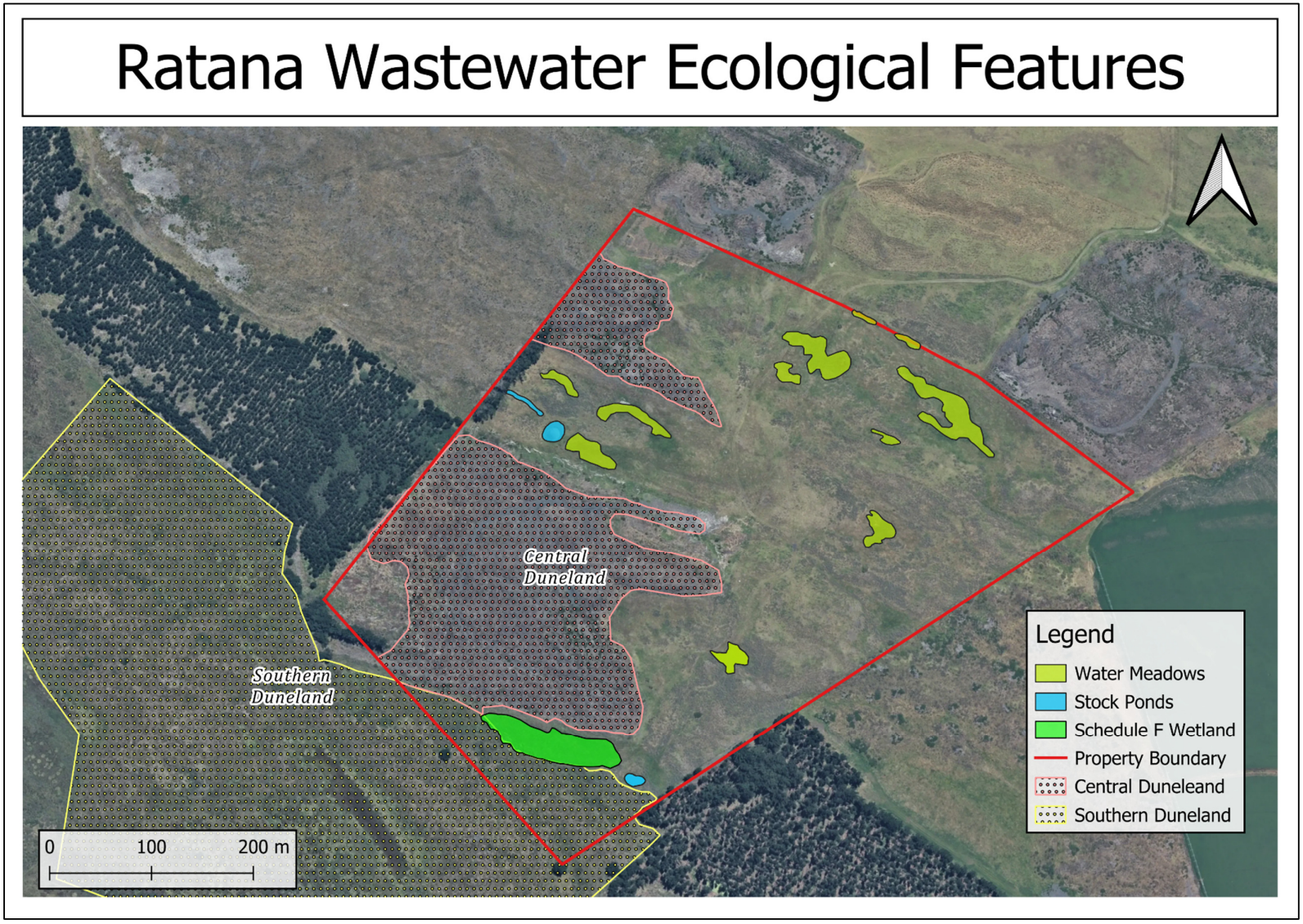

Figure 3: Areas of ecological value within the subject site.

3.1 Vegetation

As of 11 August 2021, most of the existing duneland was recently planted with young pine trees. The remainder of the site is undulating duneland / pastoral farmland. This area is dominated by exotic pasture species and does not contain any rare or threatened plants or animals.

The property contains a small area (1.145 ha) in the south of the property that is fenced and excluded from grazing. This is predominantly mixed exotic and native duneland and a small part which is indigenous dominant wetland (part of wetland W14).

Dunes are present along the entire western coastline of the Manawatu-Whanganui Region. These dunes have been formed since the last glacial maxima and have created the largest dune field in New Zealand (Townsend et al., 2008). The dunes present on the property are very young have a raw sandy soil. Images from Retrolens website between 1942 (SN215) and 1967 (SN1971) show mobile dunes were common between the Whangaehu River and Turakina River.

3.1.1 Central Duneland

The central duneland area was mature first crop radiata pine forest until harvested in 2020 and then subsequently replanted. The land is characterised by a series of dune ridges roughly orientated north-west to south-east (Figure 3), with a vegetation cover of mostly of exotic weedy plants and planted pine seedlings. The area has a low diversity and abundance of native dune species such as toetoe (*Austroderia toetoe*), small-leaved pōhuehue (*Muehlenbeckia complexa*), and knobby club rush (*Ficinia nodosa*). No national or regionally Threatened or At-risk dune specialist species such as sand daphne (*Pimelea villosa*) or matagouri (*Discaria toumatou*), which historically were known from the general area, were recorded. Despite this duneland only having a small component of generally common native plants and otherwise being dominated by exotic plant species, it has been deemed to fall under the classification of a Schedule F - Rare habitat subsequent to a Schedule F Assessment of the site (Appendix D) based on its physical dune structure.

There is another parcel of duneland in the north-eastern corner of the site that has been labelled central duneland as it is comprised of a similar exotic species assemblage and shares the same history of felling/replanting of radiata pine.

Table 5 below summarises how the central duneland scored in the four matters described in table 4 of the EIANZ Guidelines (Appendix E) resulting in its overall value and includes additional justification.

Table 5: Summary of the value assigned to the central duneland.

Matter	Value	Justification	Overall Value
Representativeness	Low	Exotic vegetation dominated this dune. It is not representative of a typical historical assemblage of species, but some native plants are present in low abundances and representative of common native dune species.	Low
Rarity/distinctiveness	Moderate	This habitat has been classified as Schedule F Stable Duneland based on its physical dune structure Stable Duneland is considered a Rare habitat type under the Horizons One Plan.	
Diversity & Pattern	Very Low	There is a low level of native diversity and low abundances of indigenous vegetation. The biodiversity that this area contributes to the wider ecological context is very low – low.	
Ecological Context	Very Low	Historically mobile dunes were present between the Whangaehu River and Turakina River. In the wider scope of the region, dunes represent a smaller area than other ecotones and it is reasonable to assume that historically this dune may have supported rare/uncommon species of native fauna. The central dune is small when compared to the wider area and its ecological context can be considered very low.	

3.1.2 Southern Duneland

The 'southern dune area' is more natural and is early successional regeneration likely established in the 1970's on formerly mobile dunes. It is a mosaic of boxthorn (*Lycium ferrocissimum*) scrub covered by small-leaved pohuehue and occasional pampas. Dune crest areas are more indigenous dominant containing knobby clubrush sedgeland and occasional marram grass (*Ammophila arenaria*). This area is contiguous towards the Tasman Sea with a much larger area of similar habitat. It contains a much higher abundance of native plants and meets the definition of schedule F stable duneland as characteristic species such as small-leaved pohuehue and knobby clubrush are dominant. Small-leaved pohuehue is the host species for a number of copper butterflies (*Lycaena boldenarum* and *L. salustius*) which were common in February 2023. Boxthorn and small-leaved pohuehue are known to be important habitat for geckos though none were seen. This duneland area merges downslope into an area of native dominant wetland (WL14).

Table 6 below summarises how the southern duneland scored in the four matters described in table 4 of the EIANZ Guidelines (Appendix E) resulting in its overall value and includes additional justification.

Table 6: Summary of the value assigned to the southern duneland.

Matter	Value	Justification	Overall Value
Representativeness	Moderate	The southern dune is dominated by native species. They are in early stages of succession/colonisation and moderately representative species assemblage in the current context.	High
Rarity/distinctiveness	High	This habitat has been classified as Schedule F Stable Duneland which is considered a rare habitat type under the Horizons One Plan.	
Diversity & Pattern	Moderate	The southern dune contains a far higher abundance of indigenous plant species than the central dune. Exotic scrub species are still predominant in areas, but the dune crests are dominated by native species. Overall, the southern duneland has a moderate level of diversity & pattern.	
Ecological Context	High	The southern duneland on-site connects to a far larger dune system that extents from the site to the Tasman Sea. Native dunes are known to support a range of At-Risk flora and fauna. No site-specific species surveys were conducted, it is therefore conservatively assumes the southern duneland is high value with regard to ecological context.	

