Boffa Miskell

Southwest Wastewater Treatment Plant

Ecological Assessment in support of Notice of Requirement
Prepared for Watercare Services Ltd.

Boffa Miskell is proudly a
Toitū net carbonzero certified consultancy

Document Quality Assurance

Bibliographic reference for citation:
Boffa Miskell Limited 2023. *Southwest Wastewater Treatment Plant: Ecological Assessment in support of Notice of Requirement*. Report prepared by Boffa Miskell Limited for Watercare Services Ltd. .

Prepared by:	**Ashley Flood** **Ecologist** **Boffa Miskell Limited**	
	Ian Boothroyd **Senior Ecologist** **Boffa Miskell Limited**	
Reviewed by:	**Sarah Flynn** **Senior Ecologist** **Boffa Miskell Limited**	
Status: FINAL	**Revision / version: 1**	**Issue date: 29 August 2023**

Use and Reliance
This report has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Boffa Miskell does not accept any liability or responsibility in relation to the use of this report contrary to the above, or to any person other than the Client. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate, without independent verification, unless otherwise indicated. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

CONTENTS

Appendices

1.0 Executive Summary

Watercare Services Limited (Watercare) is a lifeline utility providing water and wastewater services to 1.7 million people in Auckland. Watercare supplies reliable, high-quality drinking water to homes and businesses in the Auckland region and collects, treats, and discharges their wastewater in environmentally responsible ways.

Watercare has identified the site at 372 Glenbrook Beach Road as the preferred location for a Wastewater Treatment Plant (WWTP) to service the anticipated population growth in the Southwest growth area (including the communities of Kingseat, Clarks Beach, Glenbrook Beach and Waiuku) and is seeking to designate the full site. The current dominant land use of the site is market gardening with highly cultivated and exposed soils.

The location at 372 Glenbrook Beach Road has several ecological features: two watercourses, three natural wetlands, two irrigation ponds, salt marsh habitats; and sits alongside estuarine and marine habitats. All three wetlands meet the definition of a natural inland wetland under the National Policy Statement for Freshwater Management and are subject to the provisions of the National Environment Standards for Freshwater.

With the exception of the salt marsh and estuarine habitats, all the ecological features of the proposed designation area are low quality and in poor condition, reflecting the surrounding intensive and cultivated landscape. The higher value ecological features are the salt marsh and estuarine habitats downstream of the proposed designation area. These features will be avoided, and no construction activity will occur within them. Erosion and sediment management will ensure that sediment intrusions to these downstream habitats will be minimised.

Overall, the proposed location for the construction and operation of the proposed WWTP will result in negligible adverse effects on ecological values, as effects on ecological features can be avoided or managed.

2.0 Introduction

2.1 Background

Watercare Services Limited (Watercare) is a lifeline utility providing water and wastewater services to 1.7 million people in Auckland. Watercare supplies reliable, high-quality drinking water to homes and businesses in the Auckland region and collects, treats, and discharges their wastewater in environmentally responsible ways. Its services are vital for life, keep people safe and help communities to flourish.

As a council-controlled organisation (CCO), wholly owned by Auckland Council, Watercare manages water and wastewater assets worth over $14 billion and plan and build infrastructure to ensure that growth is supported today and into the future. Watercare's vision is to be "trusted by our communities to deliver exceptional performance every day". Watercare's mission is "reliable, safe and efficient water and wastewater services".

Watercare has investigated how best to manage wastewater in the Southwest area in response to the anticipated growth identified in the Auckland Unitary Plan (Operative in Part 2016) (AUP: OP). Through this work, Watercare identified the need for a sub-regional Wastewater Treatment

Plant (WWTP) to service the anticipated population growth in the Southwest growth area (including the communities of Kingseat, Clarks Beach, Glenbrook Beach and Waiuku). The new WWTP is needed to enable Watercare to discharge treated wastewater into the Waiuku Channel in accordance with stringent treatment standards included within a discharge consent granted by the Environment Court in June 2018.

Following an assessment of alternative sites, Watercare has identified the site at 372 Glenbrook Beach Road (Lot 1 DP 367461) as its preferred location for the WWTP and is seeking to designate the full site. Designation of the site will enable construction of the WWTP which will be delivered in stages. The designation provides for a WWTP at full build out that will provide the capacity to service a long-term population equivalent (PE) of 60,000 in the Southwest area. However, it is initially proposed to construct the first stage, a WWTP for 20,000 PE, shortly followed by second stage upgrade to provide a WWTP for 30,000 PE (in line with the SW Discharge Consent population growth).

2.2 Purpose

This report is an assessment of the ecological values and supports the AEE that is being submitted with the Notice of Requirement to Auckland Council. It assesses the effects of the designation on ecology from the construction of the WWTP and its on-going operation.

3.0 Site Location and Ecological Context

3.1 Location

The site at 372 Glenbrook Beach Road (the Site) is bounded by the Taihiki River to the east and Glenbrook Beach Road to the west. The tidal flat inlets of the Taihiki River form the eastern margins of the Site and the Taihiki River joins the Waiuku River before discharging to the Manukau Harbour to the north.

Rural (mainly pastoral and horticultural) land use interspersed with small residential settlements form the Site's wider landscape and ecological context (Figure 1). Mean annual precipitation in the winter period was 1120 mm recording large fluctuations in annual mean (50.1-136.9 mm). Mean annual temperature is 15.6°C, with a summer mean maximum (daytime, January) temperature of 23.9°C and a winter mean minimum (daytime, July) temperature of 7.7°C.

Figure 1. Location of the proposed southwest wastewater treatment plant (in blue) at 372 Glenbrook Beach Road within the wider landscape context.

3.2 Landform

The natural landform of the site has been modified over time to enable farming practices and the construction of two artificial irrigation ponds. One of the artificial irrigation ponds is located in the southwest part of the site adjacent to Glenbrook Beach Road, the second irrigation pond straddles the northern boundary of the site and extends into neighbouring land. We understand that the pond to the southwest is served by a deep bore.

3.3 Ecological District

The proposed WWTP is within the Manukau Ecological District in the Auckland Region, in the low-lying altitude land running southwards towards the Waikato Region. The original vegetation (pre-European times) of the Manukau Ecological District was likely dominated by abundant taraire, rimu, totara and puriri forest (DOC, 1997). Prominent salt marsh and mangrove – dominated wetlands were found in the adjacent Manukau Harbour (DOC 1997).

The lack of remnant indigenous vegetation within the Manukau ED reflects modification following human settlement of Manukau Harbour. Forests were cleared for timber and replaced with highly productive pastoral grass for stock grazing, or cultivated as cropland. The only significant area of natural habitat remaining is the Manukau Harbour itself. However, the intertidal creeks of the Harbour are classified as '*poor*' due to the high sediment/ mud input (Auckland Environment 2019).

The location of the proposed WWTP occurs at 0-100 m elevation with a warm humid climate and mild rainfall in the winter. A nearby NIWA climate station at Auckland Airport reflects these conditions at the proposed site (data from 2012-2022).

