Appendix K Terrestrial Ecology – Wetlands and Vegetation Assessment

Ecological Impact Assessment for wetlands and terrestrial vegetation

Taharoa Ironsands Central and Southern Block Mining Project

Taharoa Ironsands Limited

Prepared by:

SLR Consulting New Zealand

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	Click to enter a date.			

Basis of Report

This report has been prepared by SLR Consulting New Zealand (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Taharoa Ironsands Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report has been prepared for Taharoa Ironsands Limited in respect of its application for all approvals under the Fast-track Approvals Act 2024 for the Central and Southern Blocks of the Taharoa Ironsand Mine. The Panel appointed to consider the application for the Central and Southern Blocks Mining Project may rely on this report for the purpose of making its decision under the Fast-track Approvals Act 2024.

This report has been prepared in accordance with the Environment Court's Code of Conduct for expert witnesses, contained in the Environment Court's Practice Note 2023. The authors of this report agree to comply with the Code of Conduct, and confirm that unless otherwise stated, the issues addressed in this report are within the area of expertise of the authors. No material facts have been omitted that might alter or detracted from the opinions expressed in this report.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Executive Summary

Taharoa Ironsands Limited is applying for all resource consents and permissions to undertake ironsand mining operations in the Central and Southern Blocks at the Taharoa Mine (**Site**). Mining operations include extraction and processing of ironsand, loading of the refined product onto ships, bulk earthworks, mining above and below the water table, damming, diversion and take of water and all associated activities.

An ecological survey of the Central and Southern Blocks of the Taharoa C Block (the Site) was conducted to provide information on values and potential effects of the Taharoa Ironsands mining operation, to support an application for all necessary approvals for ironsand mining operations under the Fast-track Approvals Act 2024.

Field surveys were carried out over the summer of 2021-22 during which all vegetation and habitats across the Site were described and classified. More recently, up-to-date aerial photographs have been analysed for changes since the field work was completed. Wetlands were identified, classified and assessed against the National Policy Statement for Freshwater Management definitions. The extent of threatened and naturally uncommon ecosystems was mapped and pest plant distribution was recorded.

A total of 39 vegetation types were identified. More than 380 ha (~44%) of the Site was bare sand or very sparsely vegetated, while in the south there was large areas of kikuyu-dominated pasture overtopped with knobby clubrush, tree lupin and marram grass. An 85 ha area of pine forest is located in the east of the Site adjacent to Lakes Rotoroa and Numiti.

There are three Naturally Uncommon ecosystems present within the Site being active sand dunes, stable sand dunes and lake margins. Active and Stable Sand Dunes are restricted to a relatively narrow band along the coastal fringe, while the Lake Margins ecosystem borders Lakes Numiti, Rotoroa and Taharoa.

Nine pest plants or problem plants were identified and some require control under provisions in the Waikato Regional Pest Management Plan.

A number of potential wetlands were investigated during the survey and of these, 17.54 ha were identified as meeting the National Policy Statement on Freshwater Management definition of Natural Inland Wetland. Wetlands included lacustrine and riverine wetlands, as well as palustrine swamps, seepages and shallow water wetlands.

The majority of these wetlands are seepage wetlands located in the southern part of the Site which are dominated by exotic species, and lake margin wetlands in the east, close to Lakes Numiti, Rotoroa and Taharoa, which are typically dominated by raupō. The seepage wetlands have formed in depressions or seepage areas that are a result of previous and current mining activities or are fed by seepage water from overburden dewatering activities.

An assessment of ecological value and effects was carried out using the method detailed in the EIANZ Ecological Impact Assessment Guidelines. Ecological values for vegetation and habitats within the Site ranged from negligible to very high with the majority being of moderate ecological value.

The assessment of ecological effects has concluded that in general the level of effect of the proposed mining operations on wetlands (and their extent), vegetation and habitats will be low provided the following measures to avoid, minimise, or remedy the effects of the mine are put in place:

- Establish and maintain a clearly fenced or delineated mining exclusion zone extending 100 m inland of Mean High Water Springs;

- Develop a pest plant management plan to detail a programme for the entire Site to reduce the impact of pest and problem plants on sensitive habitats such as dunes and wetlands, and ensure machinery entering the site is cleaned and decontaminated;
- Develop a natural wetland management plan for the retained wetlands which should include the following measures:
    - A plan to fence and/or maintain vegetated wetland buffers around retained natural wetlands on the Site which should be a minimum of 30 m wide
    - A planting maintenance and weed control programme for wetlands and their buffers
    - Pest animal control, focussing on rats, possums and mustelids and protection during the nesting season in accordance with the pest management recommendations in the Natural Inland Wetland and Buffer Management Plan.
- Develop a lake margin wetland monitoring programme which should include:
    - Baseline monitoring of the extent and health of the raupō and flax wetlands on the margins of Lake Taharoa adjoining Central and Southern Block within the months of February and March following the commencement of the consents;
    - Repeat monitoring every 5 years;
    - Set a lake level of 9.6 m to trigger the following:
        - Monitoring and reporting on the extent and health of the raupō and flax wetlands if the level of Lake Taharoa is less than 9.6 metres for a continuous 30 day period;
        - If effects are found, and they relate to the mine water take, review and update the Lake Level & Water Management Plan to identify mine management measures/responses that can be implemented to address the adverse effects.
- Establish and plant (or maintain existing) 30 m buffers within the Site around perennial water bodies, and ensure that kanuka and manuka stands are included within these exclusion areas and that kanuka and manuka are planted in the wetland buffer plantings.
- It is recommended that the measures to mitigate impacts on biodiversity values outlined above are included into an overall site Ecological Management Plan, or part of a broader Environmental Management Plan, as there are a number of crossovers between the actions for wetlands, vegetation, dunes and fauna.

Approximately 4.25 ha of moderate-value natural wetland will be removed as part of the mining operation. The loss of these wetlands cannot be avoided, minimised or remedied if mining operations are to proceed at the location of these wetlands, and as such, offsetting or compensation are recommended, if no net loss of biodiversity values is to be achieved.

Creating new wetland habitat is recommended as the best option for offsetting. The Tonkin & Taylor Biodiversity Compensation Model was used to recommend that 8.3 ha be set aside to create a new wetland. This is considered an appropriate quantum for an offset because it allows for up to 10% net gain of biodiversity value and a 3% discount rate. Wetland creation at this site is highly achievable and with good management and could be well established within 6 years because work can begin before mining of other wetlands on the Site takes place, which means there will be a very limited delay between the impact on surrounding wetlands and the offset being achieved.

The measures set out above have been incorporated into the proposed conditions of consent

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1.0 Introduction

Taharoa Ironsands Limited (TIL) operates an ironsand mining operation at Taharoa on the west coast of the North Island, south of Kawhia Harbour. TIL is seeking new resource consents to continue the existing ironsand mining operation, concentration, and processing facilities at the Central and Southern Blocks of the Taharoa Mine and to enable the export of titanomagnetite from the Port of Taharoa.

SLR was engaged to undertake assessments of the potential ecological effects of the proposed continuation of the mining operation. This report provides an Ecological Impact Assessment (EcIA) for terrestrial vegetation and wetlands.

1.1 The Site

The area of interest within the Taharoa Ironsands Mine (the Mine) considered in this assessment is the Central and Southern Block of Taharoa C Block displayed in Figure 1. That is, the part of Taharoa C Block south of Mitiwai Stream. In addition, it is our understanding that there is no intention to mine the area below the escarpment at the southernmost end of the site or south of the Waiohipa Stream and this area was not surveyed in detail.

Figure 1: Taharoa Mine (Central/Southern Block) location

2.0 Methods

2.1 Terrestrial vegetation and habitats

Vegetation was mapped for the entire Site using aerial photography and walkthrough surveys over multiple visits. Vegetation was described and classified using the system developed by Atkinson (1985) which expresses cover of dominant or characteristic species to describe the vegetation composition, coupled with structural class. While the naming conventions described by Atkinson (1985) were used, cover was estimated rather than measured using plots. In most cases vegetation types were kept relatively broad so that large areas were incorporated.

Two sets of aerial photography were used during this process: The Waikato 0.3m rural aerial photography from 2016-2019 sourced via ESRI, and the Google Earth imagery from March 2021. The mine site is highly dynamic and even 2021 imagery was not completely accurate. A third set of aerial photography, taken in early 2025, was viewed during the preparation of this report and there is no significant difference in the extent of wetlands or native vegetation types.

Vegetation types were mapped into GIS and the total area of each type was calculated.

2.2 Wetlands

All potential wetlands were surveyed using the same methodology as other vegetation types except where it was not obvious that the vegetation was dominated by hydrophilic species, or the extent of a wetland was not clear. This approach is consistent with the Wetland Delineation Protocols (MfE 2020) which include a Rapid Test which allows experienced ecologists to identify wetlands based on the clear dominance of hydrophytic plant species. Where it was not clear whether a wetland qualified as a Natural Inland Wetland, wetland plots were established following the Wetland Delineation Protocols. Where the boundaries of wetlands were not apparent on aerial photographs the boundaries of the wetland were walked with a handheld GPS unit with accuracy of around +/- 5m. This was considered the only practical way to define the wetland edge as plots or transects would have taken considerably longer, and given little or no extra definition, especially where wetland edges are irregularly shaped.

Some of the more established ponds were assessed, and information on vegetation composition was collected, however many other ponds across the site were not considered as they were being actively managed for water storage or other purposes, or were transient ponds fed by rain or groundwater that will disappear as mining operations evolve around them.

Wetlands were mapped onto GIS and the area of wetland within the mine boundary was calculated. Each wetland was classified using the system described by Johnson & Gerbeaux (2004) and their ecological features, vegetation and landform were summarised.

2.3 Assessing the level of ecological effect

The assessment of the level of effect on ecological values associated with the mining operation follows the Environmental Institute of Australia and New Zealand (EIANZ) Impact Assessment Guidelines (Roper-Lindsay et. al., 2018). An ecological effect is any change in the ecosystem, it's including its biotic and abiotic parts or it's ecological processes, either positive or negative, caused by the activity being proposed.

The following steps were used for this assessment:

- Ecological values are assigned a level on a scale of Low, Moderate, High or Very High based on assessing the values of species, communities and habitats identified against criteria set out in the EcIA guidelines and using the guidance provided in Appendix 1 of the National Policy Statement on Indigenous Biodiversity 2023 (NPS-IB).
- The magnitude of effect on the Site works on ecological values is evaluated as either No Effect, Negligible, Low, Moderate, High, or Very High. The 'Magnitude of Effect' is based on:
  - The scale of the unmitigated effect per se;
  - The proportion of habitat loss versus local availability;
  - The expected duration of effect (e.g. permanent versus temporary); and
  - The intensity of the effect (i.e. the extent to which habitat loss within the Site is complete or partial).
- The overall level of effect in the absence of mitigation is determined using a matrix that is based on the ecological values and the magnitude of effects on these values in the absence of any efforts to avoid, remedy or mitigate for potential effects.
- Expert judgement is applied throughout the process, and particularly to the overall level of effect as the matrix approach has been criticised for underestimating effects and it is important that a sense check is applied.

The overall level of effect is used to determine the level of mitigation recommended. Effects assessed as 'Moderate' or greater warrant efforts to avoid, remedy and/or mitigate them, from an ecological perspective.

This method involves the evaluation of the ecosystem/habitat values (Table 1) and species ecological values (Table 2). An assessment is then made of the magnitude of the likely effect (Table 4). Ecological value and magnitude of effect on that value is then used to determine the overall level of effect using a decision matrix (Table 5).

2.3.1 Assessing ecological values

The ecological values for vegetation and habitats, were assessed using criteria set out in the EIANZ guidelines (Roper-Lindsay et. al. 2018). Table 1 and Table 2 provide an overview of the attributes that were considered when assessing ecological values of the Site.

Table 1: Criteria considered for ecological value of habitats and species (modified from Roper-Lindsay et al., 2018).

Matters	Attributes to be assessed
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.

Matters	Attributes to be assessed
	Criteria for rare/distinctive species or species assemblages: Habitat supporting nationally Threatened or At-Risk species, or locally 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; Essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience; 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 2: Criteria for assigning ecological value to species (from Roper-Lindsay et al. 2018).

Threat category	Assigned value
Threatened – Nationally Critical, Endangered or Vulnerable	Very High
Nationally At Risk – Declining	High
Nationally At Risk – Recovering, Relict or Naturally Uncommon	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pests, species having recreational value	Negligible

Table 3: Scoring for sites or areas combining values for matters (from Roper-Lindsay et al. 2018).

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 matters, 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.

Value	Description
	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.

2.3.2 Assessing magnitude of effect

Once ecological values were determined, the magnitude of the effect on ecological values was assessed. The magnitude of the effect is a measure of the extent, or scale, of the effect, its duration, and the degree of change that it will cause. Magnitude of effect can range from very high to negligible, as shown in Table 4.

Table 4: Criteria for Describing Magnitude of Effect (from Roper-Lindsay et al. 2018).

Magnitude	Description
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 one or more 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 or range of the element/feature

2.3.3 Assessing level of ecological effect

The overall level of the effect was determined by applying the following matrix (Table 5), which combines the ecological value of the habitat or species and the magnitude of effect.

Table 5: Assigning Level of effect (from Roper-Lindsay et al. 2018).

		Ecological value				
		Very High	High	Moderate	Low	Negligible
Magnitude of effect	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

3.0 The Existing Environment

For the purposes of the RMA (and this ecological assessment), an application to renew regional resource consents cannot take into account the effects of ongoing activities undertaken under the existing regional consents (because they are expiring).

The existing environment includes the state of the site at the completion of all activities under the existing consents, including rehabilitation and site closure.

The Central and Southern Blocks of the Taharoa C Block have been extensively modified by ironsand mining and landcover change since the early-1970s. Examination of historic aerial photography shows that prior to that time almost the entire Site was mobile sand dunes with only pockets of vegetation. Mining has resulted in significant changes to the landform, including creation of hollows and swales which have subsequently developed into wetlands.

The introduction of exotic grasses and other vegetation has stabilised the dunes and stopped the natural process of sand mobilisation and dune formation. The Wainui Stream was dammed early in the life of the Mine, raising the level of Lake Taharoa and altering the marginal habitat of the lake and the characteristics of the stream.

The existing environment against which effects were assessed:

- Includes the impacts of the past mining operations including any previous vegetation clearance, landform change and alteration of hydrology i.e. it can be assumed that mining has historically occurred on the site (as explained above) and that the features of the site have changed as a result;
- Excludes the water take and discharges authorised by the expired consents (being the consents TIL is seeking to replace);
- Has had the dam on the Wainui Stream removed and water levels in the Taharoa lakes returning to their natural levels, but the vegetation and habitats on the lake margins are those adapted to the higher levels associated with the expired consents;
- Includes margin wetlands that are of a similar extent to those which currently exist. Based on historic aerial photographs, we understand that the marginal wetlands prior to TIL's current mining activity (and the dam being installed) were as extensive as they are now. It can therefore be assumed that they will remain similar if mining were discontinued.
- Includes flora and fauna accustomed to regular disturbance from mining activities (i.e. the environment is resilient); and
- Includes a land surface that has been rehabilitated according to the Site Rehabilitation Plan[1] and final Site Closure Plan (prepared six months prior to site closure). Rehabilitation would have been progressively implemented and the last of the stabilisation and rehabilitation would have been completed in the lead up to site closure (as the Mine would have only recently stopped mining activity).

Although it is uncertain precisely what that environment will look like or what will be specified in the final Site Closure Plan that is prepared in the lead up to actual site closure, a general understanding can be obtained based on assessment of the current environment, the existing and proposed operations and the conceptual Site Closure Plan and the current Landscape Rehabilitation Plan[1].. In all likelihood the Site would contain planted rehabilitation

[1] Taharoa Ironsands Landscape and Rehabilitation Plan dated July 2019

species, which to date have been the exotic marram grass and tree lupin, with parts only recently being planted.

4.0 Results

4.1 Terrestrial Vegetation and Habitats

Although the ecological features and values of the Site at the time of the survey do not represent those of the existing environment as it is described above, they are essential in providing an understanding of what the existing environment might actually look like from a terrestrial ecology perspective.

In total, 39 vegetation types were described within or adjacent to the Site. Maps of the extent of each of these types are included in Figure 2 and Figure 3 below and each type is described in Table 7.

The majority of the Site is very sparsely vegetated or bare sand (Type 17) which at the time of survey covered just over 380 ha and included all the active mine areas and tailings cells. These areas were mostly devoid of vegetation but there were very sparse patches of plants such as sand sedge[2], marram grass and tree lupin. These are the areas which are to be assessed as if they had been recently rehabilitated.