There is negligible ecological value for the surrounding farmland.

3.2 Wetlands

Site visits were undertaken on 12 November 2021 and 17 February 2023. Fourteen distinct wetland areas were delineated, which occupy in total approximately 0.957 hectares. Of this total three are artificial stock ponds and drains which occupy approximately 0.055 hectares. The area of natural wetland is approximately 0.902 hectares. Part of wetland 4 crossed into the neighbouring land parcel (Figure 4) which is included in the value below.

All wetlands, except for part of W14 are almost exclusively dominated by introduced wetland species and are best described as 'water meadows', these are recognised under the Horizons One Plan as "Damp gully heads, or paddocks subject to regular ponding, dominated by pasture or exotic species in association with wetland sedge and rush species". In the lowest lying and often ponded areas, either floating sweet grass (*Glyceria declinata*) and or Mercer grass (*Paspalum distichum*) occur. In higher more intermittently wet areas toadrush (*Juncus bufonius*) and or jointed rush (*J. articulatus*) rush lands dominate, in association with creeping bent (*Agrostis stolonifera*) and nut grass (*Cyperus eragrostis*). Native plants are very rare in wetlands W1–W13. Only a few plants of sharp spiked sedge (*Eleocharis acuta*) and three-square sedge (*Schoenoplectus pungens*) were observed across these wetlands. Figure 5 below shows a wetlands 9-11 and the exotic dominant species assemblages typical of 'water meadows'. A summary of the wetland categories, exotic and native extents of wetlands 1-14 can be seen in Table 7 below.

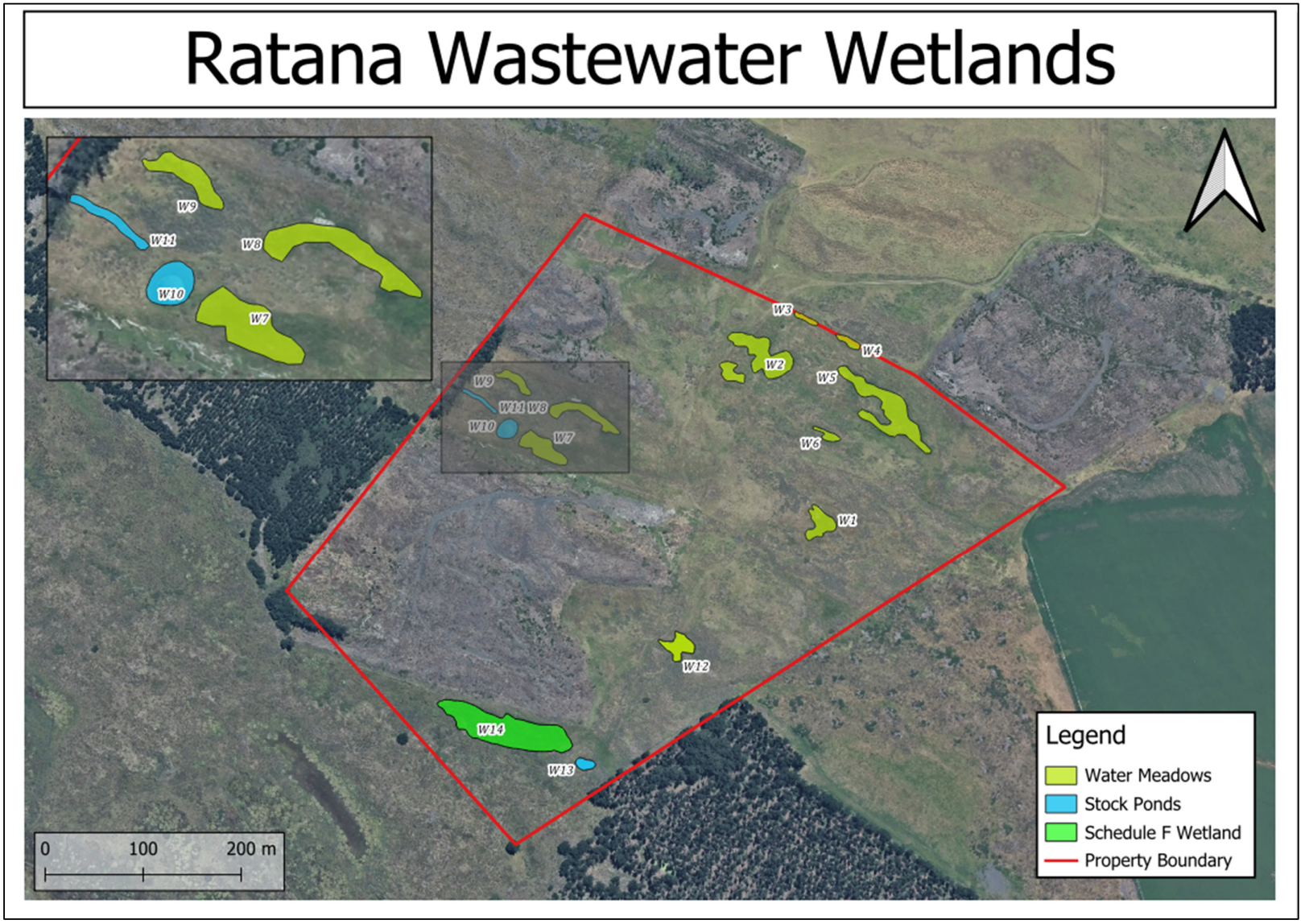

Figure 4: Wetland areas within and adjacent to the property boundary.

Figure 5: Wetlands 8, 9, 10 and 11 showing exotic dominant species assemblages. Taken facing east

Table 7: Wetlands within the property, their category, composition and area of extent.

Wetland	Wetland category	Exotic dominant (ha)	Native dominant (ha)
W1	Natural wetland	0.060	
W2	Natural wetland	0.140	
W3	Natural wetland	0.012	
W4	Natural wetland	0.015	
W5	Natural wetland	0.185	
W6	Natural wetland	0.021	
W7	Natural wetland	0.052	
W8	Natural wetland	0.049	
W9	Natural wetland	0.018	
W10	Artificial wetland – stock pond	0.025	
W11	Artificial wetland - drain	0.015	
W12	Natural wetland	0.048	
W13	Artificial wetland – stock pond	0.015	
W14	Natural wetland	0.266	0.036

Wetland 14 is split by a stock fence and most of this was previously grazed (Figure 6), this grazing history has formed distinct vegetation communities. On the northern side of the fence is jointed rushland grading into toad rush and creeping bent. To the south of the fence is dense native-dominant three-square sedgeland, on the wetland margin rising towards the southern duneland. This merges into tall fescue (*Lolium arundinaceum*), toetoe and locally umbrella sedge (*Cyperus ustulatus*).

Figure 6: Wetland 14 viewed from the western end facing east. Indigenous dominant three-square sedgeland occurs on the right side of the fence.

3.2.1 Wetland Summary

The Manawatu — Whanganui coastline is rapidly pro-grading, advancing seaward from an ample supply of sand and accumulation by sand binding plants. Located between 990 m and 1.5 km inland from the Tasman Sea, it is probable that the land is less than 3000 years old. While the dune soils are raw and youthful and were likely mobile in the last 50 years, several wetland hollows sampled had accumulated organic matter layers — which takes a longer period to develop. Potentially, these hollows may have formerly supported a range of older native habitats such as mingimingi and cabbage tree scrub or forest (Singers, 2018).

Several wetlands notably W1 and W14 have clearly developed organic layers so will be permanent wetland, though with large changes in seasonal water table height. Potentially some of the smaller wetlands delineated in February 2023 have been recently induced, caused by recent increases in the water table. This possibly occurred due a combination of factors including irrigation on an adjoining property upslope of several wetlands. Harvesting mature pine plantations on dunes is known to cause changes to water tables, by reducing water loss from transpiration. Further, the recent weather, particularly the above normal rainfall from winter 2022 to the summer of 2023, is likely to have some effect. Johnson and Gerbeaux (2004) categorises wetlands such as these as being 'episodic' occurring once every few years.

Wetland vegetation composition is almost exclusively dominated by exotic rushes, grasses, and sedges, excluding the small fenced (un-grazed) part of W14. No wetland birds were seen on 17 February 2023, despite the widespread flooding. For these reasons all wetlands except W14 have negligible indigenous biodiversity value.

