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# Mangawhai Golf Course Wetland Ecological Impact Assessment

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CONFIDENTIAL



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## Disclaimers and Limitations

This report (**'Report'**) has been prepared by WSP exclusively for Kaipara District Council (**'Client'**) in relation to [Mangawhai Golf Course Wetland Ecological Impact Assessment (**'Purpose'**) and in accordance with the Offer of service presented 31 March 2021. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

This report does not factor recent information that proposes the golf course receive stormwater flows from a new pipe from Wood Street business area. This information was not previously available at the time of assessment.

## Executive Summary

An ecological impact assessment has been prepared by WSP for the Kaipara District Council (KDC) for specific areas in support of resource consent applications to the Northland Regional Council for the reuse of treated wastewater for irrigation purposes from the Mangawhai Community Wastewater Treatment plant (MCWWTP) Mangawhai Heads, Northland.

The Kaipara District Councils capacity to discharge treated wastewater to land at its current treatment facility is nearing its limit. Additional capacity is required to keep pace with expected population increases and the resulting connections to the Mangawhai Community Wastewater Scheme (MCWWS). The neighbouring Mangawhai Golf Course is one option, providing a large area to discharge over with the dual benefit of providing irrigation to the fairways and greens.

The Environmental Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment (EclA) guidelines were used to assess and rank the existing ecological values on the course.

The ecological features of the site were assessed as being '**High**' due to the wetland area on site being considered a **Significant Natural Wetland** as it exceeds the minimum area threshold for a swamp type wetland. This wetland contains habitats that support Threatened, Nationally Vulnerable, and At Risk - Declining plant and bird species (i.e. kanuka and manuka). This indigenous vegetation and habitat provide and contributes to an important linkage or network. The wetland also plays an important hydrological, biological or ecological role and is an important habitat for critical life history stages of indigenous fauna.

Under the National Environmental Standards for Freshwater Water (NES:FM 2020) Rule 45 outlines that earthworks or land disturbance within a 10m setback from a natural wetland is a Discretionary Activity for constructing 'specified infrastructure'. Discharges within 100m setback from a natural wetland are also a Discretionary Activity. How the proposal now fits with in this new legislation needs to be considered.

The proposal to irrigate wastewater in proximity to the wetland needs to be approached with caution. Changes to the hydrology and nutrient inputs can have detrimental effects on the resident indigenous wetland species; increasing pest plants and inducing changes to vegetation composition.

The combined magnitude of the effect is considered to be '**Low**', on the basis that treated wastewater will be irrigated over an area of 35 hectares on the course at a rate of 2.3 mls per m<sup>2</sup> per day. This is a low rate of irrigation. Provided wastewater is irrigated to areas with a relatively good depth, the soil is capable of accepting these rates without ponding, runoff and groundwater contamination.

A nutrient management assessment is recommended to analyse how much of the nutrients from the wastewater would be fixed in the soil or taken up by vegetation and how much would be lost to the surrounding environment ground water system. This assessment will influence the final irrigation system design and placement and avoidance of onsite features.

Monitoring of the wetland is recommended to identify any changes to nutrient levels from baseline conditions in order make any necessary adjustments irrigations rates

Implementation of minimum setbacks and buffers on the drainage network and potential avoidance of irrigation in proximity of the wetland will also reduce the risk of adverse effects. This combined with planting of appropriate species along riparian setback areas including drains is recommended to increase uptake and filtration

Should these be adopted the underlying character, composition and baseline condition will not be dissimilar to the pre-system environment.

Therefore, it is considered that there will be a **'Low'** overall level of effect on wetland and terrestrial vegetation ecological values resulting from the installation and operation of the proposed irrigation system delivering treated wastewater from the MCWWTP

# 1 Introduction

## 1.1 Background

This report has been prepared by WSP for the Kaipara District Council (KDC) to provide an ecological impact assessment in support of resource consent applications to the Northland Regional Council (NRC) for the construction of an irrigation system and the reuse of treated wastewater for irrigation purposes from the Mangawhai Community Wastewater Treatment plant (MCWWTP) Mangawhai Heads, Northland.

The Kaipara District Council's capacity to discharge treated wastewater to land at its current treatment facility is nearing its treatment capacity. By 2043 the MCWWTP is expected to be processing wastewater from approximately 6,000 connections, or about 15,000 people. This is three times the current flow (WSP, 2020).