3.4 Significant Ecological Areas

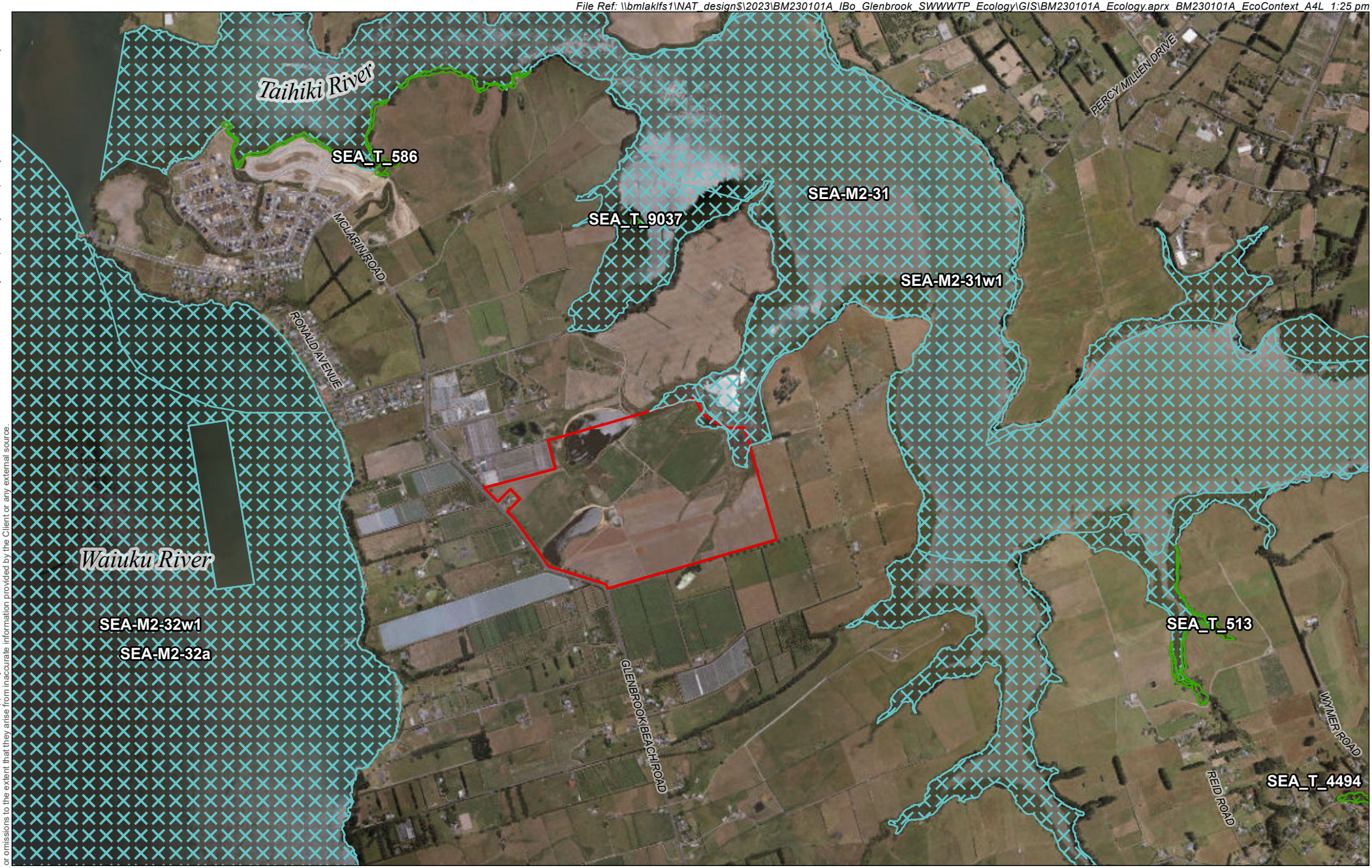
Significant Ecological Areas (SEAs) are identified by the Auckland Council through Schedule 4 of the Auckland Unitary Plan (AUP(OP)). Terrestrial SEAs meet at least one of five ecologically important factors (further defined in a number of sub-factors), including:

- *Representativeness;*
- *Threat status and rarity;*
- *Diversity;*
- *Stepping stones; and*
- *Uniqueness.*

Marine SEAs are identified using six factors (AUP(OP) Schedule 4), including the five above (though with marine-focused sub-criteria), and "recognised international or national significance" as an additional factor.

Two marine SEAs extend into the property (SEA-M2-31 and SEA-M2-31w1). Both these areas are located along the coastal margin on the north-eastern boundary of the Site and together they compromise the full extent of the Taihiki River (Figure 2).

SEA-M2-31 is composed of sheltered harbour habitats including predominantly sandy intertidal flats, mangroves, and pockets of salt marsh. It is an important nursery area for young flounder and grey mullet. It is further classified as an Area of Significant Ecological Value by the Department of Conservation. SEA-M2-31w1 is identified due to its high value for wading bird species. We note that the SEAs bordering the site are fenced and planted.



Boffa Miskell

www.boffamiskell.co.nz

0 800

1:20,000 @ A4

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Site Boundary - 372 Gleenbrook Beach Road
- **Significant Ecological Areas Overlay**
- Terrestrial
- Marine

GLENBROOK SWWWTP ECOLOGY

Ecology Context

Date: 29 August 2023 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: Ian.Boothroyd@boffamiskell.co.nz | Drawn: HCo | Checked: IBo

4.0 Approach

4.1 Data Compilation and Analysis

Information on the presence, characteristics and values of significance and other ecological features in and around the Site has been compiled through review of databases and existing literature, and field surveys to ground-truth and confirm preliminary desktop analyses. Field visits were undertaken on 2 and 13 March 2023.

This report describes identified ecological features and their values, assess the potential impacts and effects of the proposed development on these features, and recommends measures to manage and reduce adverse ecological effects.

4.2 Naming conventions

In our assessment of effects, where flora or fauna are listed in a table, we have included the scientific (latin) and Māori name in the table, and only the common name is included in the body of the text.

4.3 Wetland Delineation

4.3.1 National Environmental Standards and Policy

The Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F) regulate activities in, and within a 100 m setback of, natural inland wetlands. Regulations apply where the activity is likely to result in the complete or partial drainage of all or part of a natural inland wetland, as well as all vegetation clearance and earthworks within 10 m of a natural inland wetland. The National Policy Statement for Freshwater Management 2020 (NPS-FM) sets out the policy framework for the NES-F and includes the definition of a natural inland wetland.

4.3.2 Wetland Definitions

The Resource Management Act 1991 (RMA) definition of a wetland "*includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions".*

The NPS-FM states that a "**natural inland wetland**" is a wetland as defined in the RMA, unless it meets the following exclusions:

a) in the coastal marine area; or

b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or

c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or

d) a geothermal wetland; or

e) a wetland that:

i. is within an area of pasture used for grazing; and

ii. has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless

iii. the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply

Exclusion e ii) is referred to as the “pasture exclusion”.

4.3.3 Regulations in the NES-F

The NES-F regulate activities within and within a 100 m setback of a natural inland wetland. The regulations relevant to this project include:

Regulation 52 (Non-complying activities)

(1) Earthworks outside, but within a 100 m setback from, a natural inland wetland is a non-complying activity if it—

a. results, or is likely to result, in the complete or partial drainage of all or part of a natural wetland; and

b. does not have another status under any of regulations 38 to 51.

(2) The taking, use, damming, or diversion of water outside, but within a 100m setback from, a natural inland wetland is a non-complying activity if it—

a. results, or is likely to result, in the complete or partial drainage of all or part of a natural inland wetland; and

b. does not have another status under any of regulations 38 to 51.

Regulation 53 (Prohibited activities)

(1) Earthworks within a natural inland wetland is a prohibited activity if it—

a. results, or is likely to result, in the complete or partial drainage of all or part of a natural inland wetland; and

b. does not have another status under any of regulations 38 to 51.

(2) The taking, use, damming, or diversion of water within a natural inland wetland is a prohibited activity if it—

a. results, or is likely to result, in the complete or partial drainage of all or part of a natural wetland; and

b. does not have another status under any of regulations 38 to 51.

Regulation 54 (Other Non-complying activities)

The following activities are non-complying activities if they do not have another status under this subpart:

a. vegetation clearance within, or within a 10 m setback from, a natural inland wetland:

b. earthworks within, or within a 10 m setback from, a natural inland wetland:

c. the taking, use, damming, or diversion of water within, or within a 100 m setback from, a natural inland wetland if—

   i. there is a hydrological connection between the taking, use, damming, or diversion and the wetland; and

   ii. the taking, use, damming, or diversion will change, or is likely to change, the water level range or hydrological function of the wetland:

d. the discharge of water into water within, or within a 100m setback from, a natural inland wetland if —

   i. there is a hydrological connection between the discharge and the wetland; and

   ii. the discharge will enter the wetland; and

   iii. the discharge will change, or is likely to change, the water level range or hydrological function of the wetland.

4.3.4 Specified infrastructure

The NPS-FM provides several exceptions to the general position under the NPS-FM that the loss of extent of natural inland wetlands is to be avoided and their values are to be protected and their restoration promoted. One exception is where the loss of extent of natural inland wetlands and their values arises from '*the maintenance or operation of specified infrastructure, or other infrastructure (as defined in the Resource Management (National Environmental Standards for Freshwater) Regulations 2020*': clause 3.22(1)(a)(vi).)

The exception goes on to require, in clause 3.22(1)(b), that the regional council must be satisfied that:

(i) the activity is necessary for the purpose of the construction or upgrade of specified infrastructure; and

(ii) the specified infrastructure will provide significant national or regional benefits; and

(iii) there is a functional need for the specified infrastructure in that location; and

(iv) the effects of the activity are managed through applying the effects management hierarchy

4.3.5 Wetland indicator status (hydrophyte categories)

The hydrophyte[1] categories (wetland indicator status ratings: Clarkson (2013) and subsequent updates) are:

- Obligate (OBL): occurs almost always in wetlands (estimated probability >99% in wetlands)
- Facultative Wetland (FACW): occurs usually in wetlands (67–99%)
- Facultative (FAC): equally likely to occur in wetlands or non-wetlands (34–66%)
- Facultative Upland (FACU): occurs occasionally in wetlands (1–33%)
- Upland (UPL): rarely occurs in wetlands (<1%), almost always in 'uplands' (non-wetlands).

[1] Hydrophytes (hydrophytic vegetation) is defined as plant species capable of growing in soils that are often or constantly saturated with water during the growing season.

In applying these definitions, we note that natural inland wetlands are not restricted to indigenous ecosystems or biota, and no reference is made to the wetland feature's significance, quality, or condition.

4.3.6 Wetland identification and delineation

Potential wetland features on the site were identified using contours and aerial photography. Site investigations were then carried out on 13 March 2023 in accordance with the wetland delineation protocols (Ministry for the Environment (MfE), 2021 and 2020b). The assessment was undertaken within a period of high rainfall conditions in the Auckland region.