Ephemeral wetlands and Dune slack wetlands are rare habitat types under Table F.2(b); Schedule F of the Horizons One Plan. Dune slack wetlands occur within deflation hollows on young sand plains generally behind a mobile dune usually close to the coastline. The Schedule F definition of these two habitat types includes a range of communities from primary succession herbfield and sedgeland to shrubland, such as mingimingi scrub which was formerly common in the Foxton Ecological District (Ravine 1991). The wetlands present on the subject site are in deflations hollows between dunes, the communities present do not conform to either Schedule F definition for dune slack or ephemeral wetlands. The vegetation communities are exotic and typical of eutrophic farmland wetlands within the region and wider New Zealand. As such it has been assessed that wetlands W1 to W13 are not representative of dune slack or Rare/Threatened ephemeral wetland vegetation within the Foxton Ecological District and therefore are not classified as rare habitat under Schedule F.

The only exception to this is wetland W14, particularly the un-grazed area to the south (Figure 6). This part meets the Schedule F Dune Slack wetland definition, being three-square sedge dominant sedgeland of high ecological value. The formerly grazed part is currently of similar composition to other exotic wetlands on the property but is actively being colonised by three-square sedge. The NPSFW 2020, requires an assessment of potential values and as the wetland is larger than 500 m^2 stock exclusion rules apply by 2025. Under a stock exclusion scenario, three-square especially, and possibly also sharp spike sedge, toetoe and umbrella sedge should increase. Natural restoration of these native wetland species would increase representation of this wetland, meaning that most of the wetland would eventually conform within the definition of an ephemeral wetland. For this reason, the potential indigenous biodiversity value of W14 is likely to be at least moderate in 10 years' time and over several decades possibly high.

All wetlands have moderate value for their hydrological functioning. This value is primarily as a sink where water accumulates and recharges shallow ground aquifers. Overtime the wetlands will also accumulate organic matter, though lower rates will occur if some wetlands are episodic.

Tables 8 & 9 below summarise how wetlands 1-13 and wetland 14 scored in the four matters described in table 4 of the EIANZ Guidelines (Appendix E) resulting in its overall value and includes additional justification.

Table 8: Summary of the value assigned to the wetlands 1-13.

Matter	Value	Justification	Overall Value
Representativeness	Very Low	Wetlands 1 – 13 are dominated by exotic species and are highly un-representative of wetlands we would typically expect to observe in the area prior to European colonisation.	Low
Rarity/distinctiveness	Very Low	Wetlands 1 – 13 were not observed providing any biodiversity value. They were dominated by exotic plant species and are highly unlikely to support Threatened or At-Risk species of native fauna.	
Diversity & Pattern	Low	Wetlands provide a diverse array of habitats as they are the boundary between aquatic and terrestrial. They are high producing and as such are key ecosystem within many indigenous food webs. However, wetlands 1-13 are exotic dominant with low levels of diversity and are likely to only contribute low levels of ecosystem function. After the higher-than-average rainfall summer experienced between 2022-2023 it can be assumed that low value water meadows were common across the surrounding landscape.	
Ecological Context	Low	Some value is awarded to wetlands 1-13 for their hydrological function. Regardless of indigenous vs exotic species composition, wetlands do provide a range of functions and areas capable of being restored into high value wetlands have become rarer since the industrial/green revolution.	

Table 9: Summary of the value assigned to wetland 14.

Matter	Value	Justification	Overall Value
Representativeness	High	The southern extent of wetland 14 is highly representative of an indigenous wetland that would typically have been found in this area – prior to European settlement. The remaining extent contains an increased prevalence of exotic vegetation but has high capacity for restoration.	High
Rarity/distinctiveness	High	This wetland meets the definition of a Dune slack Wetland which is recognised under the Horizons Regional Council as a rare habitat.	
Diversity & Pattern	Moderate	Wetland 14 contains a moderate level of indigenous vegetation. In the wider scope of the area indigenous wetlands occurring within dunes are not highly common.	
Ecological Context	Moderate	The wetland is small in size but as mentioned above wetlands of this nature are not highly common across the wider landscape. Therefore, it has potential to prove moderately valuable habitat to native fauna and is likely to provide a moderate level of ecosystem services.	

3.3 Bats

A review of the Bioweb Bat Database shows records for long-tailed bat (*Chalinolobus tuberculatus*) within 12 km inland of the project site, there are no records within the project site. The long-tailed bat is considered a Very High value species if present on-site permanently or seasonally, based on their threat classification which is 'Threatened-Nationally Critical'.

The project footprint does not contain any trees with a diameter at breast height (DBH) > 15 cm (the DBH necessary for a tree to be considered for potential bat roost features; Bat Roost Protocols. 2021). The likelihood of bats roosting on site is highly unlikely. However long tailed bats have a large home range and due to bats being observed only 12 km from site we cannot rule out the potential for bats to utilise the site for foraging or commuting. The current habitats on site provide negligible biodiversity value aside from a small section of wetland 14 and the southern duneland, it is therefore highly unlikely to be a key foraging resource for bats.

No bat specific surveys were conducted on suite aside from a high-level survey which noted the lack of potential bat roosts and low value foraging habitat. Bats are absolutely protected from killing and injury under the Wildlife Act 1953, they have been observed within 25 km of the project footprint and therefore should they utilise the on-site habitat it is expected to be infrequently and highly unlikely to provide a key foraging / commuting resource for local populations. Long-tailed bats have a Threat Classification of 'Threatened – Nationally Critical' and are absolutely protected from injury or harm under the Wildlife Act of 1953. The on-site value for bats is considered to be **Low**, there is great potential for enhancement of the foraging habitat provided for bats.

3.4 Birds

During the site walkovers only pukeko (*Porphyrio porphyrio)* were noted as present within the site. No 'At Risk' or 'Threatened' bird species were recorded as present.

The area is likely to provide habitat for other common native and introduced bird species not observed during the surveys. It is possible that the Ratana site as a whole is occasionally visited by At Risk or Threatened bird species however it is unlikely that the project site currently provides important habitat for any of these species. The lack of waterfowl (i.e ducks) is worth noting as it further supports the classification of the wetlands as providing negligible biodiversity value. In an ecosystem containing 14 discrete wetlands, even with low biodiversity function, it is highly uncommon to not observe any waterfowl utilising the habitat present.

There are no site-specific records found on eBird, the closest records are those of Turakina River estuary approximately 1.6 km south of the site where Threatened and At-Risk bird species have been observed (Appendix C, Table 20). It is possible that on occasion some of these birds may be found within the Ratana project area but for reasons explained above it is highly unlikely the project footprint provides critical habitat for any Threatened or At-Risk species. Through enhancement of wetlands on-site the potential for the site to sustain higher value species of birds will increase. Note that most indigenous birds are absolutely protected from killing and injury under the Wildlife Act 1953.

The present on-site habitat can be conservatively classified as potentially supporting nationally and locally common indigenous species of birds, its assigned value is therefore **Low**.

3.5 Lizards and Frogs

A specific lizard survey was not undertaken, the results of a desktop study are below, and a summary of lizard and frog species observed within 25 km of the project footprint can be found in Table 21, Appendix C.

A review of the Bioweb Herpetofauna Database indicates a total of six native lizard species have been observed occurring within 25 km of the project footprint. Three of which have a Threat Classification of 'Not Threatened'; northern grass skink (Oligosoma polychrome), raukawa gecko (Woodworthia maculate) and pacific gecko (Dactylocnemis pacificus) and two have a Threat Classification of 'At Risk – Declining'; Ornate skink (Oligosoma ornatum) and Glossy brown skink (Oligosoma zelandicum). Kupe skink (Oligosoma aff. Infrapunctatum "Southern North Island") have also been observed in recent years within 25 km of the project footprint. These skinks are known to occur within dune systems and due to a lack of site-specific lizard surveys their potential presence on-site cannot be overlooked. The lizard habitat on-site is largely dominated by exotic vegetation and will benefit substantially from the proposed native plantings. It is highly unlikely that native frogs are present on site.

All indigenous lizards are absolutely protected from killing and injury under the Wildlife Act 1953 and Nationally Threatened species could potentially be found within the habitat on-site. Therefore, the value assigned to lizards on-site is **Very High**.

4 Ecological Values Summary

This section of the report assesses the ecological values of impacted vegetation, habitats and species in the following categories:

- Vegetation and habitats.
- Presence of At Risk, Threatened or locally uncommon - plant, and terrestrial and aquatic fauna species.

Table 10: Assignment of values to vegetation, habitats, and species in the development area (adapted from EIANZ, 2018).