Additional capacity is required to keep pace with these population increases and the resulting connections to the Mangawhai Community Wastewater Scheme (MCWWS) (WSP 2020).

Currently, MCWWTP disposes of treated effluent via spray irrigators to land at a council owned farm at Brown Road Mangawhai. Approximately 30 hectares are under irrigation. Volumes are forecast to increase as the population grows and more connections to the scheme are required. In the medium term, the farm does not have the capacity to handle all the wastewater required to be discharged and requires further capacity to adequately deal with the increases (Kaipara District Council, 2021).

The neighbouring Mangawhai Golf Course offers one option to increase the land irrigation capacity of the MCWWS. It provides the dual benefit of a large area for wastewater discharge and irrigation to the fairways and greens.

Utilising the golf course is a feasible option however there are challenges on site at the golf course with a Significant Natural Wetland identified within the course extent.

Under the National Environmental Standards for Freshwater Water (NES:FM 2020) Rule 45 outlines that earthworks or land disturbance within a 10m setback from a natural wetland is a Discretionary Activity for constructing 'specified infrastructure'. Discharges within 100m setback from a natural wetland are also a Discretionary Activity.

Changes to the wetlands hydrology and nutrient inputs can have detrimental effects on the resident indigenous species; increasing pest plants and inducing changes to vegetation composition.

## 1.2 Purpose and Scope

The purpose of this report is to provide an ecological impact assessment in support of resource consent applications to the NRC for the construction of an irrigation system and discharge of treated wastewater at the Mangawhai Golf Course, Mangawhai Heads, Northland.

The MCWWS services part of the Mangawhai Drainage District through a reticulated network of pipes connecting properties to the treatment plant (Kaipara District Council, 2021).

Another network of pipes connects the treatment plant to a holding dam at the Browns Road Farm. Disposal is achieved via disposal fields on the farm. The current plant capacity can cater close to double the current number of connections. The current disposal capacity is nearing its limit (Kaipara District Council, 2021).

The expected population increases in the Mangawhai township and the resulting additional required connections to the MCWWTP mean that the current discharge area will be inadequate to support these future volumes. The council must increase the area available to

discharge wastewater to land. The neighbouring Mangawhai Golf Course is one option for increasing the disposal capacity

The following information will be provided in this report:

- A description of the project site ecological characteristics and values that are potentially impacted by this project.
- The nature and significance of effects of the projects construction on the ecological values identified
- Details of the measures proposed to avoid, remedy, mitigate or compensate adverse effects where necessary.

## 2 Project Area Description

The Mangawhai Golf Club is located off Molesworth Drive, Mangawhai Heads, Northland. This is a 18 hole championship course and is legally described as Lot 1 DP 190306.

The surrounding landscape is characterised by the Mangawhai Harbour and estuary. Neighbouring land uses include urban and residential, reserve and rural areas.



Figure 2-1 Overview of Site Location 1:50,000



Figure 2-2 Mangawhai Golf Course showing site features described in this report

## 3 Ecological Methodology

### 3.1 Desktop Assessment

An initial desktop assessment was undertaken and included review of the following:

- Aerial Photography
- Site layout and proposed infrastructure plans
- District and Regional Planning maps and Schedules
- Department of Conservation databases including *Protected Natural Areas Reconnaissance Survey Report* for the Rodney. Ecological District Northland Conservancy.
- Existing species lists and plant, bird and reptile threat classifications (de Lange et al 2018) (Hitchmough et al 2016), (Robertson et al 2017) and Van Winkel et al 2018).
- The Northland Regional Council databases and online biodiversity maps

## 3.2 Field Assessment

A field assessment was carried out on 9 April by Wayne Teal (Ecologist, WSP) with Mike Howard of the Mangawhai Golf Club. Wetland and terrestrial vegetation including fauna were assessed at the wetland area immediate surrounds. Scrub and exotic vegetation areas around the course that were considered as additional irrigation areas were also assessed.

Note was made of the wetland and terrestrial vegetation, species present, characteristics and condition were recorded, with particular attention given to notable or threatened species across the three main vegetation tiers occupied; ground cover (0-1m) shrub layer (1-3m) and tree canopy (>3m).