For determining the presence and extent of natural inland wetlands, the wetland delineation method followed the protocols (MfE, 2020) incorporated within the NPS-FM (New Zealand Government, 2020). This protocol follows a consecutive, hierarchical sequence of tests, each requiring an increasing level of detail shown by the wetland delineation flow chart from the MfE (Figure 3). This method relies on vegetation plot sampling and the hydrophytic vegetation determination tool outlined by Clarkson (2013), as well as an assessment of the presence of hydric soils and wetland hydrology (MfE, 2020; MfE, 2021).

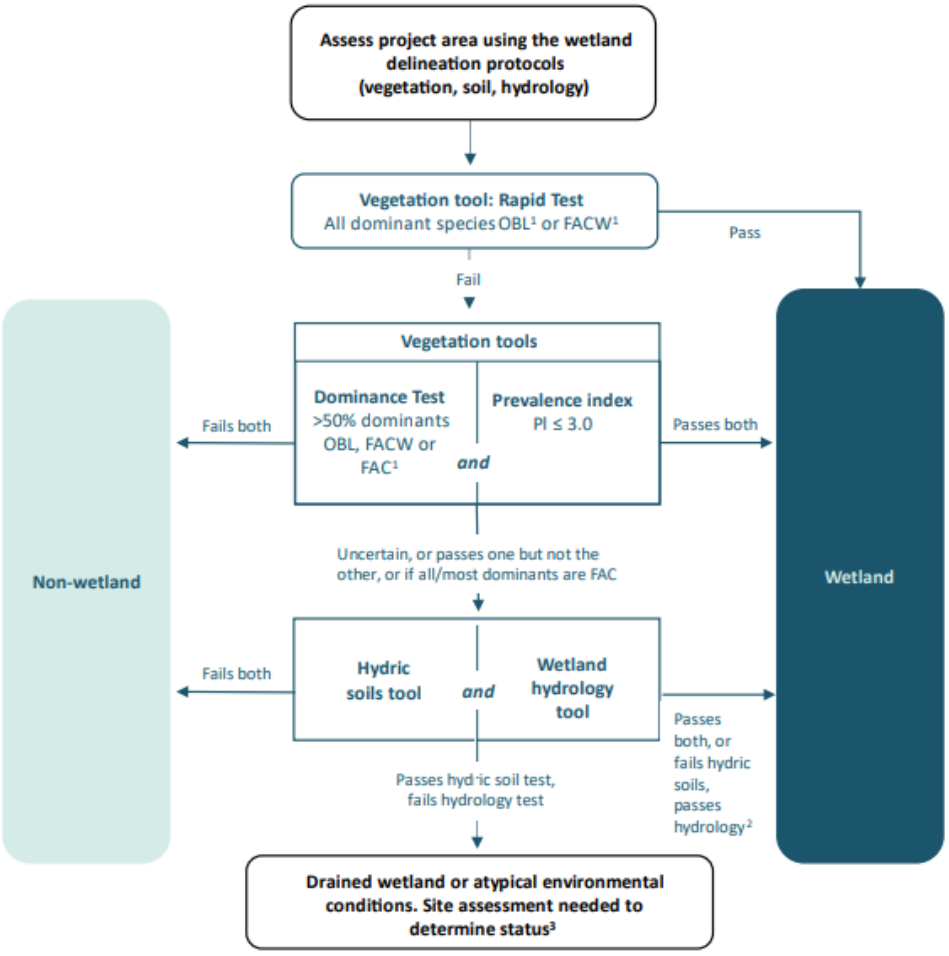
In summary, these tests comprise:

- Rapid test: if all dominant species have a wetland indicator status of OBL or FACW, the feature is a wetland.
- Dominance test: Species recorded in the plot are ranked in order of abundance. If >50% of the dominant species (i.e., which together make up more than half the vegetation cover) are OBL, FACW or FAC (provided all/ most dominant species are not FAC).
- If both the Rapid test and the Dominance test failed to identify the area as a wetland or are inconclusive, soils and hydrological characteristics are evaluated. If hydric soils are present or the site has saturated soils/ a water table near the soil surface, the 'Prevalence Index' test is applied.
- Prevalence Index (PI) test: a plot-based algorithm derived from the species composition and cover-abundance of plants is calculated. The vegetation is considered hydrophobic (wetland) if PI ≤ 3.0.

To meet the standard for wetland hydrology, an area must meet the following (taken from Ministry for the Environment, 2021):

- Inundated for at least seven consecutive days during the growing season in most years (50 per cent probability of recurrence); or
- Saturated at or near the surface for at least 14 consecutive days during the growing season in most years (50 per cent probability of recurrence, for example, five years in 10). Soils may be considered saturated if the water table is within:
    - 15 centimeters of the surface for sands
    - 30 centimeters of the surface for all other soils

The final mapping of the wetland then used the plot information, contours, and vegetation types to delineate the wetland.



Footnotes:
[1] Wetland indicator status abbreviations: FAC = facultative, FACW = facultative wetland, OBL = obligate wetland.
[2] For example, recent wetland.
[3] The US procedures for atypical or problematic situations are recommended.

Figure 3: Key steps in hydrophytic vegetation determination (from NPS-FM Wetland Delineation protocols)

4.4 Freshwater ecology

Two watercourses were identified on site (Watercourse 1 and 2 – refer section 4.3 below) These features were identified as inland wetland features (see above), while no specific freshwater surveys were undertaken.

5.0 Ecological Values

5.1 Terrestrial ecological values

5.1.1 Terrestrial vegetation

Vegetation within the site and surrounds is consistent with its rural zoning and land-use (i.e., pasture, crops, hedgerows and shelterbelts). Indigenous terrestrial vegetation is very limited with the most significant feature being the salt marsh habitat discussed below. The remaining land is largely cultivated soils largely prepared for root crops such as potatoes (Figure 4).

Figure 4: Recently sprayed and cultivated fields with limited vegetation at proposed southwest wastewater treatment plant (in blue) at 372 Glenbrook Beach Road.

5.1.2 Freshwater wetland and salt marsh habitat

Freshwater wetlands

Patches of degraded, exotic-dominated wetland vegetation are interspersed through flow paths and around the margins of irrigation ponds (as detailed in Section 4.2). No remnant indigenous wetland vegetation is present in any of these features, and vegetation communities are composed of fast-growing exotic herbs, rushes and grasses (barnyard grass, (*Echinochloa crus-galli*; willow weed, *Persicaria maculosa; Juncus* species; *Portulaca oleracea,* etc) that typically colonise disturbed sites.

Salt marsh

There are extensive patches of degraded and recovering sea rush (*Juncus kraussii*) dominated salt marsh habitat. The transition into salt marsh coincides with the appearance of estuarine conditions seen at the seaward side of the artificial pond and Watercourse 2 (Figures 5 and 6). Salt marsh habitat appears to extend above the mean high-water spring (MHWS) level. This is likely resulted from historic drainage attempts to convert these areas into arable land. The drainage channels have allowed salt water to penetrate further inland during high tides, resulting in range expansion of salt-tolerant plants.

The vegetation of the outer margin of the salt marsh consists of a combination of exotic grasses e.g., carrot weed (*Daucus carota*) and paspalum (*Paspalum dilatatum*) and a variety of rushes (sharp fruited rush and sea rush) and native sedges (*Machaerina rubiginosa, M. juncea*). All salt marsh habitats on Site are currently fenced and left to naturally regenerate. Patches of restoration planting undertaken by the former landowner are present around the upper margins of the salt marsh.

While some of the salt marsh areas are very modified and degraded through prior agricultural landuse, we have attributed high ecological values to this habitat due to evidence that it will ultimately revert to high quality indigenous vegetation in the long term with appropriate management, and for its likely value for coastal birds which are known to inhabit the fringes of the Manukau Harbour (see below).

Figure 5: Saltwater inundation observed with the change in vegetation to sea rush/ salt marsh along the eastern margins of the proposed site.