Vegetation/Habitat/Species	Value	Comments
Central duneland	Low	Dune areas contain a low diversity and abundance of indigenous species typical of stable dunes and does not contain any rare or threatened plant species. Vegetation is exotic dominant due to the land use for exotic forestry. It has however been classified as a Rare habitat under the horizons one plan (Appendix E, schedule F assessment) for landform.
Southern duneland	High	Dune areas is a mixed exotic and native community with some stable dune species, small leaved pohuehue and knobby clubrush being common and occasional other natives such as toetoe and cabbage tree. This habitat meets the Schedule F definition of Stable dunes.
Wetlands W1 to W13	Low	Wetlands are protected under the NPS-FM (2020), due to their rarity within NZ & the Whanganui Region. The wetlands present have negligible indigenous biodiversity value. No Mahinga kai were seen in these areas, so they likely have negligible Māori freshwater value. Being small and surrounded by farmland they have minimal Amenity values. There main value is for hydrological functioning as sinks for ground water discharge and land where organic matter will accumulate. Being small, combined at 0.655 hectares this value is considered to be low.
Wetland 14	High	Wetlands are protected under the NPS-FM (2020), due to their rarity within NZ & the Whanganui Region The small 360m^2 area south of the fence is native dominant wetland and for this reason has high indigenous biodiversity value. The potential value of the formerly grazed part is currently low being exotic dominant but will improve with stock exclusion and spread of native wetland plants from the fenced part. Consequently, this has moderate potential value for indigenous biodiversity. This area also contains several Mahinga kai plants such as toetoe so has at least moderate Māori freshwater values. This wetland is accumulating organic matter and likely is saturated for many months so has moderate hydrological functioning value.
Bats	Low	Long-tailed bats have been recorded within 12 km of the project site. They classified as 'Threatened-Nationally Critical'. There is no suitable roosting habitat on-site for bats and the site has negligible biodiversity value and is therefore highly un-likely to be a key foraging habitat. Bats may occasionally use the site for foraging or commuting to higher value foraging habitats, the site is highly susceptible to improvement through restoration planting.
Birds	Low	No 'At Risk' or 'Threatened' bird species were recorded at the project site. The bird fauna are common species typical of a modified landscape in a rural setting. Additionally, there is little to no suitable habitat on-site for Threatened or At-Risk bird species, the site is highly susceptible to improvement through restoration planting.
Lizards	Very High	Lizards with a Threat Classification of 'Threatened - Nationally Critical' could potentially occur within the project footprint. The majority of the habitat on-site is exotic dominated and low value for lizards but the southern duneland area may provide higher value habitat.

5 Assessment of Effects

Tables 11-17 each relate to an ecological feature described below and give a summary of the features value (assigned based on the EIANZ criteria outlined in Table 2), the magnitude of effect (assigned based on the EIANZ criteria outlined in Table 3) and an overall level off effect (assigned based on the EIANZ matrix shown in Table 4).

A summary of the value, pre/post mitigated magnitude and level of effects as well as mitigation recommendations can be seen below in section 6, Table 18.

The assessment of effects will consider the following:

- Effects on existing duneland.
- Effects on wetlands.
- Effects on bats.
- Effects on birds.
- Effects on lizards.

5.1 Vegetation

5.1.1 Central Duneland

It is proposed to irrigate to the central duneland area which is currently planted in young pine forestry and otherwise dominated by a mixture of exotic weed species and occasional native plants. This discharge will create more mesic conditions which should facilitate the establishment of understorey plants following canopy closure. In the long term this will likely assist the establishment of native forest understorey species. This discharge should be monitored to ensure that there is no adverse effect to the geomorphology of the duneland and that the plants are up taking the majority of this discharge. The species assemblage is dominated by young pines and exotic shrubs have already been established across the extent of the area. There is little scientific literature detailing the effect that irrigation may have on stable dunes; considering the value of the duneland is derived almost entirely from their physical structure (with very low – low ecological value) provided this is maintained, the magnitude of effects on these duneland areas has been assessed as **Negligible** and the level of effect is likely to be low if not positive.

Irrigation to the duneland may increase its overall productivity, resulting in the development of a moderate-highly productive exotic duneland. While the value of this would not be as high as a similar duneland dominated by indigenous species, it can be expected to still provide some ecological functions and ecosystem services. Should this occur, and provided monitoring conditions are implemented to ensure the physical structure of the dunes are maintained, the ecological effects of the proposed works may be negligible to positive in the medium – long term. It is understood that any harvesting of pines from the duneland would be undertaken in accordance with a harvest management plan. A summary of the value, pre/post mitigated magnitude and level of effects as well as mitigation recommendations can be seen below in Table 11.

Table 11: Central duneland impact assessment summary.

Value	Magnitude of effect	Pre-mitigated level of effect	Mitigation recommendations	Post-mitigated magnitude of effect	Residual level of effect
Low	Negligible	Very Low	• Monitoring should take place to ensure irrigation does not result in degradation of the physical structure of the central duneland. • Irrigation is recommended on the dunes as it will provide increased nutrients and permanence of water availability throughout the year. • Biophysical monitoring should take place to ensure the value of the dunes are maintained. • Appropriate vegetation cover is maintained to ensure the integrity of the dunes	Negligible - Positive	Very Low - Net Gain

5.1.2 Southern Duneland

The southern duneland extent continues far beyond the boundaries of the project footprint. It is of high value due it its dominant indigenous species composition and should irrigation to this dune occur, the effects will require careful monitoring. As mentioned above, the effects of irrigation on duneland are largely understudied therefore determining the effect that irrigation will have to take an adaptive approach. The project does not involve any earthworks or construction within the southern duneland, and irrigation will increase the nutrient availability and water supply will no longer be a limiting factor of plant growth throughout the year. The effects of the proposed works on the southern duneland are likely to be **Negligible** and may even result in positive effects on the native vegetation in the short – long term because natural succession and enrichment planting is proposed. Careful monitoring of the condition of the habitat should be a condition of the consent, aiming to maintain both the physical structure of the dunes as well as the ecological value of the species and habitat present. The vegetation cover should be maintained to reduce risk of adverse effects to the structure integrity of the dune.

A summary of the value, pre/post mitigated magnitude and level of effects as well as mitigation recommendations can be seen below in Table 12.

Table 12: Southern duneland impact assessment summary.

Value	Magnitude of effect	Pre-mitigated level of effect	Mitigation recommendations	Post-mitigated magnitude of effect	Residual level of effect
High	Negligible	Very Low	• Monitoring should take place to ensure irrigation does not result in degradation of the physical structure of the central duneland. • Irrigation to the dunes is recommended as it will provide increased nutrients and permanence of water availability throughout the year. • Biophysical monitoring should take place to ensure the value of the dunes are maintained. • Appropriate vegetation cover, with a focus on developing native dominate species over time, is maintained to ensure the integrity of the dunes	Negligible - Positive	Very Low - Net Gain

5.2 Wetlands

The Project will result in two effects, loss of wetland habitat and a change in wetland hydrology.

Habitat loss

Habitat loss will occur with the construction of the wastewater storage pond which will affect wetlands W2, W3, W4, W5 and W6 which amounts to approximately 0.373 hectares (3730 m^2) of exotic dominant habitat. These wetlands have negligible indigenous biodiversity value with the main value being for their hydrological functioning.

Wetland habitat loss is proposed to be offset by creating and restoring additional wetland habitat of equal or greater area. This will require careful excavation in relation to the existing elevation and water table to appear naturally created by a parabolic dune. The proposed site is located north-east of wetland W14, in an area not considered to be Schedule F dune. Offsetting will include application of a layer of peaty sand topsoil and restoration planting using typical species found on dune plains such as oioi (*Apadasmia similis*), three-square, *Cyperus ustulatus*, toetoe and harakeke. Furthermore, the wetlands being lost contain an element of open water. The offset wetland should aim to seamlessly extend the boundary of W14, containing an element of open water and include the proposed buffer of riparian native vegetation outlined below. This will satisfy Appendix 6 of the NPSFM (2020) as there will be no net loss, and likely a net gain, in wetland extent. Furthermore, the offset will be in line with the ecological context principal outlined in Appendix 6 as extending and enhancing the highest value wetland on-site represents the best ecological outcome available for offsetting.

Changes in wetland hydrology

The wetlands have been determined by WSP Hydrogeologists to be predominantly rainwater and groundwater fed. Some overland flow may occur during wetter periods of the year, although this is limited due to the very high soil permeability of these wetlands and surrounding dryland.

Increase of water from wastewater irrigation is expected to affect the hydrology of wetlands W1, W7-W9 and W12, which amounts to 0.227 hectares. These wetlands are wet intermittently or episodically so hold water after significant rainfall, during wet seasons, or only in wetter (above normal) seasons. With the proposed discharge, the period which they are saturated or flooded for

will extend in duration, increasing the total area of permanent wet wetland habitat. This will likely favour obligate wetland plants over plants more suited to intermittent wet conditions. The magnitude of effect to the current hydrology of these wetlands is expected to be Moderate.