In the south (where mining has not occurred for some time and where rehabilitation planting has occurred, the vegetation was generally kikuyu-dominated pasture overtopped with various amounts of knobby clubrush, tree lupin, and in some areas, marram grass (Type 2, 9 & 13). Several wetlands were also present in this southern area (see Section 4). In the east a large area (approximately 85 ha) of pine forest buffered the active tailings cells from Lakes Taharoa, Numiti and Rotoroa. Adjacent to Lake Taharoa there was an approximately 80 ha area where pine forest was harvested in around 2018 (Type 25). This area has re-grown in wilding radiata pine which was dense in some areas, although in others it was pasture or lupin dominated.

The Wainui Stream flows southwest from Lake Taharoa and enters the sea just north of the main export stockpile area, pumping plant and administration area. A large area of wetland is situated adjacent to where the stream leaves the lake, and wetlands dominated by raupō fringe the stream right down to the dam.

North of the Wainui Stream, to the main access road, was almost all active mine site or processing area where the dominant cover was bare sand and patchy lupin, inkweed, marram, and knobby clubrush (Types 17 & 36). This area had numerous ponds and channels which are used in the mining process or to manage stormwater. A few of these had developed patches of raupō. North and west of the main access road was mostly being actively mined in late 2021 and the area between there and the main gate had been mined in the last two or three years. Again, a few ponds and depressions were located in this area, and some included marginal wetland vegetation (see Section 4). The current Site conditions are similar to that described above, but with more extensive mining across the entire Central Block.

The Mitiwai Stream marks the northern edge of the Site. It flows through a steep-sided gully which is vegetated in pine, pasture and pampas.

[2] Note that common names are used throughout the text and corresponding botanical names can be found in Appendix A.

Along the coastal fringe there is a strip of active foredune dominated by Spinifex (Type 18) with a more stable, vegetated area on the back of the foredune (Type 19) where knobby clubrush dominates.

Figure 2: Vegetation Types in the northern half of the Site.

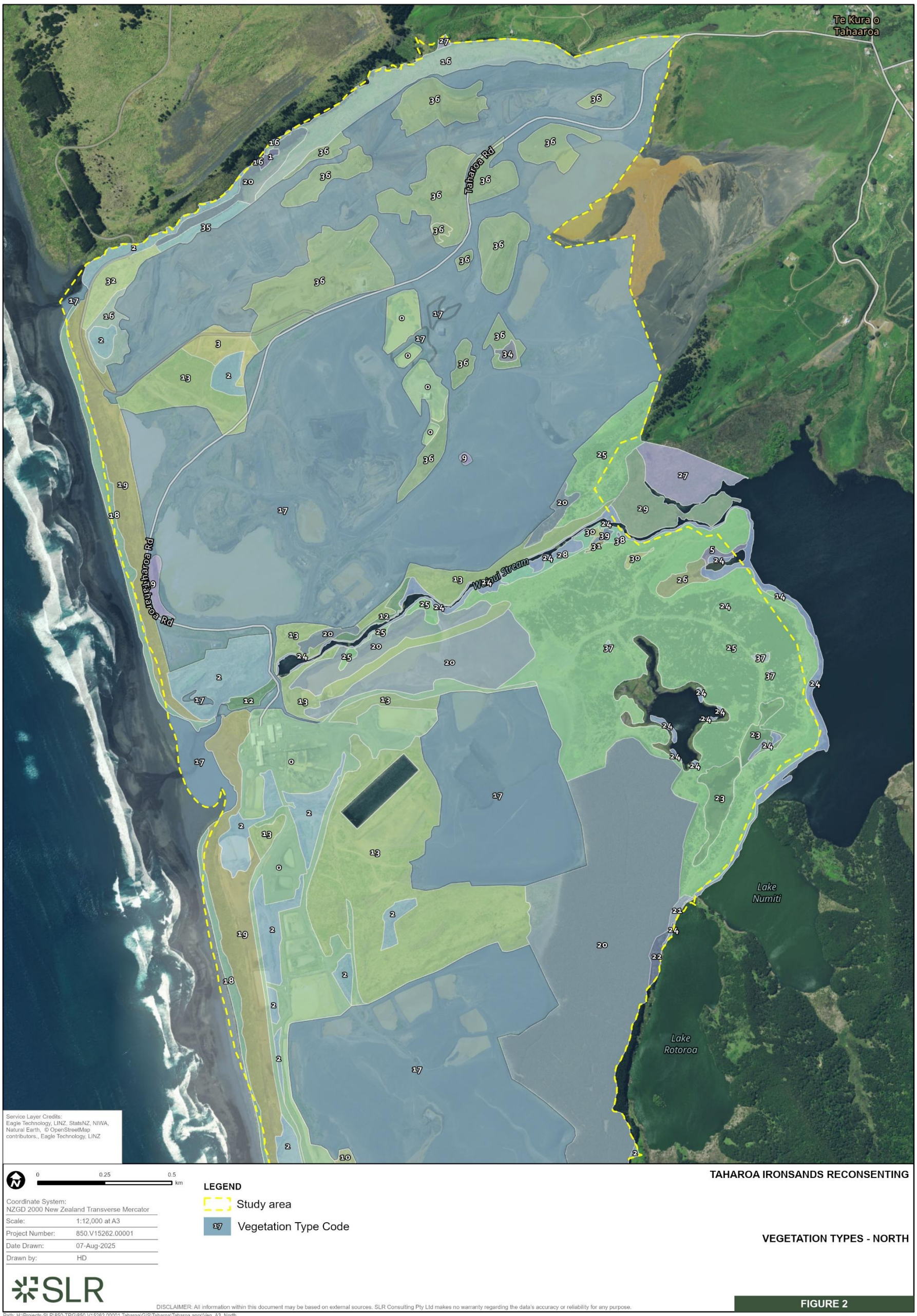


Figure 3: Vegetation types in the southern part of the Site.

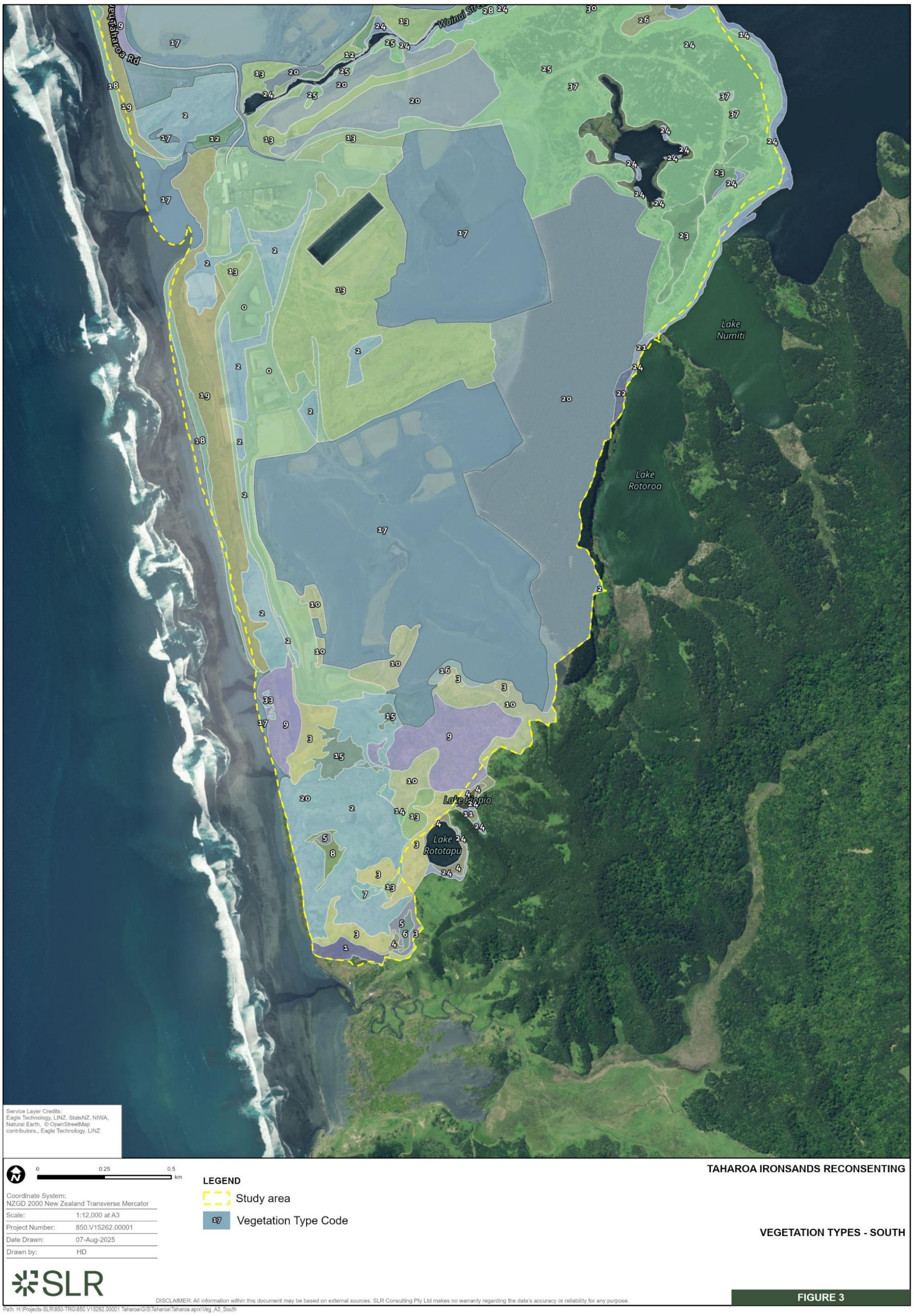


Table 6: Key to vegetation descriptions (From Atkinson 1985)

Key to vegetation descriptions (from Atkinson 1985)

species	>50% of total vegetation cover of underlined species in a particular tier
species	20-49% of total vegetation cover of underlined species in a particular tier
(species)	10-19% of total vegetation cover of a species in a particular tier
[species]	1-10% of total vegetation cover of square bracketed species in a particular tier
Species 1 / species	Species 1 in a tier above species (e.g., a species emergent above the canopy)
Species-species	Species occurring within the same tier

Generally only species with a cover greater than 20% are included in the name but conspicuous or emergent species may also be included.

Table 7: Vegetation Type Descriptions

Identifier	Description	Structural class	Total area within Taharoa Ironsands Central Southern Blocks boundary (ha)
1	Harakeke	Flaxland	1.71
2	knobby club rush - (gorse) - (lupin) - (pampas) / pasture - pōhuehue	Rushland	50.98
3	[gorse]- [tree lupin] / kikuyu - Pasture species	Grassland	11.06
4	jointed twig rush - raupō - (harakeke)	Sedge-rushland	0.22
5	*Isolepis prolifera*	Sedgeland	1.40
6	*Machaerina rubiginosa* - purei - (harakeke)	Sedgeland	0.46
7	[jointed rush] / *Myriophyllum propinquum*	Water field	0.33
8	(oioi) - [knobby club rush] / jointed rush	Rushland	0.87
9	marram - [tree lupin] / pasture	Grassland	14.78
10	[pampas] / Knobby club rush - (tree lupin) - [gorse]	Rushland	10.41
11	soft rush	Rushland	0.00
12	Native plantings	Shrubland	1.62
13	tree lupin - [knobby club rush] / kikuyu	Shrubland	61.31
14	giant umbrella sedge - [knobby club rush] / jointed rush - (lotus) - [slender clubrush]	Sedgeland	0.17
15	[raupō] / jointed rush - (lotus) - [Yorkshire fog]	Rushland	2.54
16	pampas - [tree lupin] / pasture	Tussockland	16.01
17	bare sand - [lupin] - [*sand sedge*]	Sandfield	384.00
18	spinifex - (knobby club rush) - [marram]	Grassland	3.38
19	knobby club rush - (pampas) –(marram) - [pōhuehue] - [African boxthorn]	Sedgeland	27.46
20	Radiata pine	Forest	84.79

Identifier	Description	Structural class	Total area within Taharoa Ironsands Central Southern Blocks boundary (ha)
21	Kanuka	Scrub	0.33
22	[kanuka] / lupin / kikuyu	Shrubland	0.70
23	kuta - (raupō)	Reedland	4.53
24	raupō	Reedland	4.77
25	Radiata pine / lupin - (gorse) - [giant umbrella sedge] / pasture	Scrub	79.30
26	(raupō) / Carex virgata - sharp spike sedge - [Parablechnum minus]	Sedgeland	1.22
27	Grey willow / (raupō) - (harakeke)	Scrub	0.16
28	Gorse - blackberry / pasture	Grassland	1.41
29	(Grey willow) / raupō - harakeke	Reedland	0.00
30	Carex virgata - (giant umbrella sedge) - [raupō]	Sedgeland	0.41
31	Manuka	Scrub	0.11
32	[Radiata pine] / pampas - knobby club rush - tree lupin / pasture	Tussockland	2.86
33	giant umbrella sedge / sharp spike sedge - *Isolepis prolifera*	Sedgeland	0.20
34	Sea aster - *Juncus sarophorus*	Herb-rushland	0.41
35	Inkweed	Shrubland	1.22
36	Tree lupin - (inkweed) - (pampas) / kikuyu - lotus - bare ground	Shrubland	41.82
37	[radiata pine] - [raupō] - [soft rush] - [giant umbrella sedge] / Azolla pinata	Fernland	0.25
38	[raupō] / sharp spike sedge - rautahi – giant umbrella sedge - blackberry - (pink bindweed) / water purslane	Sedgeland	0.07
39	(raupō) - [manuka] - [grey willow] / sharp spike sedge – *Isolepis prolifera*	Sedgeland	0.21

An assessment of the ecological value of the vegetation and habitats is provided in Section 5.0.

4.2 Naturally uncommon ecosystems

Three naturally uncommon ecosystems occur either within or immediately adjacent to the Site. These are active sand dune (endangered, Holdaway et. al 2012), stable sand dune (endangered), and lake margins (vulnerable).

4.2.1 Active sand dune

Historically the majority of the Site was active sand dune, which are those dunes on which sand is being actively moved by wind, or there is the possibility that dry, exposed sand may be susceptible to further wind action (Hesp 2000). The extent of active dunes on the Site has been considerably reduced by human activity and is now restricted to a narrow strip of between 20 and 50 m wide along the whole length of the beach. The tailings cells where recent deposition has occurred after the titanomagnetite has been removed from the raw product also comprise sand susceptible to wind action, however they are constantly being moved and changed by heavy machinery as part of the mining process and are not naturally functioning dune ecosystems. In total there is approximately 3.4 ha of active sand dune within the Site along the coastal fringe, although there is additional area of dune system outside the property boundary. There are also active sand dunes south of the Waiohipa Stream at the southernmost end of the Site (around 12.5 ha) which will be unaffected by mining operations.

Photo 1: Active sand dune adjacent to the active Taharoa Mine Site

4.2.2 Stable sand dune

Stable sand dunes are those that are vegetated and no longer subject to windblown sand or coastal processes. Prior to human disturbance, Taharoa C Block was active sand dune which has now been at various times mined and then stabilised through planting of mostly exotic vegetation. These highly modified dunes cover most of the Site, but they have been highly modified. While they are made up of sand, they no longer have the landform or the vegetative cover typical of either active or stable sand dunes. There are areas of less modified stable dune along the coast, but it is very difficult to define the edge of the natural dune system against the modified dune system.

Photo 2: Stable sand dune

4.2.3 Lake margins

Lake margins were considered Vulnerable by Holdaway *et. al.* (2021). At Taharoa, the lake margin ecosystems comprise raupō-(harakeke) reedland with a few areas of lower turf vegetation or *Isolepis prolifera,* and submerged macrophytes in deeper water. The majority of the lake margins are outside of Taharoa C Block and will not be directly impacted by mining works but may be indirectly affected by lake level changes. These areas are subject to regular water level fluctuations associated with natural variations in lake level and the normal operating range that has resulted from the current water take regime (which would cease at the expiry of the existing consents[3]and may change as a result of the new consents).

[3] Condition 3 – WRC Consent No. 100905, Condition 4 – WRC Consent No.100906

Photo 3: The Lake Taharoa margins include extensive wetlands

4.3 Threatened flora

No Threatened or At-Risk plant species were recorded at the Site, although at the time of the initial assessment mānuka was considered At-Risk and kānuka was considered Threatened due to the threat posed by myrtle rust (de Lange *et. al.* 2018), however these threat ratings have now been revised and both are in the Not Threatened category (de Lange *et. al.* 2024).