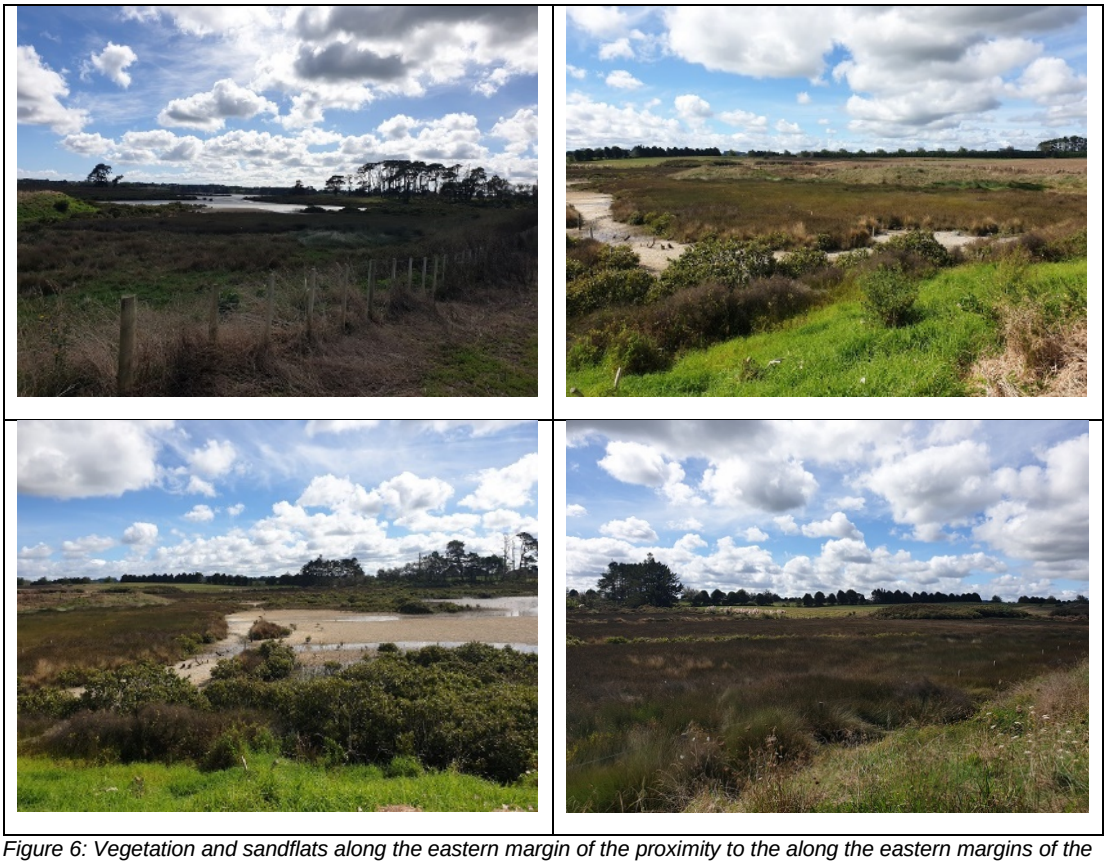


Figure 6: Vegetation and sandflats along the eastern margin of the proximity to the along the eastern margins of the proposed site.

5.1.3 Herpetofauna

A literature review and anecdotal records of indigenous herpetofauna within the Manukau Ecological District indicated that six native species of skink occur within the district (Table 1).

Sightings of other lizards and frogs have occurred in habitats including dense native forest and shrublands within the ecological district. These habitats are absent from the proposed WWTP site.

Invasive plague skinks may be present on site. Plague skinks are classed as an “unwanted organism” (Biosecurity Act 1993). Otherwise, habitat quality for indigenous lizards within the Site is very poor, due to the lack of remnant indigenous vegetation, and horticultural practices (cultivation, irrigation, etc) that would periodically damage and disturb potential refuges for lizards.

Table 1. Herpetofauna recorded within 20 km of the proposed site at 372 Glenbrook Beach Road .

Common Name	Scientific Name	Conservation Status (DOC 2021)	Nearest Record within 20 km
Forest gecko	*Mokopirirakau granulatus*	At Risk - Declining	Huia, 20 km.
Elegant gecko	*Naultinus elegans*	At Risk - Declining	Awhitu, 12 km.
Pacific gecko	*Dactylocnemis pacificus*	Not Threatened	Orua Bay, 14 km.
Copper skink	*Oligosoma aeneum*	At Risk - Declining	Martyn Wright Road, 8 km.
Ornate skink	*Oligosoma ornatum*	At Risk - Declining	Park Bright Reserve, 18 km.
Moko skink	*Oligosoma moco*	At Risk - Relict	Park Bright Reserve, 18 km.

5.1.4 Avifauna

A desktop assessment of potential bird species that are likely to occur within and adjacent to the site was undertaken using records from New Zealand Bird Atlas. Bird observations were compiled from the 10 x 10 km grid square the site sits within (AF67) in the Atlas “effort map”. A list of records is found within Appendix 2.

Fifty-nine species were recorded within the Bird Atlas, of which 37 are indigenous. Of these, three were classified as Threatened, and six At Risk – Declining. A further six species have a classification of At Risk either Relict, Naturally Uncommon or Recovering, while 20 species have a classification of Not Threatened.

Of the Threatened or At Risk species, those most likely to be present within or around the site are shags, mātuku, reef heron, dabchick, oystercatcher, bar-tailed godwit, royal spoonbill, red-billed gull and black-billed gull. Further important wader species are likely to use the surround estuarine habitats, such as wrybill (Threatened - Nationally Increasing), New Zealand dotterel (Threatened – Nationally Increasing) banded dotterel (At Risk - Declining), curlew and whimbrel.

The Manukau Harbour is the single most important harbour for migratory wading bird species in New Zealand. Approximately 25% of the national population of wading birds use the harbour at any given time and about 60% of the wading bird population pass through it at some time in their life[2].

Many coastal birds utilise flat rural land surrounding the harbour for roosting between tidal feeding bouts, and flocking (e.g., prior to migration). A small number of species (dotterels in particular) will use areas of loose soil or gravel for nesting. However, the periodic cultivation, planting out and harvesting of crops within the Site is likely to render it less favourable for congregating coastal birds relative to pastoral grasslands present in the surrounding environs.

5.1.5 Bats

Long-tailed bats (*Chalinolobus tuberculatus;* Threatened – Nationally Critical) were recorded approximately 8 km of the site in 2015, in and around Mauku and Paerata. The Hunua ranges (35 km east of the site) provide a high value habitat for bats and an established long-tailed bat population is known to be present there.

[2] From: C.Garton, D.Lawrie, B.Turner and L.Templeton.60 YEARS OF MIGRATORY BIRD MANAGEMENT ON THE MANUKAU

Bats typically occur around areas of mature exotic and native vegetation for roosting purposes and linear landscape corridors for movement and navigation. While long-tailed bats can commute long distances to forage, the location of the proposed WWTP is predominantly market gardening with no mature trees on site or the immediate surrounding environs. Accordingly, we have assessed this environment as of very low-quality habitat for bats and as fly-through routes.

5.2 Natural Inland Wetland delineation

5.2.1 Overview

Wetland vegetation assessments were limited to areas which were left undisturbed, as the majority of the area had been recently sprayed and cultivated leaving little established vegetation to make our assessment. In addition, redistribution of topsoil associated with horticultural activity meant soil profiles were not helpful in determining whether wetland conditions occurred within prospective features. Aerial photographs and site contours were relied on in addition to site assessments in delineation of features.

5.2.2 Wetland Evaluation

5.2.2.1 Wetland delineation results

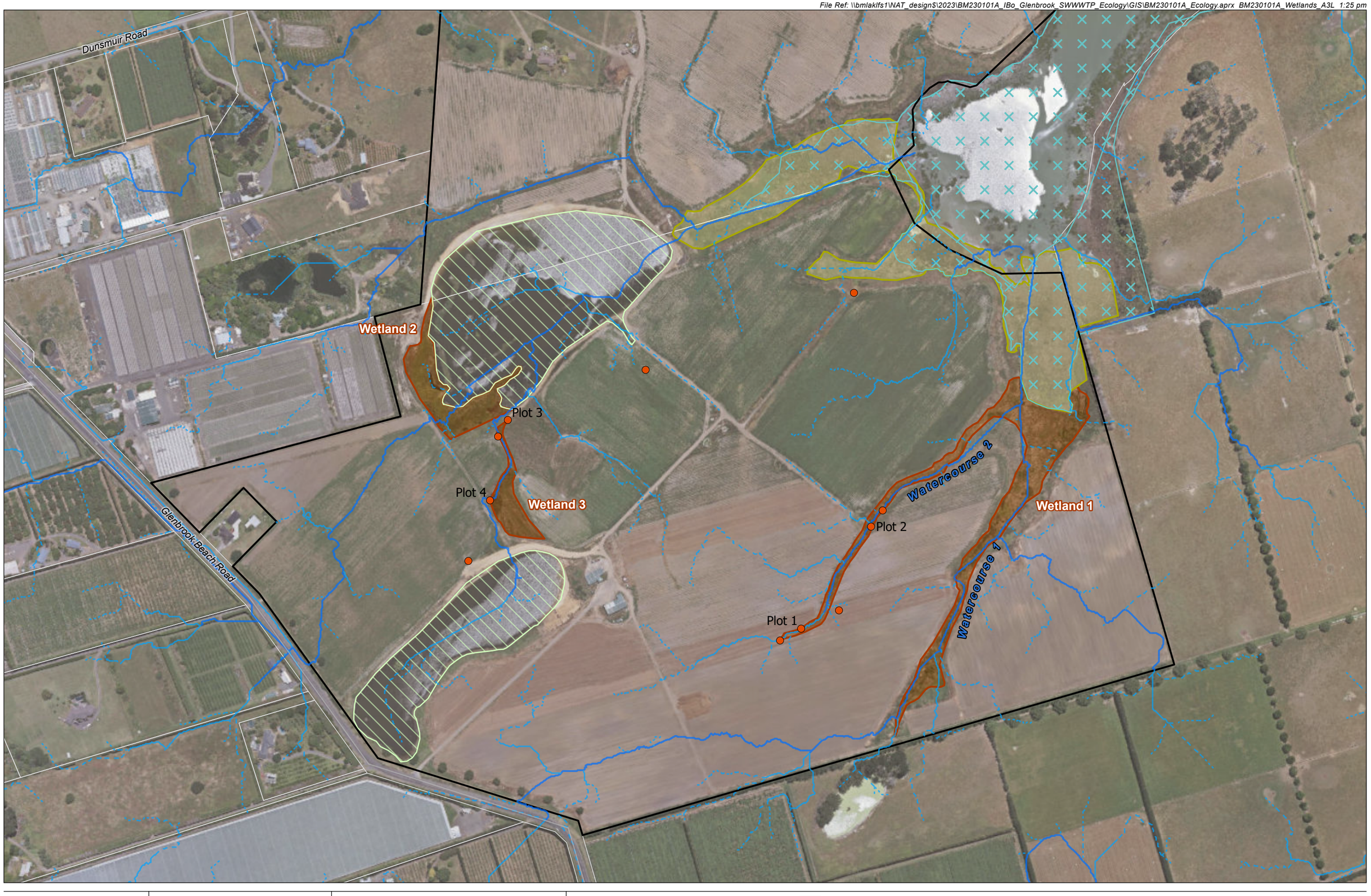
Eleven vegetation survey points were observed, and four delineations were undertaken during our site visit (Table 2). The location of the plots and resulting wetland extent are shown in Figure 7. A summary of wetland plot data is included in Appendix 1.