The proposed irrigation management within the western dune plain mitigation zone will assist in reducing the potential for nitrogen to reach the groundwater. Direct discharge to the wetland would only occur when non-deficit irrigation is required to maintain water levels in this area to a prescribed level.

Groundwater contours indicating the current flow paths of the groundwater through the site were developed for this project (WSP, 2022 Groundwater report; Figure 7 below).

Note: the figure is overlayed on aerials prior to the felling of pines on-site. The wetlands that can be observed are wetland 1 and part of wetland 2.

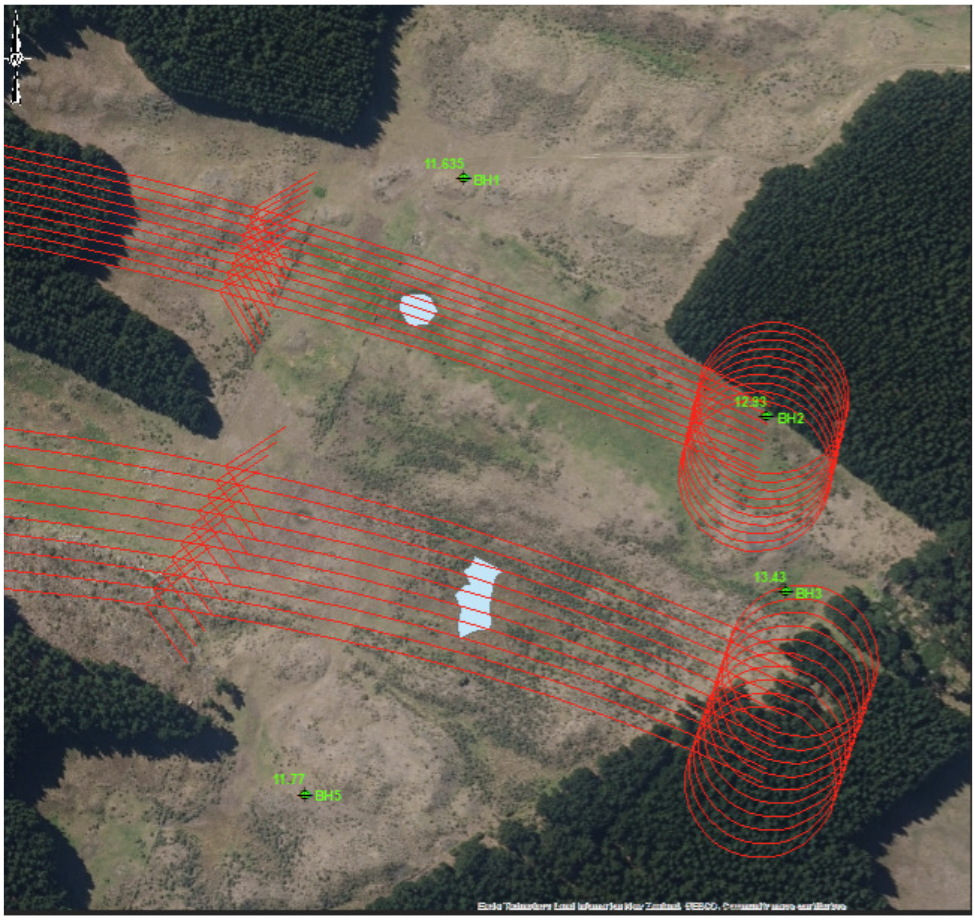

Figure 7: Groundwater flow paths on-site in relation to the wetlands (white) and bore holes (green).

Groundwater was found to be close to the surface, i.e. less than 3 m below ground level. Non deficit irrigation is proposed to occur onsite during April, September, October, and November during a median rainfall year. The maximum increase in nitrate-nitrogen concentration is 1.64 mg/L up from 0.43 mg/L in November giving a total of 2.07 mg/L, this is well below the maximum allowable value of 11.3 mg/L (this value is a drinking water standard), therefore the effects of this increase are minimal.

WSP 2022 Groundwater report identified that the microbial contamination risk is small, as is the phosphorus risk as a result of the proposed discharge. The groundwater report concludes that given the high flowing nature of groundwater beneath and surrounding the site and the high infiltration capacity of the soil applying 1 mm per day on average (for the non-deficit irrigation periods) is not expected to increase the groundwater levels on site. Due to the high groundwater levels on-site, the

wetlands are not expected to play a significant role in groundwater recharge via overbank storage. As the average discharge rate is low no significant change to the hydrological regime of either wetland is expected as a result of the proposed discharge.

The wetlands are currently already dominated by exotic plants common to eutrophic pasture. The exotic dominance is not expected to change however the composition of obligate and facultative wetland species will shift.

Due to the intermittent presence of the wetlands on site, as confirmed by the lack of wetlands present on the first site visit, additional hydrological input through irrigation is expected to increase the permanence of wetland extent within the remaining wetlands. If the remaining wetlands are also planted with indigenous vegetation, the biodiversity value will significantly increase. With the addition of higher levels of nutrients than a natural state, planted indigenous vegetation is expected to establish and grow quickly creating highly productive indigenous wetlands.

Removal of nutrients will be required for the ongoing performance of the discharge field. This provides an opportunity for the irrigated wetlands to be utilised as highly productive 'open ground' nursery habitats for eco- sourced indigenous wetland plant species. This would produce seed and/or cuttings for wetland plant cultivation to then be used in restoration planting of other wetlands projects across the region. The post-mitigated magnitude of effect on these wetlands is likely to be negligible and has high potential to produce positive effects resulting in a net gain in value provided by wetlands in the short – long term. A summary of the value, pre/post mitigated magnitude and level of effects as well as mitigation recommendations can be seen below in Table 13.

Groundwater monitoring is proposed including assessing changes in nitrogen levels in groundwater. Overall, it was assessed that potential changes in nitrogen levels will be low. However, it is important to note that irrigating after periods of heavy rainfall should be avoided to avoid additional ponding from occurring.

A restoration plan to restore these wetland areas should be developed as a condition of this consent and select species capable of high nutrient uptake and permanently wet conditions. The species chosen should be suitable for the area and unlikely to be adversely affected by the proposed discharge. Monitoring the overall response of the wetlands is recommended to ensure that the proposed discharge is not having an adverse effect on these sites. This should occur following the restoration of these sites to allow for the impact on their existing biodiversity to be determined.

Table 13: Wetlands 1-13 impact assessment summary.

Value	Magnitude of effect	Pre-mitigated level of effect	Mitigation recommendations	Post-mitigated magnitude of effect	Residual level of effect
Low	Moderate	Low	• Maintain permanent wetland extent of wetlands 1, 7-13. • Plant above wetlands with indigenous wetland vegetation. • The high nutrient – high producing environment in the remaining wetlands presents an opportunity to utilise them as an indigenous wetland vegetation nursery for other projects in the region. • Monitoring of the overall response of the wetlands is recommended to ensure that the proposed discharge is not having an adverse effect on these sites. • Offsetting the loss of wetland habitat should be undertaken by constructing a similar or greater area of wetland lost north of W14.	Negligible – Positive	Very Low -Net Gain

Wetland W14 and adjoining areas

Wetland 14 meets the definition of a Schedule F Rare habitat under the Horizons Regional Council One Plan, comprising predominantly indigenous vegetation in its southern extent. As such, the project will avoid having any adverse effects on WL14 entirely, in keeping with the effects management hierarchy (Maseyk, F. *et.al.* 2018), and the magnitude of effect on WL14 is expected to be **Very Low**.

The hydrology of wetland W14 is not expected to be affected by the irrigation because of the deficit irrigation and direction of ground water flow.

The removal of stock from the site will eliminate a source of nitrogen leaching. Retirement from grazing will also result in significant vegetation changes allowing wetland vegetation to increase in height and cover. Overtime this is expected to result in composition changes favouring taller growing grasses, rushes and sedges such as toetoe over small growing grasses. Retirement from grazing is expected to improve native species composition and abundance of wetland W14, with an increase of three-square and sharp spiked sedge, as it is the situation on the southern, stock-free side (Figure 6).

To further protect the indigenous value of WL14, it is proposed that weed control and native revegetation occurs on the northern side of W14 and the proposed offset wetlands. This buffer would be approximately 10 m wide and on the south side of the central duneland, separating it from the southern ecological enhancement area. Within this area exotic weeds such as pampas, radiata pine and boxthorn would be controlled along with enrichment planting. The enrichment planting would include wetland edge and appropriate forest species with the aim of developing dense indigenous vegetation. This would assist to buffer the wetland from invasion by exotic species and also uptake any water and nutrients which potentially transgress into this zone from the north. Suitable species include harakeke, toetoe, mingimingi, manuka, cabbage trees and on well drained sandy soils ngaio, kanuka and taupata.