Observations of birds visually or by call in the vicinity of the proposed construction footprint were noted during the site visit. Particular attention was given to the presence or evidence of birds utilising the existing vegetation.

The potential of the habitat to support lizards was also assessed based on known habitat preferences and species distribution in the locality.

Other observations were noted including presence of surface water, including drains, previous disturbance activities and invasive plant species.

## 3.3 Assessment of Effects Methodology

### 3.3.1 EIANZ Guidelines

Guidelines for undertaking Ecological Impact Assessments (EclA) published by the Environment Institute of Australia and New Zealand (EIANZ, 2018) have been used to aid assessing ecological impacts of the Project. The guidelines assist in assessing values and effects in a consistent and clear way. However, sound professional judgement is still required when applying the framework and matrix approach (Table 3-1).

The approach involves assigning values for vegetation, habitats or species using the criteria in Table 3-1 and then assigning a magnitude of effects rating using the criteria. An overall level of effects is then determined by combining the value of an ecological feature or attribute with the rating for the magnitude of effect using the matrix.

Table 3-1 Criteria for Describing the overall level of effects (EIANZ, 2018)

Magnitude of effect	Ecological value				
	Very High	High	Moderate	Low	Negligible
Very High	Very High	Very High	High	Moderate	Low
High	Very High	Very High	Moderate	Low	Very Low
Moderate	High	High	Moderate	Low	Very Low
Low	Moderate	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive 1	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

The level of effect or risk posed on ecological values ranges from Very High/High to Moderate level effects or greater, typically require measures to avoid, remedy or mitigate effects, while Low to Very low effects levels are not normally of concern, although care may be required to minimise effects through design, construction and operation. Opportunity exists for possible for improvement or net gain through restoration or creation.

### 3.1.2 *Assessment of Ecological Values*

Appendix 5 of the Regional Policy Statement for Northland (2016) updated 2018 provides criteria for determining the significance of areas of indigenous vegetation and significant habitats of Indigenous fauna within the Northland region. These criteria were used as the basis for assigning value to the vegetation within the site. Species were valued according to their conservation status; those 'At Risk' or 'Threatened' were valued at a higher level than those classified as 'Not Threatened' (De Lange et al. 2017).

Four criteria were used to determine the value of the ecological features present on-site; these being 'Representativeness, Rarity/distinctiveness, Diversity and Pattern, and Ecological Context'. To assign value under each of these four criteria, an explanation on each criterion and a series of attributes are provided for consideration in Table 4 (Appendix 2) of the EIANZ guidelines. A scoring system provided in Table 6 (Appendix 2) of the guidelines requires the combination of these assessment values to provide an overall assignment of ecological value.

### 3.1.3 *Magnitude of Effects Assessment*

An assessment of the Magnitude of effects was undertaken considering impacts on identified ecological values. Impacts were considered in the context of the project and following factors

- Scale of Impact (i.e. the real extent of area)
- The extent or proportion of habitat loss versus local availability (e.g. the proportion of area loss relative to the continuous area that remains)
- Duration of the impact (temporary, long-term or permanent)
- The intensity of the unmitigated effect (e.g.: the extent to which habitat loss within the area was complete or partial)

### 3.1.4 *Overall Level of Effects Assessment*

An overall level of effects assessment was undertaken using a matrix which weights the assessed ecological values against the magnitude of effects (Table 3-1). This overall level of effect was determined in lieu of any avoidance, mitigation or offsetting measures being implemented. This assessment framework allowed for effects to be ranked on a scale from 'Negligible' to 'Very High' and provided justification for avoidance, mitigation and offsetting requirements where appropriate.

## 4 *Assessment of Ecological Values*

### 4.1.1 *Wetland Vegetation*

The Mangawhai Golf Course Wetland wet area extent was dominated by sharp spike sedge (*Eleocharis sphacelata*) and jointed twig rush (*Machaerina articulata*). These species and extents were noted in a 2018 survey by regional council staff (Griffin, 2018). It was observed that previous areas of open water were greatly reduced from photos from within the Griffin report, however, water levels observed were reduced following recent dry conditions. These species would now amount to 85-90% coverage of the area and have increased in extent from the previous survey (Figure 4-2).



Figure 4-1 Sharp spike sedge (*Eleocharis sphacelata*) and jointed twig rush (*Machaerina articulata*) dominant area.