Three features with hydrophytic vegetation characteristics were identified within the project site, originating in flowpaths or bordering a constructed pond that is used for irrigation.

Table 2: Summary of vegetation plot delineation data

Plot	Rapid Test	Dominance Test	Prevalence Test	Exotic Pasture	Hydric Soil/ Hydrology	Dominant Species	NPS Wetland
1	No	100%	3.05	0%	Yes	Barnyard Grass (FAC)	Yes
2	Yes	100%	2.15	5%	Yes	Willow Weed (FACW)	Yes
3	Yes	100%	2.05	0%	Yes	Willow Weed (FACW)	Yes
4	Yes	100%	2.65	15%	Yes	Willow Weed (FACW)	Yes

[#]Meets the criteria for a natural inland wetland, i.e., fails the exclusion tests of the definition.



Boffa Miskell

www.boffamiskell.co.nz

0 100 m

1:4,000 @ A3

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, Auckland Council, Boffa Miskell

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Survey Points
- Marine Significant Ecological Area
- Manmade Ponds
- Salt Marsh
- Natural Inland Wetland (NPS-FM)
- Site
- Property Titles

Overland Flow Paths

- 2000m2 to 4000m2
- 4000m2 to 1ha
- 1ha to 3ha
- 3ha to 100ha

GLENBROOK SWWWTP ECOLOGY

Wetland Survey

Date: 29 August 2023 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: Ian.Boothroyd@boffamiskell.co.nz | Drawn: HCo | Checked: AFI

5.2.2.2 Wetland 1

Wetland 1 (Plot 1 and 2) was located along an ephemeral flowpath depression feeding into Watercourse 2 (Figure 7). It is our understanding that the headwater of the watercourse has novo-drainage piping underground.

Plot 1 was taken in the upper proportion of the overland flow path (OLFP) (no surface water) and was dominated by barnyard grass. Plot 1 met the RMA definition for a wetland; however, this plot had a borderline Prevalence Test score of 3.05, and its wetland status relies on the presence of 'wetland hydrology' (i.e., evidence of flooding, sediment deposits and sparse vegetation cover; drainage patterns and inundation visible on aerial imagery) (Table 2). The wetland did not meet the exclusions as set out in the NPS-FM and therefore qualifies as a natural inland wetland.

Water flows along a defined OLFP approximately 30 m above the fenced off section of Watercourse 1 (Figures 7 and 8). Plot 2 was taken where water at the surface was visible, and the vegetation changed from a predominance of barnyard grass to exotic willow weed (*Persicaria maculosa*). Plot 2 met the criteria for a RMA wetland using 'rapid' and 'dominance' tests and meets the NPS-FM definition of a natural inland wetland. Within the fenced section the riparian margins of Watercourse 2, willow weed continued to dominate, and Plot 2 is therefore still representative of the feature. Wetland 1 contains similar vegetation along the fenced off riparian margin of Watercourse 1.

Figure 8: Wetland 1, left: upper headwater of flow path vegetation dominated by barnyard grass; right: flowing water and willow weed of the fringes of watercourse 2.

5.2.2.3 Wetland 2

Wetland 2 (Plot 3, Figure 7) is located on the margin of a large, constructed pond that appears to historically to have been a large wetland. It appears that the outflow from the wetland was dammed, and the feature converted into a water storage pond between 2015 and 2020 (Figure 9). Plot 3 meets the NPS-FM criteria for a '*Natural Inland Wetland*' using 'rapid' and 'dominance' tests (Table 1). Willow weed and a variety of native and exotic rushes including sharp fruited rush (*Juncus acuminatus*), giant rush (*J. pallidus*), leafless rush (*J. effusus*) and sea rush (*J. kraussii*) dominate Wetland 2 (Figure 10).

Figure 9: Water storage pond. left: 2014 wetland feature, right: 2020 pond works

Figure 10: Wetland 2 dominated by willow weed and rushes along the pond riparian margins

5.2.2.4 Wetland 3

Wetland 3 (Plot 4, Figure 7) is located within a slight depression between two pond features. The dominant species was willow weed (Figure 11). This wetland feature meets the NPS-FM criteria for a '*Natural Inland Wetland*' using 'rapid' and 'dominance' tests (Table 2).

Figure 11: Wetland 3 within a depression dominated by willow weed

5.2.3 Wetland condition

The lower reaches of Wetland 1 and Wetland 2 are fenced to exclude stock have regenerated. Wetland 2 appears to have some limited enhancement planting, has no stock access, and is not sprayed/ ploughed.

Wetland 1 (upper proportion) and Wetland 3 are highly degraded due to frequent disturbance spraying and cultivation of the surrounding areas, and subsurface drainage which has largely redirected water away from these features.

5.3 Freshwater Ecological Values

5.3.1 Overview

No specific surveys were undertaken of the watercourses on the Site as the design of the WWTP was always to avoid the loss of watercourses. The freshwater features are either man made (the irrigation ponds) or of low quality (watercourses 1 and 2, Figure 7). We have drawn on the New Zealand Freshwater Fish Database (NZFFD) for records of fish within the Waiuku River (and Taihiki Tributary) and Manukau Harbour environs in general to inform the likelihood of fish presence.

5.3.2 Watercourses

Watercourse 1 and 2 within the Site were shallow open channels heavily laden with sediment, most likely derived from the surrounding cultivated land practices. Watercourse 2 had better marginal vegetation. Our field assessment occurred during a season of exceptionally heavy rain and it is possible that the watercourses may run dry during periods of low flows. We expect the watercourses to be of low value.

5.3.3 Irrigation ponds

The two deliberately constructed irrigation ponds provide water for the surrounding landuse. We understand that the northwestern pond is fed by a deep bore, and that both ponds can be substantially dewatered at times of high irrigation water demand. The northern and larger pond discharges via a drop structure to a downstream wetland before discharging to the Taihiki River estuary.

No specific surveys were undertaken of the ponds and at the time of writing and they are both man-made. The northern pond sits between two property boundaries and the smaller pond is located adjacent to the road.

5.3.4 Fish records

A search of the New Zealand Freshwater Fish Database (NZFFD) had records for 10 species of fish within the Waiuku River (and Taihiki Tributary) and Manukau Harbour (Table 3). Four of these fish were classified as At-Risk – Declining (longfin eel, inanga, koaro and redfin bully). The pest species Gambusia (mosquitofish), was also recorded. We would expect eels and inanga to be potentially present in Watercourse 1.

Table 3. Freshwater fish species in the Waiuku River and Manukau Harbour as recorded on the New Zealand Freshwater Fish Database.