Although pingao (*Ficinia spiralis*) was searched for on the dunes, none were found. Other threatened species known from nearby listed in the original Tonkin + Taylor impact assessment (Table 8) may be present on the Site but were not seen.

Table 8: Threatened and At-Risk plant species recorded from within 2km of the Site.

Species	Conservation Status[4]	Likelihood of being present
Lepidium oleraceum	Nationally Endangered	Unlikely
Myosotis pansa subsp. *pansa*	Nationally Critical	Possible
Metrosideros carminea	At-Risk Declining	Unlikely
Rorippa divaricata	Nationally Vulnerable	Possible on lake margins
Ranunculus urvilleanus	At-Risk Declining	Possible
Ficinia spiralis	At-Risk Declining	Possible
Thelypteris confluens	At-Risk Declining	Recorded in Lake Taharoa wetlands
Ranunculus macropus	At-Risk Declining	Recorded in Lake Rotoroa wetlands

A botanical species list is included as Appendix A.

[4] De Lange *et. al.* 2024

4.4 Pest plants

The incidence of pest plants, namely those listed in the Waikato Regional Pest Management Plan (RPMP, Waikato Regional Council 2022), is relatively low at Taharoa, as follows:

4.4.1 Arum lily

Arum lily (*Zantedeschia aethiopica*) was only observed along the Mitiwai Stream but may occur elsewhere. Arum is particularly problematic in shaded wetlands where it can exclude indigenous plant species and come to dominate. It is listed in the RPMP as a wetland site-led plant: there is a requirement to inform Waikato Regional Council of its presence but there is no obligation to control it unless it is close to a wetland on a neighbouring property.

4.4.2 Blackberry

Blackberry (*Rubus fruticosus* agg.) is relatively common in pasture and logged pine areas at Taharoa. It poses very little threat to sensitive areas but like Arum it is listed in the RPMP as a wetland site-led plant and the same rules apply.

4.4.3 Gorse

Gorse (*Ulex europaeus*) is present throughout the Site but nowhere was it particularly prevalent. Gorse is primarily a weed of pasture and waste areas and is not a particular threat to the sensitive habitats at Taharoa. Like pampas, gorse is listed as a Sustained Control pest plant in the RPMP and there is a requirement to completely remove it from quarries.

4.4.4 Pampas

Pampas (*Cortaderia selloana*) grass occurs throughout the Site but is not dense except in the north of the Site around the Mitiwai Stream (vegetation type 16 & 32) where it is the dominant plant. The prevalence of pampas may be limited because of browsing by the wild cattle and horses on the Site. Pampas is a Sustained Control pest plant in the RPMP rules which apply to quarries. The Mine fits within the definition of a quarry included in the RPMP and any pampas on the Site must be destroyed under rule PAM-1.

4.4.5 Reed sweetgrass

Reed sweetgrass (*Glyceria maxima*) is a wetland and riparian weed which forms dense swards, excludes indigenous species, and occupies what would otherwise be open water habitat. It was noted at the lower end of Wainui Stream and in some of the wetlands in the south of the Site but may occur elsewhere. Like Royal Fern it is listed in the RPMP in the Site-Led category for wetlands. There is no obligation to control this species unless it is close to a wetland on a neighbouring property (Rule WET-3).

4.4.6 Royal Fern

Royal fern (*Osmunda regalis*) is a very invasive wetland fern that can spread to dominate wetlands and exclude indigenous species. It is common in the wetlands at the northern end of Lake Taharoa but was only observed at one location within the Taharoa Ironsands boundary which was in Wetland 14 on the southern side of the Wainui Stream (Photo 4). Royal Fern is listed in the RPMP in the Site-Led category for wetlands. There is no obligation to control this species it unless it is close to a wetland on a neighbouring property (rule WET-3).

Photo 4: Royal fern in Wetland 14

4.5 Species requiring management in certain locations

The following species are also present at Taharoa and although they do not have legal status as pest species and there is no obligation to control them, they can present problems in certain ecosystems.

4.5.1 African boxthorn

African boxthorn (*Lycium ferocissimum*) was observed along the coastal fringe as well as along the Mitiwai Stream, in pasture in the north-eastern part of the Site, and close to Lake Taharoa in vegetation type 25. It is not listed in the RPMP but can spread to dominate dune habitats and should be controlled.

4.5.2 Marram

Marram grass (*Ammophila arenaria*) has been used as part of the site rehabilitation programme at the Mine and is common throughout the Site. It is not a pest plant, but it is considered a weed on sand dunes where it can exclude the native kōwhangatara (spinifex) and modify the shape of the foredune. It is therefore recommended that Marram is controlled within the coastal dune fringe but it is acknowledged that it is one of the few species that can be used to restablish vegetation after mining and that the Land Management and Rehabilitation Plan under the existing consents provides for its use in site rehabilitation.

4.5.3 Tree lupin

Like marram, tree lupin (*Lupinus arboreus*) has been used to rehabilitate parts of the Mine, but the characteristics that make it suitable for that role, also make it weedy in the wrong places. In stable dunes, lupin can form dense stands and exclude species like kōwhangatara and pōhuehue, and in those areas it should be controlled.

4.6 Wetlands

In total 17.54 ha of natural inland wetlands (as defined in the National Policy Statement for Freshwater Management 2020 (NPS-FM)) were identified on the Site. There is a much larger area of wetland outside the boundary but nearby (Figure 4). These adjacent natural

wetlands generally comprise raupō-dominated lacustrine and palustrine wetlands on the margins of Lakes Taharoa, Numiti, Rotoroa, and Rototapu but there are also areas of coastal seepage at the mouths of the Mitiwai and Wainui streams and in the south of the Site.

The wetlands within the Site are described in Table 9, along with the method used to identify them and delineate their boundaries. Many of the wetlands within the Site have been induced as a result of mining activity over the years, although some are modified natural wetlands. This is the case with all the wetlands on the margins of the lakes, as well as a few others. It is acknowledged that when considering the 'existing environment' a few of the induced wetlands may not exist or would be significantly changed in the conceptual environment where TIL's existing consents have expired, mining under those consents has ceased and the Site has been rehabilitated.

The mining operation uses and re-uses a large quantity of water and there are a number of storage ponds within the Site, as well as stormwater detention ponds. For the most part these were excluded from the wetland assessment because they are artificial waterbodies. However, a few sites (Sites 1, 3, 4, 26, 27, 28, 29) were assessed because of the presence of hydrophytic plant species, but because many of them are maintained and managed as part of the mining operation for water storage, retention or treatment, they cannot be considered natural wetlands under the NPS-FM definition.

Table 9: Wetlands and potential wetlands assessed within the Taharoa Ironsands operating area. Natural Inland Wetlands have been shaded green.

Wetland identifier	Hydrosystem	Class	Form	Vegetation structure and composition	Description	Area (Ha, within Taharoa Parcel	Edge delineation	Plot	Rapid test	Dominance test	Prevalence test	Wetland?	Deliberately Constructed ?	Natural (as defined in the NPS-FM)?	Justification
Site 1	Palustrine	Shallow water	Swale	Jointed rush rushland	A very small wetland in the base of a constructed drain and fed by a culvert. Similar vegetation continues along the drain which eventually disappears underground. The vegetation is Jointed rush - kikuyu - ferny azolla - (water celery) - [broad-leaved dock] - rushland. No plot was established here.	0.02	GPS	N/A	Yes	-	-	Yes	Yes	No	This is a constructed sediment pond fed by a culvert and drained through an artificial channel.
Site 3	Palustrine	Artificial	Artificial	Raupō reedland	A small, constructed wetland within the active mine area. Vegetation is raupō / [*Juncus sarophorus*] / white clover	0.11	GPS/Aerial	n/a	Yes	-	-	Yes	Yes	No	Created and managed as part of site stormwater system
Site 4	Palustrine	Artificial	Artificial	Sea aster herbfield	This wetland is fed by a large pipe and serves as a water storage pond, although at the time of visit it was only damp. The substrate is clay, and the vegetation is sea aster dominated in the centre, with bachelor's buttons and Epilobium ciliatum. Dense *Juncus sarophorus* dominates the edges and there is a patch of raupō in one corner. The hydrology is artificial, and the wetland appears to be used periodically for mine operations.	0.41	GPS	n/a	Maybe	Yes (from cover estimates)	Maybe (from cover estimates)	Yes	Yes	No	Created and managed as part of site stormwater system
Wetland 5	Palustrine	Seepage	Flat	Jointed rush rushland	A flat area approximately 150m inland from the beach. This is a seepage wetland which discharges via a small stream to the beach. The vegetation is a low, reasonably diverse turf dominated by *Juncus articulatus* but with a range of other species including swamp plantain, lotus, *Cyperus congestus, Myriophyllum votschii,* water purslane, and narrow-leaved carpet grass. The landform is unnaturally undulating which has resulted in a wetland of irregular shape whose boundaries were difficult to delineate. A large tailings disposal area is located upslope of this wetland to the northeast which receives large quantities of water as part of the sand slurry. The hydrology of this wetland and the one immediately to the northeast may be artificially enhanced by this.	2.18	GPS	WetP5	No	Yes	Yes	Yes	No	Yes	Likely induced by previous mining activity
Wetland 6	Palustrine	Seepage	Basin	Jointed rush rushland	This is a seepage area adjacent to Wetland 5 and very similar in vegetation composition and structure. This site is also fed by groundwater seepage and is likely to be affected by the discharge of slurry water upslope.	0.37	GPS	n/a	No	Yes - Inferred from Wetland 5		Yes	No	Yes	Likely induced by previous mining activity
Wetland 7	Palustrine	Seepage	Basin	(Oioi) - [knobby club rush] / jointed rush rushland & [jointed rush] / Myriophyllum propinquum water field	A gully floor wetland within 75m of the beach. At the time of survey there was standing water in the northern part of this wetland in an area dominated by *Isolepis prolifera*. The remaining part of the wetland includes patches of oioi and knobby clubrush over a turf dominated by jointed rush with pasture grasses. The wetland is heavily grazed by cattle and horses. It drains to the south through a narrow channel.	1.08	Aerial photo	n/a	Yes	-	-	Yes	No	Yes	This is a modified natural wetland that is evident on aerial photographs from 1944.
Wetland 8	Palustrine	Swamp	Basin	(Raupō) / rautahi sedgeland	This is a small wetland separated from the lake margin wetlands by a raised track but obviously connected hydrologically. This wetland was not closely inspected but vegetation includes raupō, dense swards of rautahi, *Isolepis prolifera*, jointed rush and soft rush.	0.13	Aerial photo	n/a	Yes	-	-	Yes	No	Yes	

Wetland identifier	Hydrosystem	Class	Form	Vegetation structure and composition	Description	Area (Ha, within Taharoa Parcel	Edge delineation	Plot	Rapid test	Dominance test	Prevalence test	Wetland?	Deliberately Constructed ?	Natural (as defined in the NPS-FM)?	Justification
Wetland 9	Palustrine	Shallow water	Basin	Ferny azolla - common duckweed floating fernland	This is an induced wetland in a hollow which appears to have been created during the harvest of the pine trees. The only wetland vegetation is *Azolla pinnata* and *Lemna disperma* floating on open water. The water levels appear to fluctuate considerably, and it may be hydraulically connected to the water body to the southeast. Pine slash has been deposited in this area. This site still constitutes a wetland despite the paucity of wetland plants. It has a wetland hydrology although water levels appear to fluctuate a lot and is likely to develop more wetland vegetation over time. It is of very low ecological value and has been induced relatively recently.	0.08	GPS	n/a	Yes	-	-	Yes	No	Yes	
Wetland 10 & 11	Palustrine	Shallow water	Basin	Ferny azolla floating fernland	Two depressions left after mining or pine harvest which are subject to seasonal ponding and likely to dry up during the drier months. These areas have a few sapling pines, patches of giant umbrella sedge, soft rush and raupō, above water or bare ground covered in ferny azolla.	0.18	GPS	n/a	Yes	-	-	Yes	No	Yes	
Wetland 12	Palustrine	Swamp	Basin	*Carex virgata* - (giant umbrella sedge) sedgeland	This wetland sits in a small gully and is dominated by *Carex virgata* with patches of raupō and giant umbrella sedge. Grazed.	0.24	GPS	n/a	Yes	-	-	Yes	No	Yes	
Wetland 13	Palustrine	Swamp	Floodplain	Sharp spike sedge sedgeland	A shallow gully adjacent to the Wainui Stream but with no surface connection to it. The vegetation includes occasional emergent raupō, patches of sharp spike sedge, giant umbrella sedgeland rautahi. In the wetter areas water purslane forms a dense groundcover.	0.07	GPS	n/a	Yes			Yes	No	Yes	
Wetland 14	Palustrine	Swamp	Floodplain	Raupō / sharp spike sedge sedgeland, *Carex virgata* sedgeland, and manuka scrub	This wetland has formed in a basin adjacent to the Wainui Stream but does not have a surface connection to the stream. Three main vegetation types are present. At the southwest end there is a patch of manuka scrub with scattered grey willow. The understorey is rautahi, *Carex virgata* and soft rush with patches of royal fern. The northern half of the wetland is sedgeland with rautahi, and *Carex virgata,* while at the eastern end there is occasional raupō, manuka, and grey willow over dense sharp spike sedge and *Isolepis prolifera.*	0.5	GPS	n/a	Yes	-	-	Yes	No	Yes	
Wetland 15	Palustrine	Seepage	Flat	Giant umbrella sedge / *Isolepis prolifera* - sharp spike sedge sedgeland	This is a seepage wetland formed on a coastal terrace just above the beach. Occasional harakeke and patches of giant umbrella sedge. There is one area of sparse kuawa and dense patches of *Isolepis prolifera* and sharp spike sedge are common. Jointed rush is also common. Other species present include *Carex virgata,* oioi, knobby clubrush, saltwater paspalum, water primrose, water purslane, ferny Azolla, purple-backed duckweed, *Isolepis cernua,* water starwort and kikuyu.	0.2	GPS	n/a	Yes	-	-	Yes	No	Yes	
Wetland 16	Palustrine	Shallow water	Basin	Raupō reedland	This small wetland has formed in a shallow gully which may have been left after mining or may have been natural and has been dammed during mining operations or pine harvest. It is dominated by dense raupō with *Isolepis prolifera* around the margins and has had pine slash pushed into it after the last pine harvest.	0.03	GPS	n/a	Yes	-	-	Yes	No	Yes	

Wetland identifier	Hydrosystem	Class	Form	Vegetation structure and composition	Description	Area (Ha, within Taharoa Parcel	Edge delineation	Plot	Rapid test	Dominance test	Prevalence test	Wetland?	Deliberately Constructed ?	Natural (as defined in the NPS-FM)?	Justification
Wetland 17	Palustrine	Shallow water	Basin	jointed rush - common water milfoil water field	This wetland occupies a shallow basin southwest of Lake Rototapu. The vegetation comprises jointed rush and floating sweetgrass over *Myriophyllum propinquum,* starwort, and Centella, with giant umbrella sedge around the margins. This site is likely to be subject to seasonal inundation.	0.33	Aerial photo	n/a	Yes	-	-	Yes	No	Yes	
Wetland 18	Palustrine	Swamp	Basin	*Machaerina rubiginosa - purei* sedgeland, jointed twig rush - raupō reedland, *Isolepis prolifera* sedgeland	This is a large wetland to the south of Lake Rototapu at the southeast corner of the Site. Historically this wetland was connected to the lake, and it is probable that there is still a hydraulic connection. The vegetation comprises three main types: *Machaerina rubiginosa - purei* sedgeland occupies the centre of the wetland while in the southwest corner there is an area of jointed twig rush and raupō. Around the margins *Isolepis prolifera* dominates. Harakeke is common throughout. The margins of this wetland have been impacted by grazing.	1.56	Aerial photo	n/a	Yes	-	-	Yes	No	Yes	
Wetland 19	Lacustrine	Swamp	Shore	Jointed twig rush - raupō reedland	Marginal wetlands around Lake Rototapu, the majority of which fall outside the Taharoa Ironsands property and as such were not closely inspected. The vegetation is similar to Wetland 18 and comprises dense stands of jointed twig rush and raupō with harakeke scattered throughout. This site is included in the draft Waitomo DC Significant Natural Area R16UP016.[5]	0.005	Aerial photo	N/A	Yes	-	-	Yes	No	Yes	
Wetland 20	Palustrine	Swamp	Basin	(Knobby clubrush) - (giant umbrella sedge / jointed rush rushland	A small wetland in a gully to the west of lake Rototapu and draining to the northwest. This wetland was not closely inspected. Vegetation includes knobby clubrush and occasional giant umbrella sedge over jointed rush and pasture grasses.	0.17	Aerial photo	n/a	Yes	Yes		Yes	No	Yes	Dominance test based on cover estimates from photograph. Clear seepage wetland hydrology at this site however.
Wetland 21	Palustrine	Shallow water	Basin	Raupō - kuta reedland	This site comprises two wetlands separated by a sand causeway. These wetlands and the lake to the west were left when this part of the Site was mined and koiwi were found here, although 1944 aerial photography shows that wetlands have been present in this locality since then. They are currently used as water storage for the mine and water levels fluctuate significantly as a result. The wetlands comprise a mosaic of emergent vegetation and open water. Large patches of kuta and raupō dominate over a lower tier of swamp millet and there are a few grey willows. Several threatened or at risk bird species were observed here, and this site is included in the draft Lake Taharoa Significant Natural Area (R16UP002) by Waitomo DC.[1]	4.81	Aerial photo	n/a	Yes	-	-	Yes	No	Yes	
Wetland 22	Palustrine	Swamp	Basin	*Carex virgata* - sharp spike sedge sedgeland	This wetland is directly connected to Lake Taharoa and occupies a shallow gully. Raupō is common around the margins and scattered elsewhere and *Carex virgata* is common throughout. Sharp spike sedge is abundant and dominates the groundcover in places. Swamp kiokio is scattered throughout. Raupō becomes more dominant towards the lake edge where the water is deeper, and in the northeast part *Isolepis prolifera* is common. A few scrubby grey willows are present in one patch, along with a few hukihuki. This wetland has been	2.17	Aerial photo	n/a	Yes	-	-	Yes	No	Yes	