Historic aerial photography shows amenity plantings of exotic species lining the eastern, northern and western margins of the wetland. These were likely to be bald cypress (*Taxodium distichum*) which have been removed and are no longer present aside from one solitary plant observed on the western edge (Figure 4-2).



Figure 4-2 Bald Cypress (*Taxodium distichum*) planting observed on the wetland edge

At the inlet to the wetland (Figure 4-4), cotoneaster (*Cotoneaster franchetii*) and a small Moreton Bay Fig (*Ficus macrophylla*) were seen on the riparian margin. Cabbage tree (*Cordyline australis*) tōtara (*Podocarpus tōtara*) were found on the edge of the fairway. Kiokio (*Parablechnum novae-zelandiae*), karo (*Pittosporum crassifolium* var. *strictum*) were found on the drain edges in multiple locations. Silver fern (*Cyathea dealbata*), karamu (*Coprosma robusta*) were present with established Australian blackwood (*Aciacia melanoxylon*), several of these large trees had been felled recently. In a small pool near the drain crossing, red pond weed (*Potamogeton cheesemanii*) was observed.



Figure 4-3 The Inlet to the Golf Course Wetland

Around the margins and in the transitions to dryland extents manuka (*Leptospermum scoparium*) and kanuka (*Kunzea ericodes* var. *linearis*) were occasional, with mahoe (*Melicystus ramiflorus*) karamu, cabbage tree occurring intermittently in a number of sites. Karo, rimu (*Darcrydium cupressinum*), along with fern species of silverfern, mamaku (*Cyathea medullaris*) and kiokio were present in frequent clusters (Figure 4-5). Some of these trees are likely to have been planted specimens established by the golf club as part of an infill and/or planting programme.



Figure 4-4 Dryland margins on the edge of the course

On the eastern end of the wetland, pampas (*Cortaderia sellona*) were also common along with gorse (*Ulex europaeus*) in various stages of maturity (Figure 4-6). Here kikuyu (*Cenchrus clandestinus*) dominated and was interspersed with water pepper (*Persicaria hydropiper*). Intertwined with these species were pinkbind weed (*Calystegia sepium subsp roseata*), dandelion (*Taraxacum officinale agg*) and oioi (*Apodasmia similis*).



Figure 4-5 Eastern area of the Golf Course Wetland

The southern area of the wetland in the vicinity of the outlet becomes drier and more appropriately considered as a mixed exotic – native shrubland (Figure 4-7). Pampas and woolly nightshade (*Solanum mauritianum*) appeared in increasing numbers.



Figure 4-6 Exotic weeds species increase on the southern area of the wetland

Progressing from the wetland outlet, a canopy of manuka and kanuka extended to 6-8 meters. The diversity of native plant species increases with mamaku, silver fern, hangehange (*Geniostoma ligustrifolium* var. *ligustrifolium*), mingimingi (*Leucopogon fasciculatus*), mahoe and karaka (*Corynocarpus laevigatus*). Ground cover species noted included gahnia (*Gahnia setifolia*) and rasp fern (*Doodia australis*). Sydney golden wattle (*Acacia longifolia*) seedlings were common in this area. Smilax (*Asparagus asparagoides*) is an established pest species and was throughout the shrubland area.



Figure 4-7 *Smilax* dominates the dryland sub-canopy

Further inspection of the shrubland area at its western and southern extent sees low points and hollows perhaps created from establishing the golf course. These low points were assessed as ephemeral – seasonally wet and dry and exhibited more wetland type species. Here sharp spike sedge was again present with areas of raupō (*Typha orientalis*), oioi and bare twig rush (*Machaerina juncea*). These areas became shrubland again at their edges with kanuka, manuka, mingimingi, cabbage tree and pampas. In the higher areas of shrubland there were a few seedlings and small maritime pine (*Pinus pinaster*) trees which have established from mature specimens present on the course fairways. Hakea (*Hakea salicifolia*) was also present in this area.