Common Name	Scientific Name	Conservation Status
Longfin eel	*Anguilla dieffenbachii*	At Risk - Declining
Inanga	*Galaxias maculatus*	At Risk - Declining
Koaro	*Galaxias brevipinnis*	At Risk - Declining
Redfin Bully	*Gobiomorphus huttoni*	At Risk Declining
Banded Kokopu	*Galaxias fasciatus*	Not Threatened
Common Smelt	*Retropinna retropinna*	Not Threatened
Shortfin eel	*Anguilla australis*	Not Threatened
Yelloweye Mullet	*Aldrichetta forsteri*	Not Threatened
Gambusia	*Gambusia affinis*	Introduced and Naturalised
Grey Mullet	*Mugil cephalus*	Introduced and Naturalised

5.4 Marine and Estuarine Ecological Values

5.4.1 Manukau harbour

Marine ecology monitoring focuses on the characteristics of intertidal sandflats (those that are periodically covered and uncovered by the tides) and the composition of the invertebrate community living within them. Less diverse invertebrate communities are found in muddy versus sandy sediments, resulting in reduced ecological function, and an increase in sediment organic content and chlorophyll a (algae) concentration can indicate nutrient enrichment. There have been declining trends in sediment organic content at five of these sites and chlorophyll a concentration at four. Accordingly, Auckland Council conclude that neither sedimentation nor nutrient enrichment are likely to be affecting ecological health in the main harbour.

The Taihiki River is 14 km in length stretching North-East from Patumahoe to the Waiuku River and cohesively the Manukau Harbour. The intensification of agriculture in the area has resulted in large drainage of sediment into the river and tributary and has resulted in a reduction in the diversity of the macrofauna community (Land, Air, Water Aotearoa (LAWA2021).

5.4.2 Water and sediment quality

Water quality monitoring has recently (in 2019) been established at two sites in the Mauku/Taihiki River estuarine system (LAWA 2023)[3]. The purpose has been to monitor estuary health scientific indicators and includes heavy metals (zinc, lead, arsenic, copper and mercury). The LAWA site reports a decline in the amount of heavy metal contaminants and a small decline in the mud-silt content; 24.6% in 2019 and 23.1% in 2021 (LAWA, 2021). A similar result was recorded for a further site on the Waiuku River. Mud content of the sites varied from >60% (macrofauna degraded) to 10-30% (macrofauna reduced).

Auckland Council (2014) rated the nearby Waiuku Estuary water quality as “fair” condition, falling in the middle ground between high quality open coastal waters and inner estuary waters impacted by point source and diffuse source discharges. Water quality appears to be generally improving slowly over time at the estuary mouth (Clarks Beach long term monitoring site). Sediment quality was reported as generally good by Auckland Council (2019).

5.4.3 Salt marsh & mangroves

As outlined above, the site is notable for the two marine SEAs that encompass patches of salt marsh which extend into the property (SEA-M2-31 and SEA-M2-31w1). Both these areas are located along the coastal margin on the north-eastern boundary of the Site (Figure 2).

This SEA remains one of the least impacted of harbour habitats in the Manukau because of the lack of major inputs of sediment from the catchment and vegetated shoreline[4]. Salt marsh and mangroves provide nurseries for juvenile fish and provide important breeding and feeding areas for birds.

[3] https://www.lawa.org.nz/explore-data/auckland-region/estuaries/manukau-harbour/maukutaihiki-river-b/

[4] Schedule 4. Significant Ecological Areas – Marine Schedule. Auckland Unitary Plan.

6.0 Proposed Activities

6.1 Background

Information about the design and operation of the WWTP is set out in the Indicative Design and Operational Report, prepared by Stantec dated August 2023 contained as Appendix A to the Assessment of Environmental Effects supporting the Notice of Requirement (NoR).

The site's size and shape provide at least 200 m of separation between the main parts of the WWTP itself and the adjacent properties. The existing planting around the watercourses and wetlands will be retained. The areas not required for the full WWTP are able to be used for farming or will be landscaped which will ensure that the current rural amenity offered by the site is retained. Construction will commence as soon as possible after the designation is in place and the required regional resource consents are obtained.

6.2 Indicative layout of the WWTP

The proposed treatment plant includes pre-treatment, secondary and tertiary treatment processes. Treated wastewater will be temporarily stored on-site before moving to storage located at an existing site at Clarks Beach. De-watered sludge will be removed from site for disposal or further processing. The treatment plant will be constructed to meet projected population levels.. An indicative layout of the WWTP is provided in Figure 12.

In summary, the proposed equipment, buildings and storage include:

- a control building and workshop
- two foul water and sludge liquor pump stations
- two inlet pump stations
- two inlets
- four activated sludge reactors
- four generators
- three sludge thickening and storage ponds
- two emergency storage ponds
- two stormwater treatment ponds
- internal roading and lighting
- partial tide storage and pump station

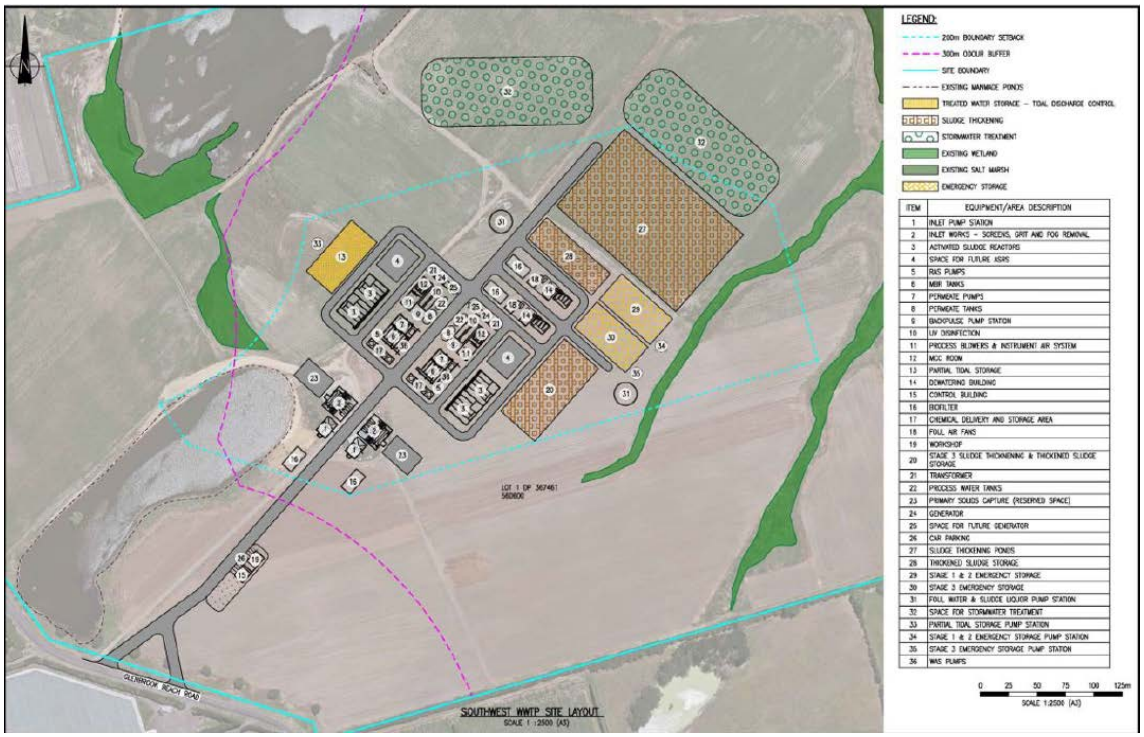


Figure 12. Indicative layout of the proposed SWWWTP.

7.0 Effects of Construction of the Proposed WWTP NOR on Ecological Values

7.1 Introduction

The assessment of the potential effects on ecological values of the proposed NOR has been informed by the indicative layout of the proposed WWTP as set out above. We note that this layout may not be the final configuration of the plant and that the layout will be detailed in the application for earthworks and relevant resource consents, and through the Outline Plan of Works. Nevertheless, the indicative layout is helpful in ascertaining the potential effects arising from the NOR and detailing the effects management which can be applied to minimise impacts on the ecological values. The indicative layout of the WWTP indicates that it will be centrally located within the site and will avoid most ecological features of value.

7.2 Effects on terrestrial ecological values

7.2.1 Vegetation

The location for the proposed WWTP has a current landuse of intensive cultivation for market gardening. Terrestrial vegetation values are generally very low, with minimal indigenous native vegetation cover. Salt marsh habitats around the coastal periphery of the site are of high value.

We note that the salt marsh habitats on Site are currently fenced and have been left to naturally regenerate (with some patchy restoration planting undertaken around some of the wetland margins around the interface between salt and freshwater conditions). While recognising that subsequent processes will clarify the details of construction activities, we recommend that any construction or operations within or within 10 m of the salt marsh habitats are avoided. We make comment on the management of sediment below.

7.2.2 Fauna

It is probable that some coastal birds use the site intermittently for roosting, and that some disturbance (e.g., noise) to birds visiting the site will occur during the construction period. This may discourage them from using at least parts of the Site during the construction period. Also, although some bird species such as dotterel can favour open and freshly disturbed soils for nesting (as has been known to occur at construction sites in the Auckland region), there is no evidence that this has occurred during the open-soil agricultural landuse currently at the site. Accordingly, we do not expect this nesting activity to occur. We note that although to be confirmed, the residual land of the Site (i.e., outside of the WWTP footprint, is likely to remain as a similar landuse as present and will continue to provide the same habitat availability.