[5] Data obtained from Waikato Regional Council geospatial portal. https://maps.waikatoregion.govt.nz/arcgis/rest/services/OurMaps/Environmental_Assessment_ICM/MapServer

Wetland identifier	Hydrosystem	Class	Form	Vegetation structure and composition	Description	Area (Ha, within Taharoa Parcel	Edge delineation	Plot	Rapid test	Dominance test	Prevalence test	Wetland?	Deliberately Constructed ?	Natural (as defined in the NPS-FM)?	Justification
					heavily grazed but was in the process of being fenced in late 2021 as part of the fencing of the Lake Taharoa shoreline. This site has been included in the Lake Taharoa draft Significant Natural Area by Waitomo DC[1].										
Wetland 23	Palustrine	Ephemeral	Basin	Raupō reedland	This small wetland appears to have formed in a shallow basin left after mining operations. The vegetation is dominated by raupō with ferny azolla and *Lemna minor* floating on the wetland surface. Mercer grass was common along with jointed rush and a range of pasture species.	0.03	Aerial photo	n/a	Yes	-	-	Yes	No	Yes	
Site 24	-	-	-	-	This is a very small area of ponded water with a few raupō but otherwise dominated by kikuyu grass. It was investigated as a potential wetland. It periodically floods but likely dry over summer. There is a groundwater bore located here and the site is bunded, whether intentionally or otherwise.	0.02	Aerial photo	N/A	No	No	No	No	Yes	-	Dominance and prevalence test based on estimates of cover data only.
Wetland 25	Palustrine	Seepage	Flat	Jointed rush - water purslane rushland	This seepage wetland occupies the coastal terrace above the beach. A few giant umbrella sedges and knobby clubrush are emergent over a groundcover dominated by Jointed rush and water purslane. This wetland was heavily grazed at the time of visit.	0.09	Aerial photo	n/a	Yes	-	-	Yes	No	Yes	
Site 26	Palustrine	Shallow water	Basin	Raupō water field	This is a very small, ponded area resulting from earthworks. Drainage appears to be confined by a hard clay layer, but the surrounding soil is predominantly sand. A small patch of raupō occurs at the deeper end along with *Potamogeton cheesemanii*. Submerged terrestrial species such as kikuyu suggest that the water level is often much lower.	0.05	Aerial photo	N/A	Yes	-	-	Yes	Yes	No	This is a constructed wetland likely put there as part of the drainage of adjacent areas and not yet removed.
Lake shore	Lacustrine	Swamp	Shore	Raupō reedland, *Juncus* rushland	Marginal lacustrine wetlands occur on all three of the larger lakes. These comprise raupō reedland with scattered harakeke where there is standing water, grading into low stature rush- and sedgeland with species such as *Isolepis prolifera*, *Juncus prismatocarpus, J. tenuis,* and *J. articulatus,* as well as a range of exotic grass species such as narrow-leaved carpet grass and Yorkshire fog. These wetlands have all been grazed although they are now being fenced off. Stock grazing has influenced the vegetation and low turf occurs where they have easy access. At Lake Taharoa these wetlands are contiguous with those along the margins of the Wainui Stream. Most of the lake shore wetlands are outside the Taharoa land parcels. This site includes parts of the Waitomo DC draft Significant Natural Areas R16UP014.01 and R16UP002.	0.28	Aerial photo	Lake shore	No	Yes	Yes	Yes	No	Yes	
Site 27	Palustrine	Shallow water	Basin	Raupō reedland	This is a large pond or lake which was left after the previous mining in the area and is now used as water storage for the mining operations. There are patches of raupō around the margins and aerial photography shows that the water level has been increased significantly between 2019, when there was a dense raupō fringe, and 2021. Examination of 1944 aerial photography showed only sand dune in this locality. This site has been included in the Lake Taharoa draft Significant Natural Area by Waitomo DC.	7.75	Aerial photo	N/A	For margins	-	-	Yes	Yes	No	Constructed wetland/pond used as water storage of mining operations.

Wetland identifier	Hydrosystem	Class	Form	Vegetation structure and composition	Description	Area (Ha, within Taharoa Parcel	Edge delineation	Plot	Rapid test	Dominance test	Prevalence test	Wetland?	Deliberately Constructed ?	Natural (as defined in the NPS-FM)?	Justification
Sites 2 & 3	Palustrine	Shallow water	Basin	n/a	Two ponded areas in an actively mined area which appear to have been used for water storage. These are mostly unvegetated, but one had swamp lily growing in it and kikuyu was common around the margins.	0.29	Aerial photo	n/a	No	-	-	Yes	Yes	No	These are constructed, transient ponds which are the product of an active mine site.
Wainui Stream Wetlands	Riverine	Shallow water	Riparian	Raupō reedland, *Carex* sedgeland	The Wainui Stream wetlands are contiguous with those around the margins of Lake Taharoa. They comprise marginal emergent vegetation of raupō with scattered harakeke and in some areas grey willow. In low lying areas away from the stream there are areas of *Carex virgata* and *C. geminata* along with sharp spike sedge, blackberry, and pampas.	3.03	Aerial photo	N/A	Yes	-	-	Yes	No	Yes	

Figure 4: Wetlands within and immediately adjacent to the Site.

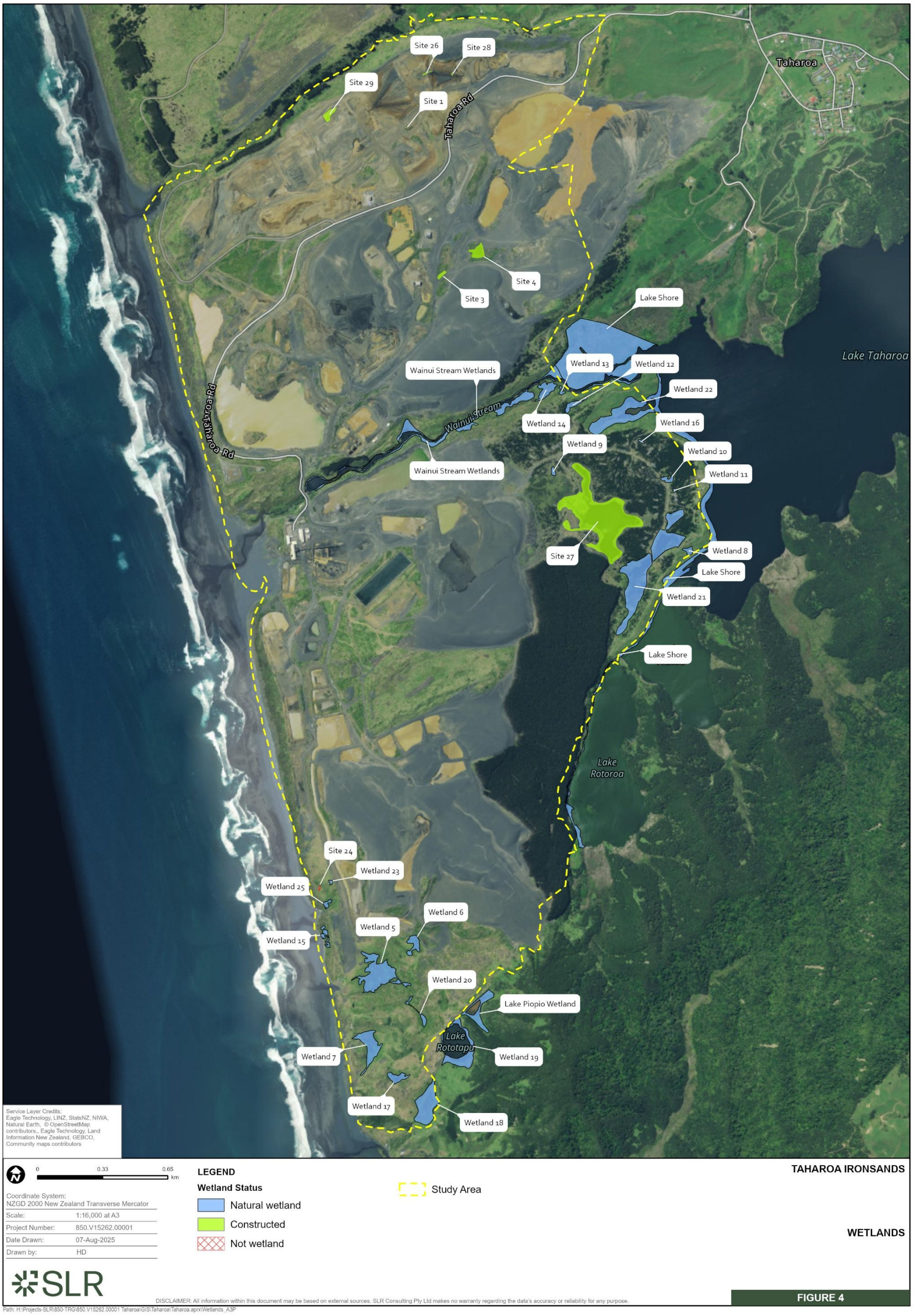


Photo 5: Carex virgata sedgeland in Wetland 12

Photo 6: The southern part of the Site (Vegetation Type 2) showing wetlands in the right foreground and left midground

5.0 Ecological Values

An assessment of ecological value, consistent with the EIANZ guidelines (Roper-Lindsay *et. al.* 2018), is provided in Table 10 (terrestrial habitats) and Table 11 (wetlands). Terrestrial vegetation types and wetlands were grouped for assessment. Ecological values range from **Negligible** for the actively mined areas to **Very High** for dune habitats and some wetlands.

With the exception of the most recently mined areas, in the conceptual state of a recently closed Site, the terrestrial habitat on the rest of the Site holds at least moderate ecological value. This is in part because of the connectivity of the Site and its size, but also because it supports a range of Threatened and At-Risk bird species, and Critically Threatened long-tailed bats utilise parts of the Site. The scale of assessment is important: the terrestrial habitats were generally assessed in large units or areas, which better capture landscape-level Diversity and Pattern, and consider the influence of scattered Threatened species, in the Rarity and Special Features criterion. The wetlands were grouped into logical groups/clusters, but small sites are less likely to exhibit diversity or be representative. In these cases, the Ecological Context criterion remains very important. For example, the ‘Eastern wetlands’ group (Wetlands 9, 10, 11, 16) may be of low value individually, but they are situated within a wider area of at least moderate value.

Table 10: Ecological values assessment for terrestrial habitats

Habitat grouping	Relevant vegetation types	Area (ha)	Representativeness		Rarity/distinctiveness		Diversity & Pattern		Ecological Context		Overall Ecological Value
Escarpment vegetation	1	1.71	High	Although on only a small area this habitat is in good condition and typical of coastal cliffs and escarpments along the Waikato west coast. It is completely within a previously identified Significant Natural Area (R17UP183) of National significance.	Low	Typical species and assemblages present. No threatened species. The historic vs current extent of flaxland escarpment vegetation is not known although it is likely to have been reduced considerably.	Low	Dominated by one species (harakeke) on one landform.	Moderate	The area of escarpment vegetation is relatively small, although it may provide some linkage function between the kanuka scrub on the hills to the east and the coastal fringe. The area has been damaged by grazing although is unlikely to suffer significant change given the species composition.	**Moderate**
Mined/built up areas	17, 34, 36	463.18	Low	When visited, these areas were either being actively mined, are water storage, or are used for processing or admin facilities. Taking into account the rehabilitation plan which forms part of the Existing Environment there would be recently planted native and exotic plants in these areas. Biodiversity values are limited to the recently planted species and pockets of other vegetation. Although historically the site was active sand dune superficially similar to some of the active mine, these areas no longer function as natural ecosystems.	Low	Recently mined with very low natural vegetation values limited to recently planted native and exotic plants. However, birds such as New Zealand dotterel (Charadrius obscurus, At Risk - Recovering) utilise bare sand areas and indigenous waterfowl such as grey teal (*Anas gracilis*) and paradise shelduck (*Tadorna variegata*) were observed using water storage ponds. These species are unlikely to rely on these areas for breeding or for extended periods given the high level of disturbance however.	Very low	Very few indigenous species and natural pattern has been completely altered.	Very low	Having been recently mined, these areas are not functioning as natural ecosystems and natural processes are severely impacted by the mining operation. For the purpose of considering the existing environment it must be assumed that these areas will be rehabilitated but they have been affected by mining operations and are still anticipated to have limited ecological value (until rehabilitation planting has matured).	**Low**
Plantation pine forest	6	84.79	Very low	Exotic plantation.	High	Provides foraging and commuting habitat for long-tailed bats (*Chalinolobus tuberculatus,* Nationally Threatened) and common forest and open-country birds.	Very low	Monoculture of an exotic species.	Very Low	Provides some buffering from mine operations for the adjacent lakes and a corridor for bat foraging.	**Moderate**
Grassland (Includes pasture, areas of exotic shrubland, and rushland)	2, 3, 9, 10, 12, 13, 16, 22, 25, 28, 32, 35	259.21	Low	These areas comprise novel ecosystems comprising a range of indigenous species amongst pasture grasses and other exotics and are not representative of a natural ecosystem although they do contain components of natural ecosystems.	High	This heavily modified dune mosaic is well represented in the Kawhia Ecological District (reference). Long-tailed bats traverse these areas, but they are unlikely to be important to them, however the value of these areas is raised as they do provide habitat for a range of birds including the At-Risk New Zealand pipit (*Anthus novaeseelandiae*, At Risk - Declining).	Low	Indigenous species diversity in these areas is relatively low although there is diversity in vegetation communities and species assemblages. These largely reflect disturbance by mining and forestry activities rather than diversity in the physical landscape or ecological processes.	Moderate	These areas comprise a large part of the total Taharoa site and provide at least transit habitat for a range of birds, as well as bats, and buffer higher value natural areas such as the lakes and wetlands from the activities of the mine.	**Moderate**