Based on the above recommendations, the post-mitigated magnitude of effect on WL14 is highly likely to be positive resulting in a net gain in overall value in the short-long term. A summary of the value, pre/post mitigated magnitude and level of effects as well as mitigation recommendations can be seen below in Table 14.

Monitoring wetland W14 health in relation to the irrigation is recommended including assessing the nutrient content of surface water (when flooded in winter) and vegetation composition.

Table 14: Wetland 14 impact assessment summary.

Value	Magnitude of effect	Pre-mitigated level of effect	Mitigation recommendations	Post-mitigated magnitude of effect	Residual level of effect
High	Negligible	Very Low	• De-stocking of the property to allow for natural regeneration of native species within W14. • Planting of indigenous buffer vegetation around the riparian margin of W14. • Maintain the wetland extent throughout the year using hydrological/irrigation inputs. • Monitor the wetland to ensure there are no adverse effects on native vegetation as a result of irrigation.	Positive	Net Gain

It is noted that there are native dominated areas and other dune slack wetlands located between the property and the coast. Wetlands on the adjoining land have not been surveyed or assessed from an ecological perspective. However, because of the deficit irrigation and the direction of shallow ground water, it is expected that there will be no adverse effects on these areas. No anticipated groundwater mounding or surface breakout of groundwater due to the proposed discharge outside of the project site boundary is expected. It is noted that these areas are presently vegetated and subject to ongoing seasonal hydrological variations.

The potential for nutrient enrichment of these neighbouring ecological areas is also consider very low for the above reasons and due to the low nitrogen loading rates proposed. Limited to no irrigation is proposed during the winter periods, only contingency irrigation during these periods will occur.

5.3 Bats

The likelihood of bats using habitat at the project site is low as the site is coastal and there are no trees at the project site that bats could use as roosting habitat. Sites with very sparse tree cover tend to be infrequently used by long-tailed bats even when they are present in the wider nearby landscape where habitat is more suitable.

Currently the proposal does not include the clearing of any suitably sized trees and the habitat on-site provides negligible biodiversity value. Therefore, it is highly unlikely that the wetlands currently provide a key foraging habitat for bats. The direct effect on bats as a result of the proposed works is likely to be **Negligible**. No bat-specific mitigation is required, however the proposed mitigation for other ecological features on-site is highly likely to result in a positive effect on bats in the medium – long term.

Through the restoration of WL14, the planting of native vegetation around WL14 and within the remaining wetlands, and the induction of a high nutrient / high producing environment through irrigation; the project is highly likely to positively affect the on-site habitat's ability to sustain invertebrates and may result in a net gain in key foraging habitat for native bats in the wider ecological area. A summary of the value, pre/post mitigated magnitude and level of effects as well as mitigation recommendations can be seen below in Table 15.

Table 15: Bat impact assessment summary.

Value	Magnitude of effect	Pre-mitigated level of effect	Mitigation recommendations	Post-mitigated magnitude of effect	Residual level of effect
Low	Negligible	Very Low	• No bat specific mitigations are required. However, other recommendations proposed are likely to benefit bats. • Enhancement of the biodiversity values of wetlands 1, 2, 7-13 through native planting. • Restoration of WL14. • Planting of indigenous buffer vegetation around WL14.	Positive	Net Gain

5.4 Birds

Since the site is primarily habitat for common introduced or native bird species, it is not expected that the proposed development will have any discernible adverse impact on the current bird population of the area. As the proposal involves restoration of both the duneland and wetland areas once these areas have been restored, they may provide additional suitable habitat for the birdlife in the area and increase the avifauna presence at this site.

Birds may temporarily be displaced during construction works for the proposed pipeline & storage tank however, these works are anticipated to be of short duration. Following the construction of the discharge infrastructure and restoration of the dune and wetland areas birds will likely return to the area. The effects on native bird populations have been assessed as **Negligible**.

Most native bird species are protected from killing or injury under the Wildlife Act 1953. It is therefore recommended that if vegetation clearance occurs it should take place outside of the main bird breeding season (September to December, inclusive). Alternatively, if this is not practicable, a pre-clearance nesting native bird survey conducted by an experienced ecologist is recommended. If wetland 14 and wetlands 1, 2, 7-13 are rehabilitated as recommended by this report, the on-site habitat for birds is likely to be improved significantly. Provided this occurs, and passive management protocols for avoiding disturbance to nesting birds are followed, if necessary, the post-mitigated level of effect on birds is likely to be positive in the medium – long term. A summary of the value, pre/post mitigated magnitude, and level of effects as well as mitigation recommendations can be seen below in Table 16.

Table 16: Bird impact assessment summary.

Value	Magnitude of effect	Pre-mitigated level of effect	Mitigation recommendations	Post-mitigated magnitude of effect	Residual level of effect
Low	Negligible	Very Low	• Restoration planting to offset the loss of wetland extent will likely have a positive effect on native birds. • Irrigation will maintain high levels of plant productivity on-site which may result in bottom-up effects on birds.	Positive	Net Gain

5.5 Lizards and Frogs

There is potential for low value (Not Threatened) native lizards to be impacted by the proposed works, particularly during the construction phase. Lizards with a Very High value may also be present within the project footprint but are more likely to occur in the southern duneland area which will not be impacted by the proposed works. However, there is the potential for them to be harmed during the instillation of irrigation equipment however this is considered unlikely. Therefore, the unmitigated effect on lizards has been assessed as **Low**.

By implementing simple passive management and best practice techniques during the construction phase of this project, the risk of death of injury to native lizards is greatly reduced. In zones where construction will occur, long grass can be mown and left for at least 48 hours prior to removal to allow native skinks to evacuate the area. Should lizards be found during the instillation of irrigation equipment then works should cease immediately and a suitably qualified ecologist should be contacted.

The planting of native vegetation proposed around wetland 14, and the irrigation of existing stable duneland is likely to increase the on-site habitat's ability to sustain native skinks and increase the overall value of native skinks present on-site. Provided these recommendations are implemented, the post-mitigated magnitude of effect on native lizards is likely to be negligible if not positive in the medium – long term. A summary of the value, pre/post mitigated magnitude, and level of effects as well as mitigation recommendations can be seen below in Table 17.

Table 17: Lizards and frogs impact assessment summary.

Value	Magnitude of effect	Pre-mitigated level of effect	Mitigation recommendations	Post-mitigated magnitude of effect	Residual level of effect
Very High	Low	Moderate	• If long grass is present within the construction zone it should be cut and left for at least 48 hours prior to commencement of the works. • Should lizards be found during the instillation of irrigation equipment then works should cease immediately and a suitably qualified ecologist should be contacted.	Negligible – Positive	Very Low – Net Gain

6 Summary of Effects

Below in Table 15 is a summary of the pre-mitigated and post-mitigated level of effect on the ecological features described within this report.

Table 18: Summary of Pre and Post – Mitigated effects.

Ecological Feature	Pre-Mitigated Level of Effect	Post Mitigated Level of Effect
Central duneland	Very Low	Very Low – Net Gain
Southern duneland	Very Low	Very Low – Net Gain
Wetlands 1-13	Low	Very Low – Net Gain
Wetland 14	Very Low	Net Gain
Bats	Very Low	Net gain
Birds	Very Low	Net Gain
Lizards and Frogs	Moderate	Very Low – Net Gain

7 Recommendations

A summary of the recommended measures proposed to minimise the effects of the project are given below.

7.1 General

- Any areas of exposed earth (as a result of construction, if required) will be revegetated to minimise soil erosion as soon as is practicable.
- Works, excluding excavation for the offset wetland, will not occur within a minimum of a 20 m setback from the delineated boundary of wetland 14.

7.2 Vegetation Management

The following vegetation management measures are proposed:

- The duneland area is to be fenced for stock. If the entire project site has stock excluded this would be sufficient.
- A planting / restoration plan should be prepared as a condition of this consent detailing native planting of buffer vegetation to occur surrounding wetland 14.
- Where irrigation will occur to duneland areas, ecological/biophysical monitoring should be undertaken to ensure the physical structure and ecological value of the dunes are maintained. This should be conditioned as part of the consent application.
- Should irrigating to Schedule F Duneland be found to negatively affect the physical structure of the dunes, irrigation should cease immediately and a 5 m no – irrigation buffer be placed on the boundary of the dune.