7.3 Effects on Wetlands

Three natural inland wetlands were identified on the site, each associated with either a watercourse (wetland 3) or flowpaths associated with irrigation pond (wetlands 1 and 2). As outlined earlier in our assessment, the NESF sets out clear regulations regarding activities near natural inland wetlands. The indicative layout of the proposed WWTP demonstrates that all three wetlands can be avoided within the NOR boundaries. The indicative layout of the WWTP occurs within 100 m of wetland 3, but a 10 m buffer is provided.

We understand that the construction and operation of the WWTP will be formed to avoid drainage of the wetlands and to sustain a neutral ground and surface water hydrological regime thus avoiding impacts to the wetlands and downstream (including coastal) environments.

7.4 Effects on Freshwater ecological values

7.4.1 Watercourses

With the exception of the wetlands discussed above, freshwater features on the site are limited to two watercourse and two man-made irrigation ponds. The association of natural inland wetlands with the watercourses provides regulatory requirement to avoid these features although we note the exception given the status of the WWTP as regionally significant infrastructure.

The indicative layout of the WWTP shows that the watercourses and the wetlands can be avoided. Nevertheless, as outlined in the NPS-FM, the application of the effects management hierarchy requires that if effects on the wetlands are unavoidable then the remaining provisions of the hierarchy come into force.

We understand and recommend that the watercourses be avoided and thus no loss of extent of watercourses or loss of freshwater ecological values will occur. As indicated above, the

indicative layout strongly suggests that the WWTP can be located to avoid the freshwater features of the site.

7.4.2 Irrigation ponds

The northern pond is located between two property boundaries and the southern pond is located adjacent to the Glenbrook Beach Road. Watercare is still investigating the structure of the pond and a decision is yet to be made on the retention of the ponds. In the case the smaller pond is removed, appropriate consents will be sought and the overland flow path will be managed.

7.5 Marine and Coastal Area

We understand that any construction earthworks are expected to occur at 100 m or more from the coastal marine area. Accordingly, there will be no earthworks within the coastal marine area as a result of the construction of the proposed WWTP in the NOR. The construction of the proposed WWTP has the potential to mobilise sediments into the marine environment. We note that the mud content of the Taihiki River (and Waiuku River) estuarine systems is moderate to high thus intrusions of excessive sediment should be avoided. We have set out the recommendations for sediment management below, and when implemented and maintained will minimise any effects of sediments on the marine environment.

8.0 Effects of Operation of the Proposed WWTP NOR on Ecological Values

As outlined above, it is anticipated that the WWTP will be constructed in stages. Also as noted above, the site's size and shape provide at least 200m of separation between the main parts of the WWTP itself from the property boundary. The existing planting around the watercourses,and wetlands will be retained.

Following construction, the likely effects of the operating of the SWWWTP on ecological values are likely to occur from noise disturbance and stormwater discharge. Details of the design and operation of the proposed WWTP will be completed at the time of applications for regional resource consents but we expect that noise and stormwater will be managed to regional standards via stormwater ponds. Accordingly, we expect that the effects of the operations of the proposed SW WWTP on ecological values at the site will be negligible.

9.0 Conclusion

Watercare has identified the site at 372 Glenbrook Beach Road as the preferred location for the WWTP and is seeking to designate the full site. Designation of the site will enable construction of the WWTP which will be delivered in stages. The current dominant landuse of the site is

market gardening with highly cultivated and exposed soils. Two artificial irrigation ponds occur at the Site.

The ecological features of the Site comprise:

- Two watercourses.
- Three natural wetlands which meet the definition of a natural inland wetland under the NPS-FM.
- Two artificial irrigation ponds.
- Salt marsh.

The wetland features are low quality and in poor condition. This reflects the surrounding intensive and cultivated landscape.

The higher value salt marsh and estuarine habitats will be avoided and no construction activity will occur within them. Erosion and sediment management will ensure that sediment intrusions to these downstream habitats will be minimised.

We emphasise that the site's size and shape provide at least 200 m of separation between the main parts of the WWTP itself and the property boundary and 300 m from the adjacent properties; and that the existing wetlands and watercourses including the planting around the watercourses and wetlands will be retained. The areas not required for the full WWTP are able to be used in the future for continued farming or landscaping.

Accordingly, we expect the designation of the Site for the construction and operation of the indicative design of the proposed SW WWTP, set within the Site's size and shape, will result in negligible adverse effects on ecological values, as effects on ecological features can be avoided or managed.

10.0 References

Auckland Council 2018. Erosion and sediment control guide for land disturbing activities in the Auckland region. Auckland Council Guideline Document GD2016/005. Incorporating amendment 1. Prepared by Beca Ltd and Southern Skies Environmental for Auckland Council.

Auckland Council 2021. Inaugural Manukau Harbour environment report to guide future investment for long term change. Our Auckland. https://ourauckland.aucklandcouncil.govt.nz/news/2021/06/inaugural-manukau-harbour-environment-report-to-guide-future-investment-for-long-term-change/

Auckland Council 2019. River ecology state and trends in Tāmaki Makaurau / Auckland 2010-2019. State of the environment reporting (knowledgeauckland.org.nz)l

Auckland Council 2020. The health of Tāmaki Makaurau / Auckland's natural environment in 2020 – a synthesis of Auckland Council's State of Environment reporting. Report prepared by Auckland Council. https://www.knowledgeauckland.org.nz/media/2009/the-health-of-t%C4%81maki-makaurau-auckland-s-natural-environment-in-2020.pdf

DOC 1997. Ecological Districts of New Zealand. Report prepared by Department of Conservation. https://www.doc.govt.nz/Documents/science-and-technical/Ecoregions1.pdf

DOC 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35. Prepared by Department of Conservation.

C.Garton (Watercare Services Ltd), D.Lawrie (Birds NZ), B.Turner (Manukau Harbour Restoration Society), and L.Templeton (Watercare Services Ltd).

New Zealand Birds Online 2022. The digital encyclopaedia of New Zealand birds. Department of Conservation.

The Cornell Lab of Ornithology 2022. New Zealand Bird Atlas.

LAWA 2021. Manukau Harbour monitored estuary sites. Auckland Council. https://www.lawa.org.nz/explore-data/auckland-region/estuaries/manukau-harbour/maukutaihiki-river-b/

Appendix 1: Wetland Plot Data

Plot Number	1								
6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
echcru	75	Y	*Echinochloa crus-galli*	*Barnyard Grass*		*FAC*		Yes	3	225.0
permcl	10		*Persicaria maculosa*	*Willow Weed*		*FAC*			2	20.0
hyprad	5		*Hypochaeris radicata*	*Catsear*		*FACU*			4	20.0
porole	10		*Portulaca oleracea*	*Purslane*		*FACU*			4	40.0

Clarkson 2013			
Wetland vegetation determination			
1. Rapid test score:	0.00	Wetland if all dominant species across all strata rated OBL and/or FACW (pass score = 1)	*Fail*
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Pass*
2b. FAC dominants	1.00	Are all / most dominants FAC?	*Fail*
3. Indicators of hydric soil or wetland hydrology present?	P	Pass (Yes) / Fail (No) / Not recorded	*Pass*
4. Prevalence Index Result:	3.05	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Not Wetland, But Score is Borderline*
5. Pasture Species (%)	0	Actively grazed? Yes or No — N	*FALSE*

MFE 2021			
Wetland determination			
1. Rapid test score:	0.00	Wetland if all dominant species across all strata rated OBL and/or FACW (pass score = 1)	*Fail*
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Pass*
2b. Prevalence Index Score:	3.05	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Fail*
3. Dominance + Prevalence			*Next*
4. Indicators of hydric soil or wetland hydrology present?	B	Neither / Hydric Soil / Wetland Hydrology / Both	*Pass*

Plot Number	2								
6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
permcl	65	Y	*Persicaria maculosa*	*Willow Weed*		*FACW*	Yes	Yes	2	130.0
echcru	15		*Echinochloa crus-galli*	*Barnyard Grass*		*FAC*			3	45.0
junbul	5		*Juncus bulbosus*	*Bulbous Rush*		*OBL*			1	5.0
glymax	5		*Glyceria maxima*	*Floating Sweetgrass*		*OBL*			1	5.0
pasdil	5		*Paspalum dilatatum*	*Paspalum*		*FACU*			4	20.0
juneff	5		*Juncus effusus*	*Leafless Rush*		*FACW*			2	10.0

Clarkson 2013			
Wetland vegetation determination			
1. Rapid test score:	1.00	Wetland if all dominant species across all strata rated OBL and/or FACW (pass score = 1)	*Pass*
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Pass*
2b. FAC dominants	0.00	Are all / most dominants FAC?	*Pass*
3. Indicators of hydric soil or wetland hydrology present?	P	Pass (Yes) / Fail (No) / Not recorded	*Pass*
4. Prevalence Index Result:	2.15	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Wetland*
5. Pasture Species (%)	5	Actively grazed? Yes or No — N	*FALSE*