Habitat grouping	Relevant vegetation types	Area (ha)	Representativeness		Rarity/distinctiveness		Diversity & Pattern		Ecological Context		Overall Ecological Value
Stable dune system	19	27.46	Moderate	This site comprises a narrow but relatively large area of modified stable sand dune which includes some of the species and vegetation assemblages characteristic of the habitat type.	High	Stable sand dunes are a naturally uncommon ecosystem and have been classified as Endangered by Holdaway et. al (2012). No threatened or at risk species were recorded but pingao (*Ficinia spiralis* At Risk - Declining) has been recorded nearby and may be present.	Moderate	Species diversity is lower than would be expected in an un-modified example of this habitat type, and stabilisation of the dunes landward of this strip has reduced landform diversity where features such as swales or parabolic dunes may once have been present.	High	This area provides buffering to the more active foredune areas as well as the open coast. It provides an unbroken linkage of coastal dune vegetation to the north and south of the Site.	**High**
Active dune system	18	3.38	High	This site comprises a relatively large area of stable sand dune which includes species and vegetation assemblages characteristic of the habitat type.	High	Active sand dunes are a naturally uncommon ecosystem and have been classified as Endangered by Holdaway et. al (2012). More locally, the area of active sand dune has been severely depleted by the stabilisation of dunes on the Taharoa site, reducing the total area of active dune from more than 500 ha to less than 5 ha (<1%). No threatened or at risk species were recorded but pingao (*Ficinia spiralis* At Risk - Declining) has been recorded nearby and may be present.	Moderate	Species diversity is lower than would be expected in an un-modified example of this habitat type, and stabilisation of the dunes landward of this strip has reduced landform diversity where features such as swales or parabolic dunes may once have been present.	High	This area provides buffering to the more active foredune areas as well as the open coast. It provides an unbroken linkage of coastal dune vegetation to the north and south of the Site.	**Very High**
Kanuka forest	21	0.33	Low	This area of kanuka forest is typical of the habitat type, but it is a very small area and this habitat type may not have been present at Taharoa prior to the stabilisation of the dunes by exotic plant species.	Moderate	Kawhia ED contains around 2,450 ha of kanuka scrub and forest, and it is a common vegetation type along the Waikato west coast in general. Nevertheless this area and surrounding forests provide habitat for the threatened long-tailed bat.	Low	This is a small area with low species diversity situated on one landform.	Moderate	This area and adjacent similar habitat outside the Taharoa boundary provide commuting and feeding habitat for bats as well as buffering of the lakes from mining and forestry activities.	**Moderate**

Table 11: Ecological values assessment for wetlands

Wetlands	Relevant wetland identifier	Area (ha) within Taharoa boundary	Representativeness		Rarity/distinctiveness		Diversity & Pattern		Ecological Context		Overall Ecological Value
Lakes and Wainui Stream	Lake shore, Wetland 8 Wetland 22, Wainui Stream Wetlands, Wetland 18, Wetland 19, Lake Piopio	7.175	High	Although modified by grazing, these are all high-quality wetlands and contain the species assemblages expected of such habitat. They are part of a much larger area of wetlands extending beyond the Taharoa boundary which make up a significant proportion of the wetlands in the Kawhia Ecological District. Part of a previously identified Significant Natural Area of National importance (R16UP002)	High	Wetlands are not rare within the Kawhia ED where approximately 56% of the 1840 extent of swamp, and swamp/fen mosaic remains. However, on a national scale, wetlands have been severely reduced in extent and their protection is a national priority (MfE 2007). Lake Margins have been identified as a Naturally Uncommon Ecosystem and were classified as Vulnerable by Holdaway *et. al (2012)*. These wetlands also provide habitat for a range of threatened and at risk fauna including the Nationally Critical Australasian bittern	Moderate	These wetlands contain the species and assemblages expected from such habitats as well as a high diversity of fauna species. They contain a range of vegetation types and habitat conditions from deep water through to periodically wet ground supporting turf vegetation	High	These sites are part of a large complex of wetlands, forest, and scrub around the lakes. The smaller lakes to the south provide stepping-stones of wetland habitat between the larger lakes and wetlands to the south including Lake Harihari, while those along Wainui Stream link the lakes with the coast	**Very High**
Southern wetlands	Wetlands 5, 6, 7, 15, 17, 20, 23 & 25	4.45	Low	These wetlands are highly modified by grazing and many of the species assemblages found within them are novel and contain a high proportion of exotic species	Moderate	Wetlands are under-represented at a national scale and are a national priority for protection (MfE 2007), although locally they are reasonably well represented. These degraded and in some cases induced wetlands may provide temporary habitat for threatened and at risk bird species found in nearby areas, although none were recorded here	Moderate	These grazed wetlands include a moderate diversity of native and exotic species, two wetland forms (basin & flat) and four wetland classes (swamp, seepage, shallow water and ephemeral)	Moderate	Wetlands provide a range of ecosystem services including water filtration and carbon sequestration. These sites provide somewhat limited habitat for indigenous flora and fauna and are part of a mosaic of wetlands in the wider landscape	**Moderate**
Eastern wetlands	Wetlands 9, 10, 11, 16	0.29	Low	These wetlands are induced and include highly modified vegetation types. They are dominated by exotic species not representative of the typical wetlands of the Kawhia Ecological District.	Moderate	Wetlands are under-represented nationally, although these have been induced by mining and forestry operations and are of low quality. They may provide habitat for indigenous waterfowl and wetland birds which are present in nearby areas	Low	Very low species diversity, one wetland form, and one wetland class	Low	These sites provide very limited habitat for indigenous flora and fauna and are part of a mosaic of wetlands in the wider landscape	**Low**
Wetland 21	Wetland 21, Site 27	12.56	Moderate	Wetland comprises two excavated areas which were left after mining in the area, but which were historically wetlands, while Site 27 has been excavated. The vegetation indigenous and is similar to that surrounding Lake Taharoa, although it is sparse in Site 27, and diversity is lower than the lake margin wetlands. Part of a previously identified Significant Natural Area of National importance (R16UP002)	High	Wetlands are under-represented at a national scale and are a national priority for protection (MfE 2007), although locally they are reasonably well represented. These wetlands provide habitat for a range of indigenous wetland birds and waterfowl including Nationally Critical Australasian bittern and grey duck, spotless crake (At Risk - Declining), and dabchick (At Risk - Recovering)	Low	With only one wetland form (basin) and one class (shallow water) the species diversity was not high. This is likely impacted further by the irregular water level fluctuations resulting from pumping water from these sites	Moderate	These sites are part of a large complex of wetlands, forest, and scrub in the area and provide good habitat for several threatened or at risk species, additional to that around the lakes	**Moderate**

Wetlands	Relevant	Area (ha)	Representativeness		Rarity/distinctiveness		Diversity & Pattern		Ecological Context		Overall
East Wainui Stream wetlands	Wetlands 12, 13, 14	0.81	Moderate	These three small wetlands include areas of good quality natural wetland habitat as well as degraded areas. Species in Wetland 14 are typical of lower-nutrient sites	High	This site includes a lower nutrient wetland and the only example of a manuka-dominated wetland on the Taharoa land, although there are others in the wider landscape. Wetlands are under-represented at a national scale and are a national priority for protection, although locally they are reasonably well represented. Spotless crake and fernbird (both At Risk - Declining) utilise these wetlands	Moderate	Several vegetation communities are present in these wetlands, representing a diversity of water regime and nutrient levels, as well as grazing pressure. One wetland class (swamp) and two wetland forms (floodplain, basin) are present	Moderate	These sites are part of a large complex of wetlands, forest, and scrub in the area and are essentially a continuation of the wetlands along the Wainui stream and around lake Taharoa. They provide good habitat for indigenous birds, including two at risk species	**Moderate**

Photo 8: *Myriophyllum propinquum* and *Juncus articulatus* in Wetland 17

Photo 7: Wetland 17 at the southern end of the Site

6.0 Ecological Impact Assessment

6.1 Assumptions

6.1.1 Existing avoidance and mitigation measures

TIL's existing resource consents include conditions relating to the avoidance or mitigation of effects on the natural environment. These and other controls have been incorporated into the Mine's operational management plans and have been carried through to the proposed conditions for the new consent. In summary, these controls are as follows:

- Mining operations shall not be undertaken within 100 metres of the Mean High-Water Springs (MHWS) and not closer than 30 metres from any perennial water bodies or any retained natural inland wetlands. These exclusions are mapped in Figure 5.
- An Erosion and Sediment Control Plan must be developed and appropriate sediment controls must be in place to ensure that sediment losses to natural waterbodies is minimised.
- Buffers around perennial water bodies and natural inland wetlands are to be planted.
- Minimum lake level requirements.
- A requirement to rehabilitate the Site following the cessation of mining activity.

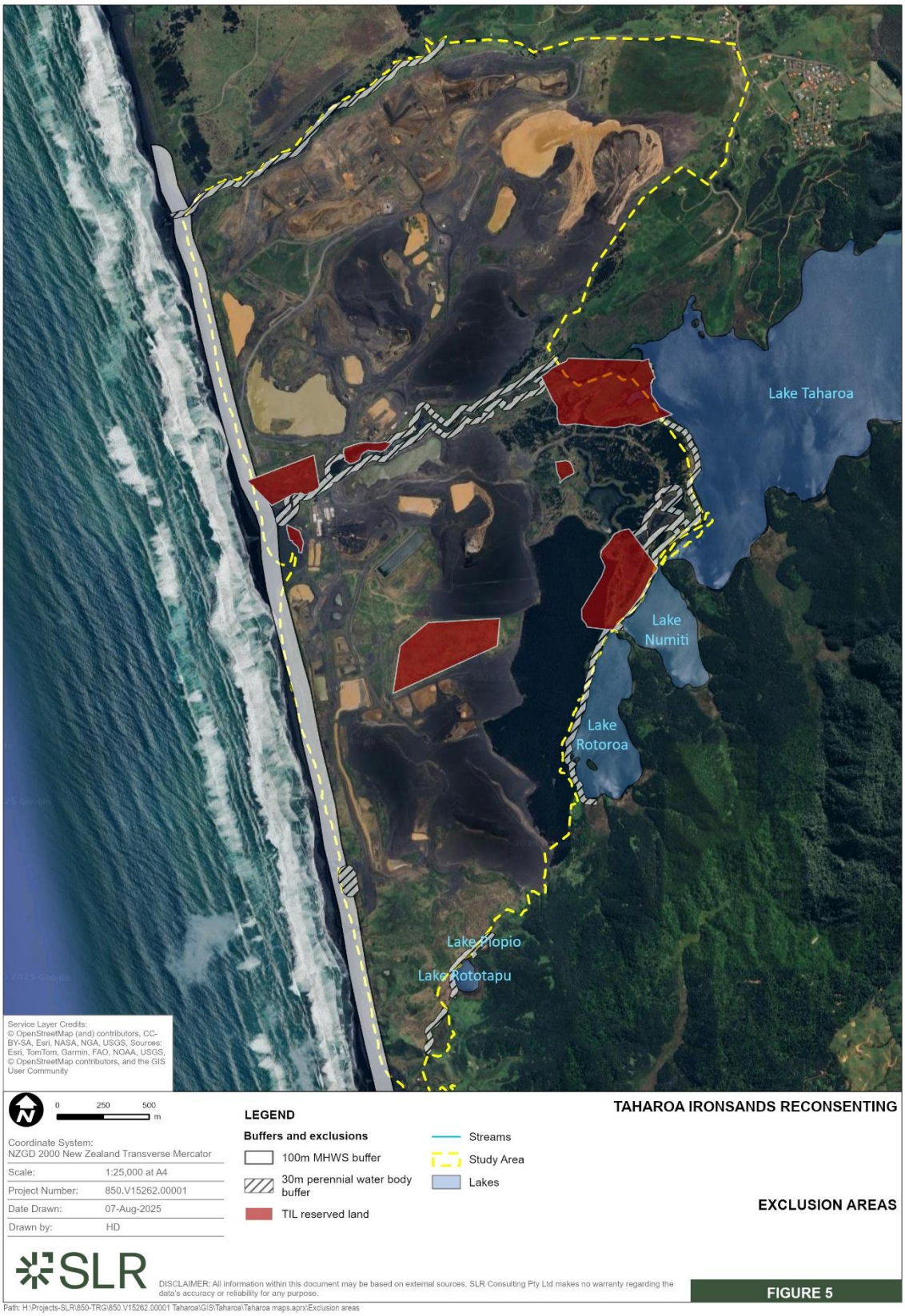
There are also several areas reserved from mining which are of some significance, including to the landowners (Figure 5). These areas will not be mined and are either fenced or in the process of being fenced.

These avoidance and mitigation measures have been considered in the following effects assessment.

6.2 Actual and potential effects

The adverse effects on wetlands and terrestrial vegetation are outlined below, along with an assessment of their likelihood and the anticipated timeframe over which it would occur. This assessment takes into account the existing environment, as well as the proposed avoidance and mitigation measures outlined above, which form the baseline for this assessment. Further recommended mitigation measures are proposed as a result.

Figure 5: Exclusion areas.



6.2.1 Removal of all vegetation within the mining footprint

The mining process involves the stripping of any vegetation from the area to be mined, removing any topsoil, and then excavating the ironsand, resulting in complete loss of habitat in all mined areas. However, it is worth noting that the Central/Southern area of Taharoa C Block is a young environment because it has all been mined previously and has been a highly modified, human-induced environment since mining began in the 1970s. A total of 463 ha of negligible value habitat and 344 ha of moderate value habitat will be removed as part of the application.

This effect is certain and can be considered medium term because of the length of time it takes to mine, re-fill the pit with sand, and then rehabilitate the new surface.

In the moderate value habitat there are At-Risk and Threatened species, but the habitat is otherwise of low value as it is generally dominated by exotic species. Appropriate habitat for these fauna will be progressively restored as the compartments are mined and rehabilitated. Upon closure, the Mine will be rehabilitated into a mix of indigenous landcover and productive land use which will result in a long-term net benefit. The magnitude of this effect is considered **moderate**, given the presence of a large amount of similar habitat in the wider landscape and the relatively temporary nature of the effect**.**

6.2.2 Potential to damage dune vegetation

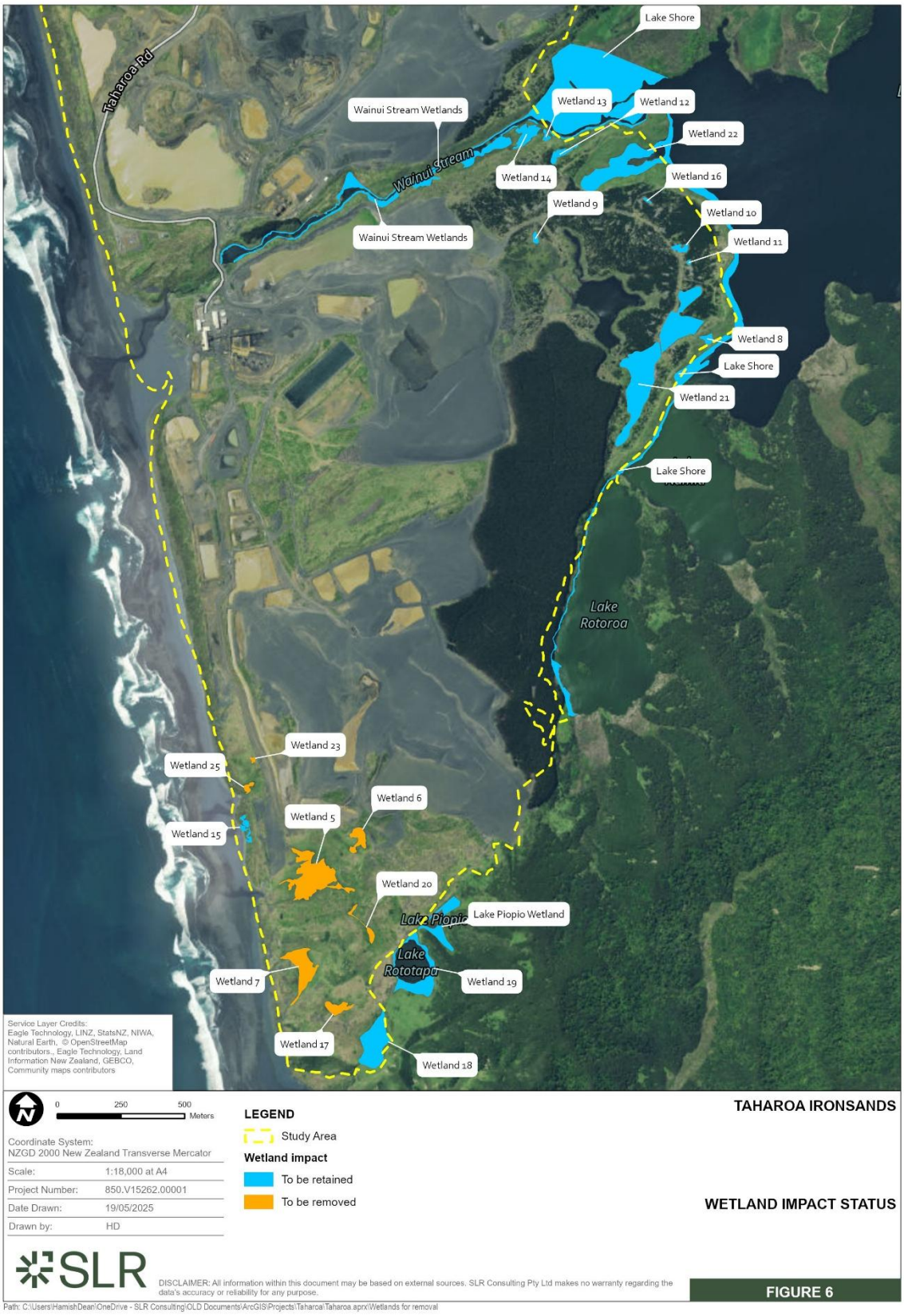
Dune vegetation could potentially be damaged or destroyed by mining operations, including where it extends beyond 100 m. However, a clearly marked 100 m buffer is proposed to protect the majority of this vegetation. The existing indigenous dune vegetation strip has been maintained adjacent to mining activities since the 1970s and the buffer is well respected by the current operators so this potential adverse effect is considered unlikely, and the timeframe of any effect would be short term.