7.3 Wetlands 1-14 Management

Effects to the wetlands will be mitigated by undertaking the following:

- Offsetting the loss of wetland habitat should be undertaken by constructing and restoring a similar or greater area of wetland lost. There is approximately 0.390 ha of land adjacent to wetland 14 which could be developed for this purpose (Appendix A, Figure 8).
- The property should be de-stocked to remove physical trampling damage and nutrient enrichment to wetlands.
- If construction works are occurring immediately adjacent to the wetlands a site-specific erosion and sediment control plan should be prepared to minimise the risk of adverse effects on these wetlands as a result of sedimentation.
- A planting / restoration plan should be developed as a condition of this consent that details the enhancement of wetlands 1, 7-13. This will enhance the values of the wetlands on-site and increase the amount of suitable habitat for native fauna.
- Monitoring of the effects of the proposed discharge to the wetlands. Indicators of wetland change as an adverse effect of the proposed discharge that should be monitored over time are groundwater contamination, wetland eutrophication/algal blooming and loss in health of wetland plants. Should any of these adverse effects occur, direct irrigation to the wetlands should cease immediately, and the discharge rates revaluated.

7.4 Bat Management

No potential bat roosts are present on-site therefore no bat related vegetation removal protocols apply. The native planting and wetland restoration on-site is likely to positively affect the on-site habitats value for bats.

7.5 Bird Management

No bird specific management is recommended as part of this consent. The native planting and wetland restoration on-site is likely to have positive effects on bird populations, increasing the value of the site for native birds.

7.6 Lizard Management

Effects to lizards can be managed by undertaking the following prior to land disturbance works and vegetation removal:

- Cut all/any rank grass areas within the construction zone to a height of 100–150mm at least 48 hours prior to earthworks. Rake the cut grass to areas outside of the impacted area. This will remove lizard cover from the site and encourage any lizards that might be present to seek refuge outside of the impact area where cover remains intact.
- Felled vegetation (if any) should remain onsite for no less than four days and no more than 10 days. This will allow any arboreal species that might be living in felled trees (e.g., geckos) time to leave. Note, lizards will not be able to be relocated without a permit issued by the Department of Conservation.
- Boxthorn should be controlled using sensitive methods, such as basal spraying, drilling and poisoning, cutting and stump application, to minimise structural damage to lizard habitat.

8 Conclusions

This ecological impact assessment has determined that the Project Area (and its receiving environments) include habitat with a range of ecological values. Most of the area is pasture with negligible values. The Project Area includes rare ecosystem types such as duneland and a dune slack wetland (although degraded from farming activities).

The effects of the proposed discharge have been assessed and range from very low—low and there is a potential moderate effect of the construction phase on native lizards, although this is considered very unlikely.

The proposed restoration of the southern dune area will result in a net gain for Stable duneland and Dune slack wetland habitats. This will improve ecosystem health of 2.6 hectares of duneland, 0.302 hectares of existing wetland (W14) and offset wetland of up to 0.284 hectares.

The post mitigated effects of the proposed works, provided the above recommendations are followed, range from very low to net gains across the ecological features present on-site.

Measures to mitigate the residual effects have been recommended and assuming these are implemented, it is considered that the overall effect on biodiversity and the ecology of the proposed discharge and associated infrastructure can be managed so that residual effects are Very Low, with a realistic possibility of achieving a net gain in on-site ecological value. It is likely that once completed the final restoration will provide suitable habitat for additional species to use this site and as such will provide additional gains in ecological value.

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Appendix A: Southern Ecological Enhancement Area

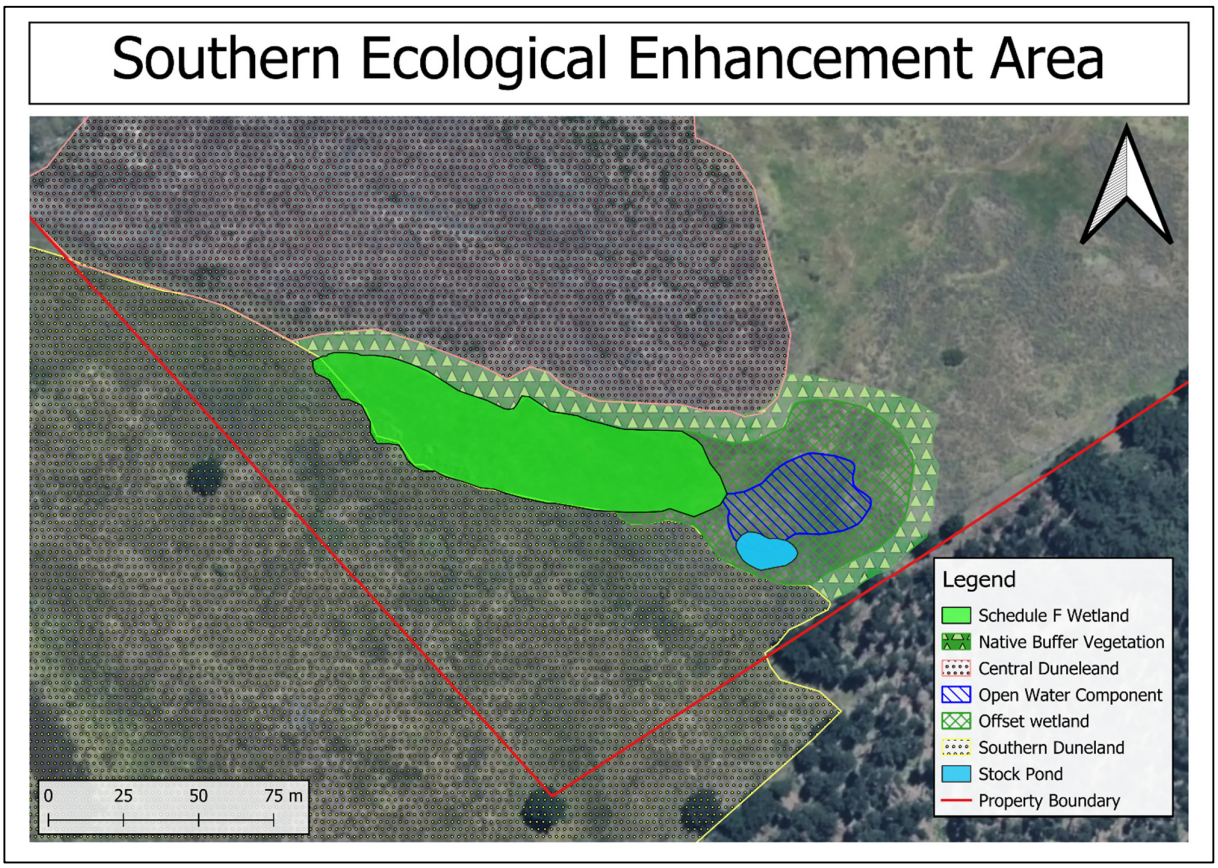

Figure 8: Proposed location of wetland offset, dune enhancement and buffer vegetation.