MFE 2021			
Wetland determination			
1. Rapid test score:	1.00	Wetland if all dominant species across all strata rated OBL and/or FACW (pass score = 1)	*Pass*
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Pass*
2b. Prevalence Index Score:	2.15	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Pass*
3. Dominance + Prevalence			*Pass*
4. Indicators of hydric soil or wetland hydrology present?	B	Neither / Hydric Soil / Wetland Hydrology / Both	*Pass*

Plot Number	3									
6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
permcl	45	Y	*Persicaria maculosa*	*Willow Weed*		*FACW*	Yes	Yes	2	90.0
ranrep	15		*Ranunculus repens*	*Creeping Buttercup*		*FAC*			3	45.0
junacu	10		*Juncus acuminatus*	*Sharp-Fruited Rush*		*OBL*			1	10.0
junpal	10		*Juncus pallidus*	*Giant Rush*	*Not Threatened*	*FACW*			2	20.0
juneff	10		*Juncus effusus*	*Leafless Rush*		*FACW*			2	20.0
junkra	10		*Juncus kraussii*			*FACW*			2	20.0

Clarkson 2013				
Wetland vegetation determination				
1. Rapid test score:	1.00	Wetland if all dominant species across all strata rated OBL and/or FACW (pass score = 1)		***Pass***
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.		***Pass***
2b. FAC dominants	0.00	Are all / most dominants FAC?		***Pass***
3. Indicators of hydric soil or wetland hydrology present?	P	Pass (Yes) / Fail (No) / Not recorded		***Pass***
4. Prevalence Index Result:	2.05	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.		***Wetland***
5. Pasture Species (%)	0	Actively grazed? Yes or No	N	***FALSE***

MFE 2021			
Wetland determination			
1. Rapid test score:	1.00	Wetland if all dominant species across all strata rated OBL and/or FACW (pass score = 1)	***Pass***
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Pass*
2b. Prevalence Index Score:	2.05	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Pass*
3. Dominance + Prevalence			***Pass***
4. Indicators of hydric soil or wetland hydrology present?	N	Neither / Hydric Soil / Wetland Hydrology / Both	***Fail***

Plot Number	4									
6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
permcl	40	Y	*Persicaria maculosa*	*Willow Weed*		*FACW*	Yes	Yes	2	80.0
junkra	20	Y	*Juncus kraussii*			*FACW*	Yes	Yes	2	40.0
pasdil	15		*Paspalum dilatatum*	*Paspalum*		*FACU*			4	60.0
ranrep	15		*Ranunculus repens*	*Creeping Buttercup*		*FAC*			3	45.0
echcru	10		*Echinochloa crus-galli*	*Barnyard Grass*		*FAC*			4	40.0

Clarkson 2013				
Wetland vegetation determination				
1. Rapid test score:	1.00	Wetland if all dominant species across all strata rated OBL and/or FACW (pass score = 1)		***Pass***
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.		***Pass***
2b. FAC dominants	0.00	Are all / most dominants FAC?		***Pass***
3. Indicators of hydric soil or wetland hydrology present?	P	Pass (Yes) / Fail (No) / Not recorded		***Pass***
4. Prevalence Index Result:	2.65	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.		***Wetland, But Score is Borderline***
5. Pasture Species (%)	15	Actively grazed? Yes or No	N	***FALSE***

MFE 2021			
Wetland determination			
1. Rapid test score:	1.00	Wetland if all dominant species across all strata rated OBL and/or FACW (pass score = 1)	***Pass***
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Pass*
2b. Prevalence Index Score:	2.65	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Pass*
3. Dominance + Prevalence			***Pass***
4. Indicators of hydric soil or wetland hydrology present?	B	Neither / Hydric Soil / Wetland Hydrology / Both	***Pass***

Appendix 2: Avifauna records

Avifauna in Manukau record frequents from the New Zealand Bird Atlas (2022) and The Ornithological Society of New Zealand (2004).

Common Name	Māori name	Scientific name	Conservation Status ()
reef heron	Matuku-moana	*Egretta sacra sacra*	Threatened
caspian tern	Taranui	*Hydroprogne caspia*	Threatened - Nationally Vulnerable
New Zealand dabchick	*Waiwea*	*Poliocephalus rufopectus*	Threatened - Nationally Increasing
southern pied oystercatcher	Tōrea	*Haematopus finschi*	At Risk - Declining
red-billed gull	Tarāpunga	*Larus noveahollandiae scopulinus*	At Risk - Declining
New Zealand pipit	Pīhoihoi	*Anthus n. novaeseelandiae*	At Risk - Declining
white fronted tern	Tara	*Sterna s. striata*	At Risk - Declining
black-billed gull	Tarāpuka	*Larus bulleri*	At Risk - Declining
bar-tailed godwit	Kūaka	*Limosa lapponica baueri*	At Risk - Declining
black cormorant	Kawau	*Phalocorax carbo novaeseelandiae*	At Risk - Relict
little pied shag	Kawaupaka	*Phalacrocorax melanileucos brevirostris*	At Risk - Relict
royal spoonbill	Kōtuku ngutupapa	*Platalea regia*	At Risk - Naturally uncommon
pied shag	Kāruhiruhi	*Phalacrocorax v. varius*	At Risk - Recovering
variable oystercatcher	Tōreo-pango	*Haematopus unicolor*	At Risk - Recovering
little black shag	Kawau tūī	*Phalacrocorax sulcirostris*	At Risk - Recovering
pied stilt	Poaka	*Himantopus h. leucocephalus*	Not Threatened
Australasian gannet	Tākapu	*Morus serrator*	Not Threatened
white-faced heron	Matuku moana	*Egretta novaehollandiae*	Not Threatened
sacred kingfisher	Kōtare	*Todiramphus sanctus vagans*	Not Threatened
welcome swallow	Warou	*Hirundo h. neoxena*	Not Threatened
swamp harrier	Kāhu	*Cirrus approximans*	Not threatened

southern black backed gull	Karoro	*Larus d. dominicanus*	Not Threatened
spur-winged plover		*Vanellus miles novaehollandiae*	Not Threatened
silvereye	Tauhou	*Zosterops lateralis lateralis*	Not Threatened
North island fantail	Piwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened
purple swamphen	Pūkeko	*Porphyrio m. melanotus*	Not Threatened
black swan	Kakīānau	*Cygnus atratus*	Not threatened
paradise shelduck	Pūtangitangi	*Tadorna variegata*	Not Threatened
Australasian shoveler	Kuruwhengu	*Anas rhychotis*	Not Threatened
mallard x grey duck hybrid		*Anas superciliosa x platyrhynchos*	Not Threatened
morepork	Ruru	*Ninox n. novaeseelandiae*	Not Threatened
grey teal	Tētē	*Anas gracilis*	Not Threatened
New Zealand pidgeon	Kererū	*Hemiphaga novaeseelandiae*	Not Threatened
pied stilt x black stilt hybrid		*Himantopus h. leucocephalus x novaeseelandiae*	Not Threatened
grey warbler	Riroriro	*Gerygone igata*	Not Threatened
bronze-shinning cuckoo	Pīpīwharauroa	*Chrysococcyx l. lucidus*	Not threatened
Parson's bird	Tūī	*Prosthemadera n. novaeseelandiae*	Not Threatened
cattle egret		*Ardea ibis coromanda*	Migrant
Eurasian skylark	Kairaka	*Alauda arvensis*	Introduced
common myna		*Acridotheres tristis*	Introduced
Starling	Tāringi	*Sturnus vulgaris*	Introduced
eastern rosella	Kākā uni whero	*Platycercus eximius*	Introduced
Australasian magpie	Makipai	*Gymnorhina tibicen*	Introduced
common chaffinch	Pahirini	*Fringilla coelebs*	Introduced
common pheasant		*Fringilla coelebs*	Introduced
rock dove		*Columba livia*	Introduced
Eurasian golfinch	Kōurarini	*Carduelis chloris*	Introduced
spotted dove		*Streptopelia chinensis tigrina*	Introduced

European greenfinch		*Carduelis chloris*	Introduced
Canada goose	Kuihi	*Branta canadensis*	Introduced
Yellowhammer	Hurukōwhai	*Emberiza citrinella*	Introduced
collard dove		*Streptopelia risoria*	Introduced
greylag goose	Kuihi	*Anser anser*	Introduced
helmeted guineafowl		*Numida meleagris*	Introduced
red junglefowl		*Gallus gallus*	Introduced
wild turkey	Korukoru	*Meleagris gallopavo*	Introduced
mallard	Rakiraki	*Anas platyrhychos*	Introduced
song thrush	Piopio	*Turdus philomelos*	Introduced
blackbird	Manu pango	*Turdus merula*	Introduced
House sparrow	Tiu	*Passer domesticus*	Introduced

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Whangarei, Auckland, Hamilton, Tauranga, Wellington, Nelson, Christchurch, Dunedin, and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.