6.2.3 Loss of wetlands

Several wetlands within the Site are proposed to be completely removed. These are Wetlands 5, 6, 7, 17, 20, 23 & 25 (Figure 6, Table 11) which are well established wetlands of moderate ecological value, some of which appear to have been induced by the landform left by historic mining of this area. Mining in these areas will result in the loss of 4.25 ha of moderate value wetland habitat. The magnitude of this effect is considered to be **Very High** given the complete removal of these sites.

Wetlands 9 – 11, 16, and 21, and the lake shore and Wainui Stream wetlands are to be retained with a 30m planted buffer. Wetland 15, which is also included in the southern wetlands group in Table 11, and will be protected by the 100 m coastal buffer and therefore retained.

Figure 6: Impacted Wetlands. Sites in orange will be removed as part of mining operations



6.2.4 Potential to alter hydrology of retained wetlands

Mining operations close to wetlands could potentially impact wetland hydrology by intercepting and diverting ground or surface water sources. This is a particular risk for mining operations which are below the water table. The Williamson Land and Water Advisory Assessment of Groundwater Effects (2025) has identified which wetlands are connected to groundwater (Table 12) as well as modelling potential groundwater drawdown as a result of mining activities. This assessment shows significant drawdown of groundwater in the vicinity of the wetlands west of Lake Taharoa (being wetlands 12, 13, 14 & 21) during mining of the Southern Block which could see a 1 – 3 m drop in groundwater over a period of six months or more. This level of change in hydrology could fundamentally alter these wetlands, either by causing them to completely dry up (because they lose their primary water source), or by changing the water regime (including the duration and timing of inundation) such that the plant communities and habitat values are adversely affected.

Potential adverse effects on these wetlands will vary depending on the actual drawdown, the influence of surface water on these wetlands and amount of drying that occurs but could include a decline in habitat quality for wetland flora and fauna, a change in vegetation type to a different wetland type or dryland vegetation, or promotion of invasive species adapted to fluctuating or drier conditions.

There is some uncertainty over whether wetlands 8, 9, 11, 15, and 16 are connected to groundwater or are perched and they will need to be carefully monitored once mining starts and any adverse effects managed appropriately (as further discussed below). The wetlands adjacent to the lakes which are affected by the fluctuation in the lake operating level and those in the south which are not connected to groundwater are not expected to be affected by groundwater drawdown.

The extent to which groundwater drawdown will impact the wetlands is unclear (because the effects vary, as explained above) but all of these sites are dominated by obligate hydrophyte species, meaning that they are more likely to be susceptible to drying than species that have a greater tolerance to upland (dry land) conditions. If there is even a moderate level of drying in these wetlands such that they lose their current standing water regime, or are dry for extended periods, we would expect to see a change to at least a different vegetation composition, complete loss of wetland habitat in marginal areas, loss or reduction of some functions such as nutrient cycling, carbon sequestration, and primary production, and reduced habitat value for indigenous fauna. The level of effect for these changes would be dependent on the amount of drying that occurs and with the current level of information this appears likely to be substantial. Without management, the magnitude of adverse effect is expected to be high.

However, a small amount of change in groundwater levels may be acceptable provided there is only a minor shift away from the status quo and changes to the wetlands are minimal. It is very difficult to set a trigger point for what constitutes an acceptable level of change without doing some monitoring of each wetland and this is our recommendation. From monitoring of the current hydrological conditions of each wetland prior to mining, a trigger for the implementation of mitigation measures could be set, based on the natural seasonal fluctuation in water level.

Table 12: Groundwater connectivity status of natural wetlands to be retained

Wetland - Groundwater Interaction	Wetlands (SLR Numbering)	Wetlands (WWLA Numbering)[1]
Groundwater fed wetlands	Wainui Stream wetlands, 12, 13, 14, 10, 21, 22, Lake Margin Wetlands	(63, 65, 68, 58), 62, 60, 59, 69, (73, 75), 64, (56, 57,71, 76)
Potentially groundwater fed wetlands	Wetland 8, 9, 11, 15, 16	74, 67, 70, 80, 66
Surface fed wetlands	Lake Piopio, 18, 19	83, 88, 86

1 As per Figure 4 in WWLA (2025) Taharoa Mine Expansion: Assessment of Groundwater Effects.

6.2.4.1 Lake margin wetlands

Modelling has shown that there are large natural fluctuations in lake levels over the course of a year, with local climate and rainfall being the main driver (Williamson Water and Land Advisory 2025b). However, the increased number of ship loading events proposed will increase the regularity of those fluctuations to some extent, albeit within the minimum lake operating level imposed by the existing and proposed consent conditions and change the hydrological regime of the lake margin wetlands. This application could result in changes to the extent of these wetlands or changes to the composition or health of the vegetation. Under the current operating regime there is already a significant fluctuation in water levels throughout the year, with a maximum lake level fluctuation of approximately 700 mm over the course of several months (WWLA 2025b, Figure 15). The current wetlands have survived and thrived under this regime. The proposal will result in slightly larger fluctuations in water levels because a greater number of ship loading events are proposed and there will be slightly longer periods of sustained low water in summer when abstraction exceeds the summer low flows into the lake (WWLA 2025b).

The dominant wetland vegetation around the lakes is raupō (*Typha orientalis*) which is moderately tolerant of fluctuations in water levels (Eser & Rosen 2000, Chen *et. al* 2021) and effective at colonising available habitat. *Typha* also exhibits plasticity in growth traits which allows them to change when and how much they grow based on water levels, and they are very good at utilising high nutrient levels (Froend & McComb 1994) like those found in Lake Taharoa. Given these traits, it is likely that raupō beds will adapt to the new hydrological regime without any notable loss in extent. Nevertheless, fluctuations can impact the growth and vigour of *Typha* (Roberts & Marston 2011) so adverse effects on the lake margin wetlands are possible. Other communities such as sedgeland and turf associations are adapted to fluctuating water levels at Taharoa and are likely to migrate in response to any change in the regime rather than disappear.

Under typical climactic conditions the annual lake level fluctuations will not be extreme and will return to normal each winter when lake inflows far exceed abstraction, but in the event of severe drought conditions the lake margin wetlands could be put under stress due to low lake water levels. While these very dry conditions would be purely climate driven, the water takes would induce a faster drawdown than under purely natural conditions. The modelling conducted by Williamson Water and Land Advisory[6] shows that the likelihood of this occurring is low, but if this happened there is potential for the adverse effects on wetlands, and the species they support, to be high.

6.2.5 Effects on water quality in wetlands

Discharge of stormwater or sediment to wetlands could potentially have an adverse effect on water quality, substrate and ultimately the functioning of the ecosystem and the composition

of the vegetation. However, this effect will be avoided by the 30 m buffer along perennial water bodies, the buffer around the retained wetlands, and the sediment controls explained above. Some wetlands (12, 13, 14, 21, & 22) are also protected by reserved areas. The timeframe of this potential effect is likely to be short term and of negligible magnitude.

6.2.6 Pest plant invasion

All indigenous habitats within and adjacent to the Mine footprint are susceptible to invasion by pest plant species. Dune vegetation and wetlands are particularly sensitive to pest plants which have the potential to alter the structure and composition of the vegetation by excluding native species, resulting in loss of ecological value. Mining activities have the potential to further spread pest plants that are already present in the site but given the weedy nature of the site and the presence of other dispersal methods such as livestock and birds, the magnitude of this effect is considered very low.

6.3 Unmitigated Level of Effect

An assessment of the effects of the mining activities on each component of the Site is provided in Table 13 for terrestrial habitats and Table 14 for wetland habitats. The tables include an outline of the likely effects of the mining operation on each component, the magnitude of the effects and the overall level of unmitigated effect. The anticipated level of effect has been assigned based on the EIANZ guidelines but applying professional judgement and sense checking. Options to avoid or mitigate these effects are discussed in Section 6.4 below.

Table 13: Summary of unmitigated effects on terrestrial habitat

		Ecological Effect	Removal of all vegetation in mining footprint		Potential damage to dune vegetation		Pest plant invasion	
Ecological feature	**Ecological Value**	**Description of effects**	**Magnitude**	**Level**	**Magnitude**	**Level**	**Magnitude**	**Level**
Escarpment vegetation	Moderate	Unlikely to be directly removed by mining activity because of the underlying geology (rock rather than sand). May be subjected to higher levels of disturbance and introduction of pest plants by machinery					Low	Low
Mined/built up areas	Low	Ongoing earthwork and extraction of sand. High levels of noise and light disturbance. Constant change of landform but very little deviation from previous state	Moderate	Low			Negligible	Very Low
Plantation pine forest	Moderate	Complete removal of this habitat type prior to mining including removal of a valuable bat foraging area. This effect will be medium to long term	Moderate	Moderate			Low	Low
Grassland, shrubland, and terrestrial rushland	Moderate	Complete removal of vegetation and long-term removal of habitat for indigenous flora and fauna including pipit (At Risk – Declining). Short to medium term light and sound disturbance for areas bounding active mine site	Moderate	Moderate			Moderate	Moderate
Stable dune system	Very High	Potential damage to edges of this habitat. Additional weed invasion due to mine machinery and pest plant populations allowed to grow in active mine areas and waste places			Negligible	Low	Moderate	High
Active dune system	Very High	Potential damage to edges of this habitat. Additional weed invasion due to mine machinery and pest plant populations allowed to grow in active mine areas and waste places			Negligible	Low	Moderate	High

Table 14: Summary of unmitigated effects on wetland habitat

		Ecological Effect	Loss of wetlands		Hydrological changes to wetlands		Reduction in wetland water quality		Pest plant invasion	
Ecological feature	**Ecological Value**	**Description of effects**	**Magnitude**	**Level**	**Magnitude**	**Level**	**Magnitude**	**Level**	**Magnitude**	**Level**
Lakes and Wainui Stream	Very High	These wetlands are and will be all protected by a 30 m buffer zone however there is potential for discharge of sediment laden water or other pollutants into these areas as a result of mining operations. Any such effect would be accidental and short in duration. Pest plant invasion potential could be increased as a result of mining moving closer to these wetlands. Potential for adverse effects on lake margin wetlands due to change in water take regime and potential for increased fluctuations in lake water level	-	-	Low	Moderate	Negligible	Low	Negligible	Low
Southern wetlands	Moderate	Complete loss of up to 4.25 ha of freshwater wetland (all wetlands in this group apart from Wetland 15 & 18) and potentially significant drawdown effects on Wetland 15	Very high	High	High	Moderate				
Eastern wetlands	Low	Potential for alteration of hydrology from groundwater drawdown which could result in loss or degradation of up to 0.29 ha of freshwater wetland. Incidence of pest plants could increase. Physical damage could occur if 30 m buffer is not applied and enforced	-	-	High	Low	Negligible	Very low	Low	Very low

		Ecological Effect	Loss of wetlands		Hydrological changes to wetlands		Reduction in wetland water quality		Pest plant invasion	
Wetland 21	Moderate	Impact on vegetation due to rapid water level changes from pumping of water, although this is an established regime and the effect would be minimal. Potential for damage to hydrology from significant drawdown of groundwater, introduction of additional pest plants, and degradation of habitat through light and noise disturbance			High	Moderate	Negligible	Very low	Low	Low
East Wainui Stream wetlands	Moderate	Potential for alteration of hydrology due to significant groundwater drawdown which could result in loss or degradation of up to 0.81 ha of freshwater wetland. Incidence of pest plants could increase. Physical damage could occur if 30m buffer is not applied and enforced			High	Moderate	Negligible	Very low	Low	Low

6.4 Impact Management

6.4.1 Effects Management Hierarchy

The effects management hierarchy is an internationally accepted approach for managing ecological impacts which requires that adverse effects are avoided, minimised, remedied, offset or compensated for, in that order of preference. The NPS-FM (Ministry for the Environment 2020b) requires Regional Councils to be satisfied that the effects management hierarchy has been followed before issuing a consent for quarrying or mineral extraction under wetland regulations or rules. While the effects management hierarchy may not receive the same weight under the Fast-track Approvals Act, it is used here to inform the management of adverse effects. The definition of the effects management hierarchy included in the NPS-FM is as follows:

a) *adverse effects are avoided where practicable; and*

b) *where adverse effects cannot be avoided, they are minimised where practicable; and*

c) *where adverse effects cannot be minimised, they are remedied where practicable; and*

d) *where more than minor residual adverse effects cannot be avoided, minimised, or remedied, aquatic offsetting is provided where possible; and*

e) *if aquatic offsetting of more than minor residual adverse effects is not possible, aquatic compensation is provided; and*

f) *if aquatic compensation is not appropriate, the activity itself is avoided.*

6.4.2 Management of adverse effects

Recommended measures to avoid, minimise and remedy the impacts of the mining operation on vegetation and habitat values are detailed in Table 15. For each potential effect, the impact management actions proposed are set out following the effects management hierarchy of Avoid, Minimise, Remedy and then Offset. Mitigation measures listed in the table below are detailed in the Natural Inland Wetland and Buffer Management Plan (SLR Consulting 2025).

Table 15: Recommended mitigation of adverse effects

Effect	Mitigation recommendations
Removal of all vegetation within the mining footprint	Include provisions in the proposed Site Rehabilitation Plan, to restore vegetation as soon as possible after tailings cells are filled. Rehabilitation should include establishing open habitat suitable for NZ pipit e.g. grassland and open sand. (Remedy)
Potential to damage dune vegetation	Continue dune fencing, or clearly delineate and communicate to all staff and contractors, the location of the 100 m dune buffer which has been in place for many years. (Avoid)
Loss of wetlands Alteration of wetland hydrology Adverse effects on water quality in wetlands	Include the following in the proposed Natural Inland Wetland and Buffer Management Plan chapter of the Environmental Management Plan: • A map of all remaining wetlands, perennial water bodies and their buffers and measures to ensure staff and machines avoid these areas (Avoid)

Effect	Mitigation recommendations
	• A plan to plant buffers around retained wetlands and perennial water bodies to limit runoff, disturbance effects and weed invasion (Minimise, Remedy) • A maintenance and weed control programme for wetlands and buffers (Minimise, Remedy) • Other measures as outlined in the fauna report (Mueller 2025) As part of the proposed Natural Inland Wetland and Buffer Management Plan, develop a lake margin wetland monitoring programme which should include: • Baseline monitoring of the extent and health of the raupō and flax wetlands on the margins of Lake Taharoa adjoining Taharoa C Block within the months of February and March following the commencement of the consents; • Repeat monitoring every 5 years. Set a lake level equivalent of 9.6m RL to trigger the following: • Implement mine management responses that will reduce water consumption and take. • Monitor and report on the extent and health of the raupō and flax wetlands if the level of Lake Taharoa is less than the 9.6m RL trigger for a continuous 30-day period. If effects are found review and update the Lake Level and Water Management Plan to identify measures that can be implemented to address the adverse effects. As part of the Natural Inland Wetland and Buffer Management Plan develop a method to monitor and manage water levels in all retained wetlands in the proposed groundwater drawdown areas. This should include establishing the typical operating water level of wetlands in this area, triggers for beginning supplementary water flows into these wetlands, as needed, and details of how water will be pumped into the wetlands to maintain their typical operating levels for the duration of the groundwater drawdown. Triggers are recommended to be based on the lowest natural level (recorded from pre-mining baseline monitoring) during any given season. If water levels in any of the groundwater connected wetlands drop below the seasonal low for more than 14 days, supplementary water flow should be provided and levels maintained within the natural seasonal range (Minimise). This approach has been used in other parts of the Waikato and although there is a level of risk, if well managed this approach can appropriately minimise adverse hydrological effects on these wetlands.