Appendix B: Wetland Delineation Protocols

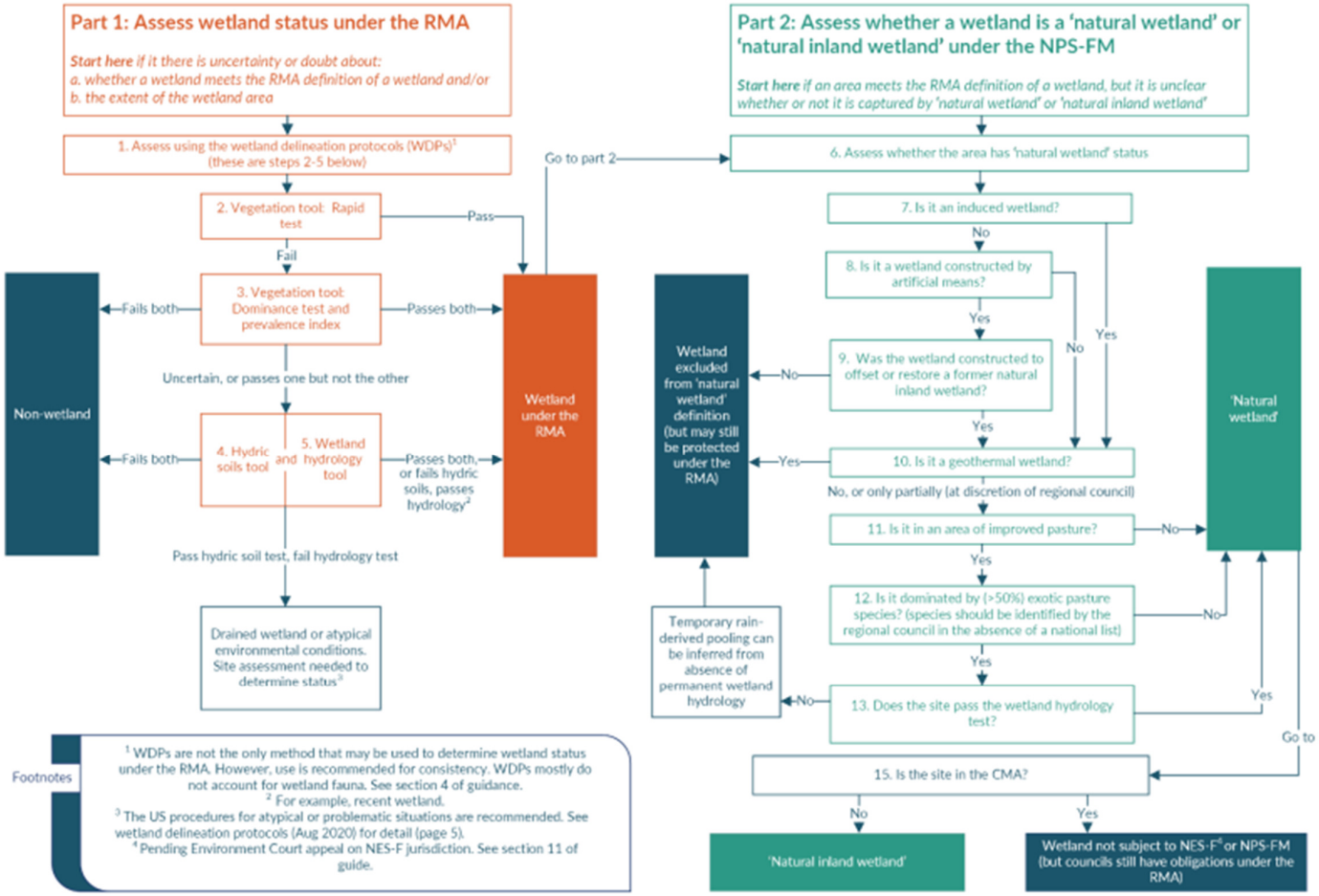

Figure 9: Assessing 'natural wetland' and 'natural inland wetland' status under the NPS-FM.

Appendix C: Species Lists

Duneland vegetation

Table 19: Plant species and relative abundance identified within the duneland areas. * denotes an exotic species.

Common name	Latin name	Central duneland	Southern duneland
Boxthorn*	*Lycium ferocissimum*	Occasional	Common
Cabbage tree	*Cordyline australis*	Not present	Uncommon
Gorse*	*Ulex europeaus*	Not present	Occasional
Ink weed*	*Phytolacca octandra*	Occasional	Not present
Knobby clubrush	*Ficinia nodosa*	Occasional	Common
Marram*	*Ammophila arenaria*	Local	Occasional
Pink ragwort*	*Senecio glastifolius*	Common	Occasional
Pampas*	*Cortderia selloana*	Local	Occasional
Radiata pine*	*Pinus radiata*	Abundant	Not present
Small-leaved pōhuehue	*Muehlenbeckia complexa*	Uncommon	Abundant
Tree lupin*	*Lupinus arboreus.*	Common	Occasional
Tauhinu	*Ozothamnus leptophyllus*	Not present	Occasional
Toetoe	*Austroderia toetoe*	Uncommon	Common
Tree lucerne*	*Chamaecytisus palmensis*	Occasional	Not present

Birds

Table 20: Birds identified on eBird[1] for the Turakina River and their conservation status.

Common name	Scientific name	Threat Classification
Anas superciliosa	Pacific black duck	Threatened - Nationally Critical
Larus bulleri	Black billed gull	Threatened - Nationally critical
Calidris canutus	Red knot	Threatened - Nationally Vulnerable
Charadrius bicinctus	Double banded plover	Threatened - Nationally Vulnerable
Hydroprogne caspia	Caspian tern	Threatened - Nationally Vulnerable
Anthus novaeseelandiae	New Zealand pipit	At-Risk Declining
Larus novaehollandiae	Silver gull	At-Risk Declining
Limosa lapponica	Bar-tailed godwit	At-Risk Declining
Sterna striata	White fronted tern	At-Risk Declining
Haematopus unicolor	Variable oystercatcher	At Risk - Recovering
Phalacrocorax carbo	Black Shag	At-Risk Relict
Elseyornis melanops	Black fronted dotterel	At Risk - Naturally Uncommon
Platalea regia	Royal spoonbill	At Risk - Naturally Uncommon
Phalacrocorax sulcirostris	Little black cormorant	At Risk - Naturally Uncommon
Anas gracillis	Grey teal	Not Threatened
Anas rhynchotis	Australian shoveler	Not Threatened
Circus approximans	Swamp harrier	Not Threatened
Cygnus atratus	Black swan	Not Threatened
Egretta novaehollandiae	White-faced heron	Not Threatened
Himantopus himantopus	Pied stilt	Not Threatened
Hirundo neoxena	Welcome swallow	Not Threatened

[1] eBird. 2021. eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available: http://www.ebird.org. (Accessed: Date [e.g., December 01, 2021]).

Larus dominicanus	Kelp gull	Not Threatened
Morus serrator	Australasian gannet	Not Threatened
Porphyrio melanotus	Australasian swamphen	Not Threatened
Tadorna variegate	Paradise shelduck	Not Threatened
Todiramphus sanctus	Sacred kingfisher	Not Threatened
Vanellus miles	Masked lapwing	Not Threatened
Zosterops lateralis	Silvereye	Not Threatened
Calidris melanotos	Pectoral sandpiper	Non-resident Native - Vagrant
Arenaria interpres	Ruddy turnstone	Non-resident Native - Migrant
Calidris acuminata	Sharp-tailed sandpiper	Non-resident Native - Migrant
Pluvialis fulva	Pacific golden plover	Non-resident Native - Migrant
Stercorarius parasiticus	Arctic skua	Non-resident Native - Migrant
Alauda arvensis	Eurasian skylark	Introduced and Naturalised
Anas platyrhynchos	Mallard	Introduced and Naturalised
Anser anser	Greylag goose	Introduced and Naturalised
Branta canadensis	Canada goose	Introduced and Naturalised
Callipepla californica	California quail	Introduced and Naturalised
Carduelis carduelis	European goldfinch	Introduced and Naturalised
Columba livia	Rock Dove	Introduced and Naturalised
Emberiza citronella	Yellowhammer	Introduced and Naturalised
Fringilla coelebs	Common chaffinch	Introduced and Naturalised
Gymnorhina tibicen	Australian magpie	Introduced and Naturalised
Prunella modularis	Dunnock	Introduced and Naturalised
Sturnus vulgaris	Common starling	Introduced and Naturalised
Turdus merula	Eurasian blackbird	Introduced and Naturalised
Turdus philomelos	Song thrush	Introduced and Naturalised

Table 21: 2021 DOC Bioweb Herpetofauna records within 25 km of the project footprint.

Common name	Scientific name	Threat Classification
Kupe skink	*Oligosoma aff. Infrapunctatum "Southern North Island"*	Threatened – Nationally Critical
Ornate skink	*Oligosoma ornatum*	At Risk - Declining
Glossy brown skink	*Oligosoma zelandicum*	At Risk-Declining
Northern grass skink	*Oligosoma polychroma*	Not Threatened
Raukawa gecko	*Woodworthia maculata*	Not Threatened
Pacific gecko	*Dactylocnemis pacificus*	Not Threatened
Southern bell frog	*Ranoidea raniformis*	Introduced and Naturalised
Brown tree frog	*Litoria ewingii*	Introduced and Naturalised
Plauge skink	*Lampropholis delicata*	Introduced and Naturalised

Appendix D – Schedule F Assessment

Appendix E – EIANZ Guidelines Figures/Tables

Table 4 Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/habitat/community.

Matters	Attributes to be considered
Representativeness	Criteria for representative vegetation and aquatic habitats: • Typical structure and composition • Indigenous species dominate • Expected species and tiers are present • Thresholds may need to be lowered where all examples of a type are strongly modified Criteria for representative species and species assemblages: • Species assemblages that are typical of the habitat • Indigenous species that occur in most of the guilds expected for the habitat type
Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats: • Naturally uncommon, or induced scarcity • Amount of habitat or vegetation remaining • Distinctive ecological features • National priority for protection Criteria for rare/distinctive species or species assemblages: • Habitat supporting nationally Threatened or At Risk species, or locally[19] uncommon species • Regional or national distribution limits of species or communities • Unusual species or assemblages • Endemism
Diversity and Pattern	• Level of natural diversity, abundance and distribution • Biodiversity reflecting underlying diversity • Biogeographical considerations – pattern, complexity • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation
Ecological context	• Site history, and local environmental conditions which have influenced the development of habitats and communities • The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA) • Size, shape and buffering • Condition and sensitivity to change • Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material • Species role in ecosystem functioning – high level, key species identification, habitat as proxy

Table 6. Scoring for sites or areas combining values for four matters in Table 4.

Value	Description
Very High	Area rates High for 3 or all of the four assessment matters listed in **Table 4**. Likely to be nationally important and recognised as such.
High	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder, or Area rates High for 1 of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

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