Effect	Mitigation recommendations
Pest plant invasion	Ensure any machinery arriving from off-site is properly cleaned and decontaminated to reduce the chance of introducing pest plant propagules (Avoid, Minimise). As part of the proposed Ecology and Rehabilitation Plan, develop a pest plant management plan to detail a programme for the protected parts of the Site (i.e. dunes, wetlands and planted buffers) to reduce the impact of pest and problem plants on sensitive habitats. This should focus on the following species but should be revised periodically to ensure that new weed invasions are picked up and incorporated into the control plan (Minimise): • Royal fern • Grey willow • Pampas • Tree lupin, marram, and kikuyu where they occur in the dune exclusion areas • Reed sweetgrass • African boxthorn • Arum lily • Gorse • Blackberry

6.5 Mitigated Level of Effect

The overall level of effect on each habitat type and wetland, after impact management actions have been applied, is shown in Table 16 and Table 17 below. Management of residual adverse effects is then discussed in Section 6.6.

Table 16: Level of effects on terrestrial vegetation after mitigation

		Removal of all vegetation in mining footprint		Potential damage to dune vegetation		Pest plant invasion	
Summary of mitigation measures:		Include suitable habitat (incl for pipit) in rehabilitation methodology. Progressively rehabilitate cells as mining progresses		Continue dune fencing, or clearly delineate the 100m dune buffer which has been proposed		Ensure machinery arriving to site is clean. Develop pest plant management plan for protected areas	
Ecological feature	**Ecological Value**	**Magnitude of effect**	**Level of effect**	**Magnitude of effect**	**Level of effect**	**Magnitude of effect**	**Level of effect**
Escarpment vegetation	Moderate					Negligible	Very low
Mined/built up areas	Negligible	Negligible	Very low			Negligible	Very low
Plantation pine forest	Moderate	Impact management for the pine plantation has been dealt with in the separate fauna report as its value is derived primarily form the presence of long-tailed bats.				Negligible	Very low
Grassland, shrubland, and terrestial rushland	Moderate	Low	Low			Negligible	Very low
Stable dune system	Very High			Negligible	Low	Negligible	Very low
Active dune system	Very High			Negligible	Low	Negligible	Very low

Table 17: Level of effects on wetlands after mitigation

		Loss of wetlands		Hydrological changes to wetlands		Reduction in wetland water quality		Pest plant invasion	
Summary of mitigation measures:		Destruction of these wetlands cannot be avoided, and no measures are available to minimise the impact of habitat loss. Remediation is not possible because the landform and hydrology will be different after mining in the area is complete.		Planting of appropriate buffers. Lake margin monitoring programme. Lake trigger level. Wetland water supplementation.		Buffer planting and appropriate sediment controls		Ensure machinery arriving to site is clean. Develop pest plant management plan	
Ecological feature	**Ecological Value**	**Magnitude of effect**	**Level of effect**	**Magnitude of effect**	**Level of effect**	**Magnitude of effect**	**Level of effect**	**Magnitude of effect**	**Level of effect**
Lakes and Wainui Stream	Very High			Negligible	Low	Negligible	Low	Negligible	Low
Southern wetlands	Moderate	Very high	High	Low (Wetland 15)	Low				
Eastern wetlands	Low			Low	Low	Negligible	Very low	Negligible	Very low
Wetland 21	Moderate			Low	Low	Negligible	Very low	Negligible	Very low
East Wainui Stream wetlands	Moderate			Low	Low	Negligible	Very low	Negligible	Very low

With the recommended mitigation options properly implemented, the overall effect of the proposed mining operation on vegetation and the majority of wetlands will be low**.** However, the current plan is likely to result in the complete loss of 4.25 ha of moderate value wetland habitat that cannot be avoided, minimised or remedied and represents a residual adverse effect for which ecological offsetting or compensation needs to be considered if an overall low level of effect or a net gain is to be achieved. An offsetting approach is detailed in Section 6.6 below.

6.6 Offsetting residual effects

The proposed offset method is to create wetland habitat within Taharoa C block, most likely around the artificial pond at Site 27 and in the surrounding area. This area is outside of an anticipated mining pit , has potential for suitable hydrology to be established, and is close to the high value habitat of Lake Taharoa and Wetland 21. However, this site is subject to groundwater drawdown from mining activities and may need to be supplemented with water. The final offsetting site will be confirmed once consent has been granted and detailed mine planning has been further advanced.

6.6.1 Biodiversity offsetting principles

For a mitigation action to be considered an offset it must meet certain principles. Various versions of these principles have been published for New Zealand and elsewhere (e.g. NZ Government 2014, Maseyk *et. al.* 2018) but the most recent are in the National Policy Statement for Indigenous Biodiversity (NPS-IB). The principles from the NPS-IB are summarised below.

1) **Adherence to effects management hierarchy:** Offsetting is only appropriate after steps to avoid, minimise, and remedy adverse effects have been sequentially exhausted.
2) **Biodiversity offsetting is not appropriate if**: A net gain outcome for biodiversity values cannot be achieved and adversely impacted biodiversity values will be permanently lost.
3) **Net gain**: Biodiversity values that are lost from the proposed works are counterbalanced and exceeded by the proposed offsetting. This results in a net gain for biodiversity values when compared to what is lost.
4) **Additionality:** The proposed offset achieves biodiversity gains above and beyond what would have occurred without the offset.
5) **Leakage**: The design and implementation of the proposed offsetting avoids displacing activities that are harmful to indigenous biodiversity to other locations.
6) **Landscape context**: Biodiversity offset actions are undertaken only when this will result in the best ecological outcome. These actions consider the landscape context of both the impact and compensation site, interactions between species, habitats, ecosystems, spatial connections, and ecosystem function.
7) **Long-term outcomes:** Biodiversity offsets are managed to ensure they last as long as the impacts and preferably in perpetuity.
8) **Time lags:** The delay between indigenous biodiversity impacts and gain or maturity of indigenous biodiversity at the offset site is minimised so that the calculated gains are achieved within the consent period.
9) **Science and mātauranga Māori:** The design and implementation of a biodiversity offset is a documented process informed by science and mātauranga Māori where available.
10) **Stakeholder participation:** Opportunity for the effective and early participation of stakeholders is demonstrated for when planning for biodiversity offsets.

11) **Transparency:** The design, implementation, and results of a biodiversity offset is communicated to the public in a transparent and timely manner.

6.6.2 Recommended offset actions

It is recommended that the loss of wetland habitat is offset by creating wetland habitat elsewhere in the Site, and that work on wetland creation starts before the wetlands are damaged or destroyed. We consider that this approach can meet all the principles of biodiversity offsetting outlined in the NPS-IB. We recommend that a wetland creation project involves the following steps:

1. Identify an appropriately sized and located site where wetland hydrology can be established.
2. Develop a detailed design of landform, hydrology, desired habitat characteristics, and planting, which will achieve the desired outcome of at least 8.3 ha of freshwater wetland with habitats functionally similar to those that will be lost, as well as high suitability for the threatened and at-risk bird species which are present in the area. The wetland design should include shallow open water habitats, sedgeland and reedland habitats, and if possible, seepage and ephemeral areas.
3. Set up baseline monitoring.
4. Undertake appropriate earthworks to establish landform and wetland hydrology. This will likely involve lowering the ground level to at or below the groundwater or lake level (depending on the location).
5. Undertake a staged planting programme to establish target vegetation types.
6. Undertake maintenance weed control and establish a pest control programme.
7. Formally protect the new wetland to ensure long-term sustainability of the biodiversity gains.
8. Monitor biodiversity gains.

6.6.3 Establishing an offset quantum

Often the amount of restoration or rehabilitation work required to offset a biodiversity loss has been worked out using a simple ratio of area restored to area lost, with the ratio being ascribed using expert knowledge and experience. A ratio of 3:1 (3 times the area lost is restored) has commonly been used but ratios have varied depending on the quality of the habitat and ecological value. It is common now to use offset or compensation models which better account for the complex nature of biodiversity values as well as the risks associated with offsets. Two offset models were considered for use in this case: The Department of Conservation (DOC) Biodiversity Offset Accounting Model (BOAM) (Maseyk *et. al.* 2015), and the Tonkin & Taylor Biodiversity Compensation Model (BCM) (Baber *et. al.* 2021).

The DOC model is a detailed offset model which uses quantitative inputs and is well suited to complex situations. The T&T model is less detailed and is termed a compensation model, but provided the offsetting principles are met it can provide guidance on offset requirements for a given level of loss. Appropriate quantitative data on the potentially impacted sites was not available and the use of the more complex model was not deemed warranted. Accordingly, the T&T BCM was used to give guidance on the amount of offset or compensation that will be required for the loss of the wetlands and the process used is discussed in Section 6.6.4 below.

6.6.4 Biodiversity offset calculations

This section details the values that were used in the Biodiversity Compensation Model (the model) to calculate the required offset. Guidance material provided with the model (Baber *et. al.* 2021) was used to guide the process. Each of the inputs to the model are detailed in Table 18 below, along with the values that were used and the justification for using them.

Table 18: Details of values used in the Biodiversity Compensation Model and justification for their use

Model input	Description	Value used	Justification
Benchmark	This is a realistic but hypothetical reference state representing high quality, mature habitat.	5	This value is always set at 5 as per the guidance.
Number of habitat types or sites	Sites and habitats may be grouped if they are broadly similar and have similar values, or split if values are different across habitats or sites.	1	The potentially impacted wetlands were assessed in a group (southern wetlands) as per previous sections of this EcIA, to which ecological value was assigned. The group was used as the number of sites in the model, rather than splitting each out into the individual wetlands as habitats and values were similar within the group.
Number of proposed compensation actions	Number of separate actions.	1	In this case only wetland creation was used as the offset action as the intent is to restore like for like or better wetland habitat elsewhere in the Site. Pest control would have been another option but is being recommended to mitigate effects on fauna and additionality is required.
Net Gain Target	This is the desired net gain of biodiversity value over and above no net loss.	10%	This is essentially a contingency or buffer which allows for any unforeseen issues with restoring habitat of at least the same value as that which is being lost. 10% was used because although wetland restoration should be relatively straightforward, there is always a risk that not quite enough area will be made available, or hydrological conditions are not quite right, or weed control and maintenance are not done to the desired standard which, among other possibilities, could result in less gain at the offset site than expected.
Impact risk contingency	This is a contingency that deals with the likelihood that with higher value or rarer ecosystem values, comes a higher risk that	2	This value relates directly to the ecological value of the habitat as assessed through the EcIA process. The southern wetlands are of Moderate value and are therefore

Model input	Description	Value used	Justification
	some values will be permanently lost.		assigned a value of 2 as per the Model guidance.
Impact uncertainty contingency	This is a contingency that deals with the likelihood that there are values being lost that haven't been recognised and relates to the complexity of the ecosystem.	1	These sites were all examined quite closely and the botanical and avifauna values were well documented which makes it unlikely that there are undocumented values not accounted for. There is still a chance that ecological values were overlooked and this is dealt with by the 5% contingency provided by the score of 1.
Areal extent of impact (ha)	The area in hectares that will be impacted.	4.25	These are the areas of all wetlands in the southern group except Wetland 15
Value prior to impact	The value assigned to the habitat being impacted.	2.5	The southern group of wetlands were assigned an overall ecological value of Moderate which equates to a score of 2 - 2.99, as per the Model guidance.
Value after impact	The likely value after the impact has occurred.	0.001	The lowest available value was assigned because the assumption is that all these wetlands will be destroyed during the mining process.
Compensation actions	The proposed actions to compensate for the biodiversity loss.	Restoration of wetland habitat	Only restoration of wetland habitat has been considered at this stage because following the effects management hierarchy the wetland loss should be offset if possible, and the principles of offsetting require like for like (or better) offsets.
Discount rate	The discount rate (also called an interest rate elsewhere) addresses the temporal lag between when the impact occurs and the offset generating ecological value.	3%	3% is the rate recommended in the guidance for the Model and generally used.
Finite end point	This is the number of years between the impact and the assessment of biodiversity gain at the offset site.	2	The proposed restoration timeframe is one year to identify and prepare a site (earthworks etc), and secure a plant supply, three years over which to stage planting, and two years of growth to reach a moderate level of maturity. However, mining in the southern area will only take place after several years of restoration work so the time between impact and the finite end point has been set to just two years.

Model input	Description	Value used	Justification
Compensation confidence contingency	This is a contingency related to the level of confidence in the proposed offset actions. I.e, how likely they are to be successful in achieving the offset goals.	2	The value 2 represents a high level of confidence in the offset being successful. The restoration of wetland habitat at Taharoa should be relatively straightforward provided the resources are put into identifying an appropriate site where wetland hydrology exists or can be established through earthworks. With appropriate consent conditions the likelihood of the work happening is high.
Areal extent (ha) of compensation action	The area over which the offset action will occur.	8.3 ha	8.3 ha was used here because it achieves 10% net gain of biodiversity value with all other parameters already set.
Value score prior to compensation action	The ecological value of the site prior to the offset action being undertaken.	1	The value of 1 represents low ecological value at the offset site prior to the offset action taking place. This is based on an offset site being located in land immediately west of Lake Taharoa where there is some ecological value.

The inputs and outputs of the model are shown in Figure 7. The model shows that with the inputs described above, 8.3 ha of wetland creation, achieving a high biodiversity value, is required to offset the loss of 4.25 ha of moderate value wetland with a 10% net gain as a buffer.

6.6.5 Feasibility of potential offset

Based on the above, the wetland offset needs to be 8.3ha in size and involve establishing a new wetland habitat or enhancing an existing constructed waterbody.

We consider that appropriate land is available, in various locations, and that by following the approach in section 6.6.2 above, any offset can meet all the principles of biodiversity offsetting outlined in the NPS-IB. Conditions have been proposed which align with the principles of offsetting to achieve no net loss.

It is recommended that TIL investigates the possibility of establishing a new wetland habitat or enhancing an existing waterbody somewhere close to the existing high value wetlands. This would allow natural population by wetland plant species and would extend habitat for threatened and at-risk birds such as Australasian bittern which utilise existing wetlands in that area.

A potential location and layout for wetland creation is included in Figure 8 to demonstrate feasibility. This utilises the existing Site 27 constructed pond but will require earthworks to lower the ground level to intercept groundwater. As Site 27 is potentially affected by groundwater drawdown, the provisions recommended in Table 15 will be essential if the offset site is to be viable. It is recommended that the wetland creation process should begin immediately after consent is granted so that the time lag between the impact and the biodiversity gain from the restoration project is minimised. It also needs to be achievable within two years of the impact occurring i.e., ideally it would be two years into the wetland creation project before the impact takes place, which minimises the risk considerably.

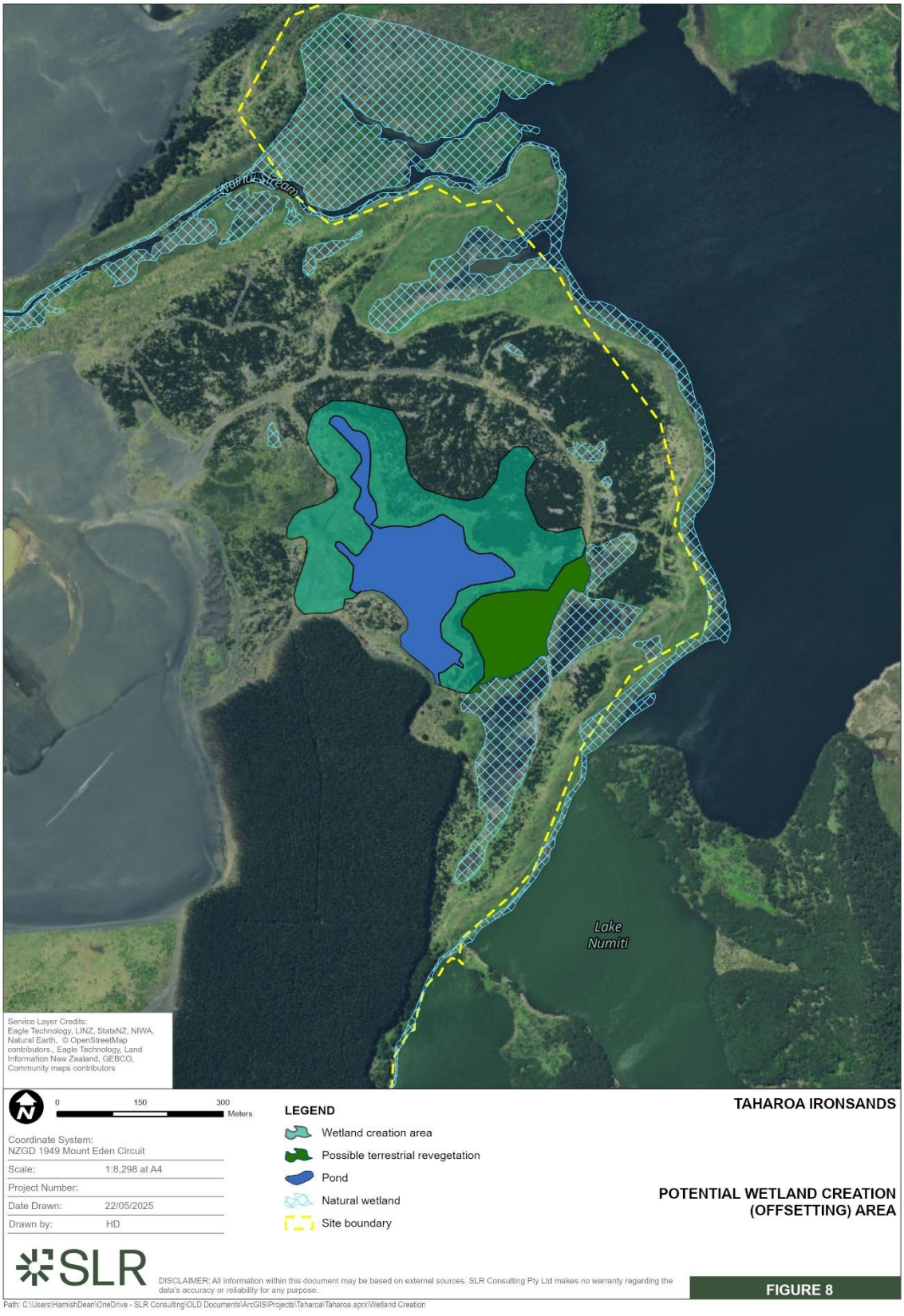
A Natural Inland Wetland and Buffer Management Plan has been prepared which addresses the matters set out above (SLR Consulting 2025).

Figure 7: Inputs and outputs of the BCM

Model Inputs	
Input descriptors	**Input data**
Project/reference name	Taharoa Ironsands
Biodiversity type	Wetlands
Technical expert(s) input	Hamish Dean, Keren Bennett
Benchmark	5
How many habitat types OR sites are impacted	1
Number of proposed compensation actions	1
Net gain target	10%
Habitat/Site Impact(s)	
Impact risk contingency:	2
Impact uncertainty contingency:	1
Areal extent of impact (ha):	4.25
Value score prior to impact:	2.5
Value score after impact:	0.001
Compensation Action(s)	**Restoration of indigenous shallow water and rush-sedgland habitats**
Discount rate:	3.0%
Finite end point (years):	2
Compensation confidence contingency:	2
Areal extent (ha) of compensation type:	8.3
Value score prior to compensation:	1
Value score after compensation:	3

Model outputs		
Impact score	**Total impact score**	**0**
	-2.34188	-2.34188
Compensation score	**Total compensation score**	**Restoration of indigenous**
	2.58177	2.58177
Net gain outcome	**10.2%**	

Figure 8: Potential wetland creation area for offsetting wetland loss



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8.0 Closure

Sincerely,

SLR Consulting New Zealand

Hamish Dean, MSc, CEnvP
Principal Ecologist

9.0 Feedback

At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team's performance, deliverables and service are valuable and SLR welcome all feedback via https://www.slrconsulting.com/en/feedback. We recognise the value of your time and we will make a $10 donation to our Charity Partner - Lifeline, for every completed form.

Appendix A Plant Species List

Ecological Impact Assessment for wetlands and terrestrial vegetation

Taharoa Ironsands Central and Southern Block Mining Project

Taharoa Ironsands Limited

SLR Project No.: 850.V15262.00001

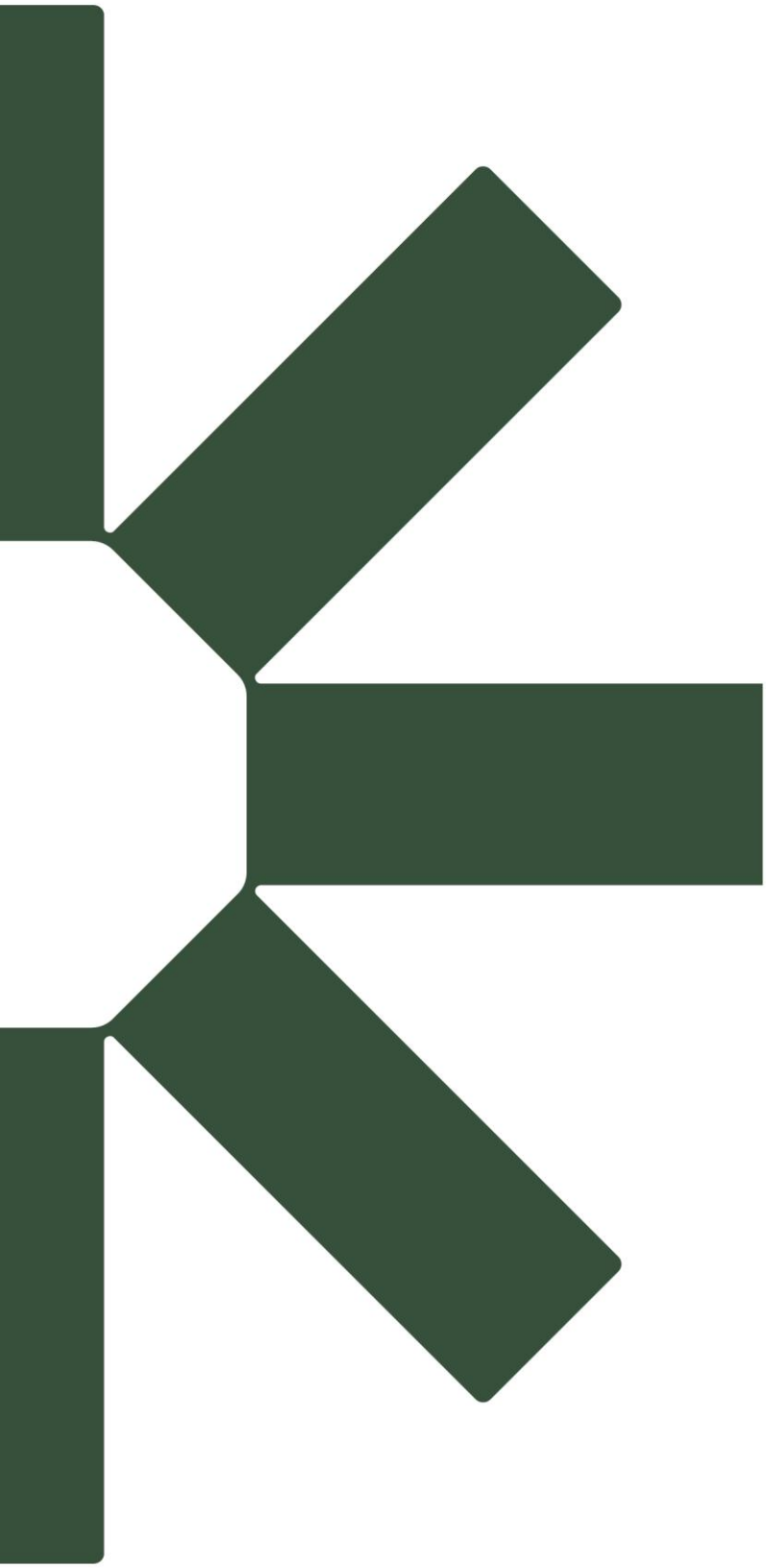
13 October 2025

Botanical name	Common name	Threat Status
Ferns		
Adiantum hispidulum var. hispidulum	Rosy maidenhair	Not Threatened
Asplenium oblongifolium	huruhuruwhenua	Not Threatened
Azolla pinnata	Ferny azolla	Naturalised
Blechnum minus	Swamp kiokio	Not Threatened
Blechnum novae-zelandiae	Kiokio	Not Threatened
Cyathea dealbata	Ponga	Not Threatened
Cyathea medullaris	Mamaku	Not Threatened
Dicksonia squarrosa	wheki	Not Threatened
Diplazium australe		Not Threatened
Osmunda regalis	Royal fern	Naturalised
Paesia scaberula	mātata	Not Threatened
Pteridium esculentum	Rarauhe	Not Threatened
Pteris tremula	Shaking brake	Not Threatened
Grasses		
Ammophila arenaria	Marram grass	Naturalised
Anthoxanthum odoratum	Sweet vernal	Naturalised
Axonopus fissifolius	Narrow-leaved carpet	Naturalised
Cenchrus clandestinus	Kikuyu grass	Naturalised
Cortaderia selloana	Pampas grass	Naturalised
Cynodon dactylon	Bermuda grass	Naturalised
Dactylis glomerata	Orchard grass	Naturalised
Digitaria sanguinalis	Summer grass	Naturalised
Glyceria fluitans	Floating sweetgrass	Naturalised
Glyceria maxima	Reed sweetgrass	Naturalised
Holcus lanatus	Yorkshire fog	Naturalised
Isachne globosa	Swamp millet	Not Threatened
Lachnagrostis billardierei subsp.	Sand wind grass	Not Threatened
Lagurus ovatus	Harestail	Naturalised
Paspalum distichum	Mercer grass	Naturalised
Paspalum vaginatum	Saltwater paspalum	Naturalised
Poa annua	Annual poa	Naturalised
Spinifex sericeus	kōwhangatara	Not Threatened
Sporobolus africanus	Rat's tail grass	Naturalised
Stenotaphrum secundatum	Buffalo grass	Naturalised
Herbs - Dicotyledonous composites		
Bidens frondosa	Beggar's ticks	Naturalised
Cirsium vulgare	Scotch thistle	Naturalised
Cotula coronopifolia	Bachelor's button	Not Threatened
Crepis capillaris	Hawksbeard	Naturalised
Erigeron sumatrensis	Broad-leaved fleabane	Naturalised
Gamochaeta sp.		Naturalised

Botanical name	Common name	Threat Status
Hypochaeris radicata	Catsear	Naturalised
Leontodon saxatilis	Hawkbit	Naturalised
Pseudognaphalium luteoalbum	Jersey cudweed	Not Threatened
Senecio bipinnatisectus	Australian fireweed	Not Threatened
Sonchus asper	Prickly sow thistle	Naturalised
Sonchus oleraceus	Sow thistle	Naturalised
Symphyotrichum subulatum	Sea aster	Naturalised
Herbs - Dicotyledons other than Composites		
Anagallis arvensis subsp. arvensis var	Pimpernel	Naturalised
Apium nodiflorum	Water celery	Naturalised
Bellardia viscosa	Tarweed	Naturalised
Callitriche stagnalis	Water starwort	Naturalised
Calystegia soldanella	Shore bindweed	Not Threatened
Calystegia tuguriorum	Convolvulus, bindweed	Not Threatened
Centella uniflora	Centella	Not Threatened
Daucus carota	Wild carrot	Naturalised
Digitalis purpurea	Foxglove	Naturalised
Epilobium ciliatum	Willowherb	Naturalised
Fumaria muralis	Scrambling fumitory	Naturalised
Galium aparine	Cleavers	Naturalised
Galium palustre	Marsh bedstraw	Naturalised
Lilaeopsis novae-zelandiae	Lilaeopsis	Not Threatened
Lotus pedunculatus	Lotus	Naturalised
Lotus suaveolens	Hairy birdsfoot trefoil	Naturalised
Ludwigia palustris	Water purslane	Naturalised
Ludwigia peploides	Water primrose	Naturalised
Lysimachia arvensis subsp. arvensis var.	Pimpernel	Naturalised
Lythrum hyssopifolia	Hyssop loosestrife	Naturalised
Myosotis laxa	Water forget-me-not	Naturalised
Myriophyllum propinquum	Common water milfoil	Not Threatened
Myriophyllum votschii		Not Threatened
Ornithopus perpusillus	Wild serradella	Naturalised
Oxalis rubens	Oxalis	Not Threatened
Persicaria decipiens		Not Threatened
Persicaria maculosa	Willow weed	Naturalised
Phytolacca octandra	Inkweed	Naturalised
Plantago australis	Swamp plantain	Naturalised
Plantago lanceolata	Narrow-leaved plantain	Naturalised
Plantago major	Broad-leaved plantain	Naturalised
Polycarpon tetraphyllum	Allseed	Naturalised
Prunella vulgaris	Selfheal	Naturalised
Ranunculus flammula	Spearwort	Naturalised
Ranunculus repens	Buttercup	Naturalised
Rumex acetosella	Sheep's sorrel	Naturalised

Botanical name	Common name	Threat Status
Rumex conglomeratus	Clustered dock	Naturalised
Rumex crispus	Curled dock	Naturalised
Rumex obtusifolius	Broad-leaved dock	Naturalised
Sagina procumbens	Procumbent pearlwort	Naturalised
Solanum chenopodioides	Velvety nightshade	Naturalised
Solanum nigrum	Black nightshade	Naturalised
Trifolium repens	White clover	Naturalised
Vicia	Vetch	Naturalised
Herbs - Monocots		
Landoltia punctata	Purple-backed duck	Naturalised
Lemna disperma	Common duckweed	Not Threatened
Ottelia ovalifolia	Swamp lily	Naturalised
Phormium tenax	Harakeke / flax	Not Threatened
Potamogeton cheesemanii	Red pondweed	Not Threatened
Potamogeton crispus	Curly pondweed	Naturalised
Sisyrinchium sp.	purple-eyed grass	Naturalised
Typha orientalis	Raupō	Not Threatened
Zantedeschia aethiopica	Arum lily	Naturalised
Lianes & Related Trailing Plants - Dicotyledons		
Tetragonia trigyna	Native spinach	Not Threatened
Orchids		
Microtis unifolia	Onion-leaved orchid	Not Threatened
Rushes & Allied Plants		
Apodasmia similis	Oioi	Not Threatened
Juncus aff. *caespiticius*		Naturalised
Juncus articulatus	Jointed rush	Naturalised
Juncus effusus	Soft rush	Naturalised
Juncus planifolius	Grass-leaved rush	Not Threatened
Juncus prismatocarpus	Rush	Not Threatened
Juncus sarophorus	Broom rush	Not Threatened
Juncus tenuis subsp. tenuis	track rush	Naturalised
Sedges		
Bolboschoenus fluviatilis	Kukuraho	Not Threatened
Carex lessoniana	Rautahi	Not Threatened
Carex pumila	Sand sedge	Not Threatened
Carex secta	Purei, pukio	Not Threatened
Carex testacea	Speckled sedge	Not Threatened
Carex virgata	Pukio	Not Threatened
Cyperus brevifolius		Naturalised
Cyperus congestus	Purple umbrella sedge	Naturalised
Cyperus ustulatus	Cyperus, coastal cutty	Not Threatened

Botanical name	Common name	Threat Status
Eleocharis acuta	Sharp spike sedge	Not Threatened
Eleocharis gracilis	Slender spike sedge	Not Threatened
Eleocharis sphacelata	Kutakuta	Not Threatened
Ficinia nodosa	Wiwi	Not Threatened
Isolepis cernua var. cernua	Slender clubrush	Not Threatened
Isolepis prolifera	Isolepis	Not Threatened
Machaerina articulata	jointed twig rush	Not Threatened
Machaerina rubiginosa	Baumea	Not Threatened
Schoenoplectus tabernaemontani	Kuawa	Not Threatened
Schoenus apogon		Not Threatened
Trees & Shrubs - Dicotyledons		
Coprosma propinqua var. propinqua	Mingimingi	Not Threatened
Coprosma rhamnoides	Mingimingi	Not Threatened
Coprosma tenuicaulis	Hukihuki	Not Threatened
Corynocarpus laevigatus	Karaka	Not Threatened
Geniostoma ligustrifolium var.	Hangehange	Not Threatened
Kunzea robusta	Kanuka	Threatened - Nationally Vulnerable
Leptospermum scoparium var.	Mānuka	At Risk - Declining
Leucopogon fasciculatus	Mingimingi	Not Threatened
Lupinus arboreus	Tree lupin	Naturalised
Lycium ferocissimum	African boxthorn	Naturalised
Melicytus ramiflorus subsp. ramiflorus	Māhoe	Not Threatened
Muehlenbeckia complexa var. complexa	Small-leaved pōhuehue	Not Threatened
Ozothamnus leptophyllus	Tauhinu	Not Threatened
Piper excelsum subsp. excelsum	Kawakawa	Not Threatened
Rubus fruticosus	Blackberry	Naturalised
Salix cinerea	Grey willow	Naturalised
Solanum linnaeanum	Apple of Sodom	Naturalised
Ulex europaeus	Gorse	Naturalised
Trees & Shrubs - Gymnosperms		
Pinus radiata	Monterey pine	Naturalised
Trees & Shrubs - Monocotyledons		
Cordyline australis	Tī kōuka / cabbage tree	Not Threatened



Making Sustainability Happen