*Figure 4-8 Western and Southern extents of the wetland*

The eastern side of the wetland had a similar composition of native species described in the southern area, with manuka, kanuka, mahoe, and mingimingi. There were dense areas of hangehange with what appeared to be flax (*Phormium tenax*) and tōtara (*Podocarpus tōtara*) plantings. Kumarahou (*Pomaderris kumeraho*) was present on this edge with karo and then large areas of smilax. Ground covers consisted of tangle fern (*Gleichenia dicarpa*) waterfern (*Histiopteris incisa*), ring fern (*Paesia scaberula*) and pohuehue (*Muehlenbeckia australis*). Banana Passionfruit (*Passiflora tarminiana*) was intertwined on the trunks of kanuka and across the above-mentioned species. On the very edge fleabane (*Erigeron bonariensis*) was emergent through kikuyu.



Figure 4-9 Tangle Fern (*Gleichenia dicarpa*), water fern (*Histiopteris incisa*) and banana passionfruit (*Passiflora tarminiana*).

#### 4.1.2 Terrestrial Vegetation – Scrub and Exotic Vegetation Areas

Eight stands of kanuka and manuka scrub across the golf course were assessed for their species composition and potential for irrigation of treated effluent (Figure 2-3). These areas exhibited a similar composition of species with a dominant canopy of kanuka and manuka. These typically occupied higher topographies of the course. Here thin sandy topsoil's with minimal development, were often exposed and lacked organic layers.



*Figure 4-10 Higher topographies of the course with sparse and patchy vegetation and sandy soils with limited profile and development*

These stands were in various states of condition with some trees showing effects of drought., A number of shrub species had browned off or had experienced recent dieback.

Beneath the canopy there was a general lack of understory and ground cover species and these areas were quite open. There was evidence of recruitment with canopy species, manuka and kanuka seedlings naturally regenerating. Occasional miningmingi were observed at the margins and in lightwells and Wharangi (*Melicope ternata*) was less common but observed at each of the sites.



*Figure 4-11 Understory beneath kanuka*

Gorse and pampas occupied the edges of these areas with Sydney golden wattle, and Australian blackwood of varying maturities from seedlings to trees. Gahnia were seen in larger clusters along with areas of cushion moss. Maritime pine seedlings and some mature

trees were in the vicinity of the practice course area, close to the clubhouse. Five Finger (*Pseudopanax lessonii*) was infrequent but encountered at each of the sites. In some cases, this may have been planted along with pohutukawa (*Metrosideros excelsa*).



Figure 4-12 Typical Understory beneath scrub areas

Table 4-1 Plant Species List

Common Name	Scientific Name	Conservation Status (de Lange et al, 2017)
Bald Cypress	<i>Taxodium distichum</i>	Exotic - Not Threatened
Banana Passionfruit	<i>Passiflora tarminiana</i>	Exotic - Not Threatened
Bare Twig Rush	<i>Machaerina juncea</i>	Native - Not Threatened
Black Nightshade	<i>Solanum nigrum</i>	Exotic - Not Threatened
Bracken	<i>Pteridium esculentum</i>	Native - Not Threatened
Cabbage Tree/ Ti Kouka	<i>Cordyline australis</i>	Endemic - Not Threatened
Dandelion	<i>Taraxacum officinale agg.</i>	Exotic - Not Threatened
Five-finger	<i>Pseudopanax lessonii</i>	Endemic - Not Threatened
Flax	<i>Phormium tenax</i>	Endemic - Not Threatened
Fleabane	<i>Erigeron bonariensis</i>	Exotic - Not Threatened
Giant gahnia	<i>Gahnia setifolia</i>	Endemic - Not Threatened
Corse	<i>Ulex europaeus</i>	Exotic - Not Threatened
Hakea	<i>Hakea salicifolia</i>	Exotic - Not Threatened

Hangehange	<i>Geniostoma ligustrifolium</i> var. <i>ligustrifolium</i>	Endemic - Not Threatened
Jointed Twig Rush	<i>Machaerina articulata</i>	Native - Not Threatened
Kanuka	<i>Kunzea ericoides</i> var. <i>linearis</i>	At Risk - Declining
Karaka	<i>Corynocarpus laevigatus</i>	Endemic - Not Threatened
Karamu	<i>Coprosma robusta</i>	Endemic - Not Threatened
Karo	<i>Pittosporum crassifolium</i> var. <i>strictum</i>	Endemic - Not Threatened
Kikuyu grass	<i>Cenchrus clandestinus</i>	Exotic - Not Threatened
Kiokio	<i>Parablechnum novae-zelandiae</i>	Endemic - Not Threatened
Kumarahou	<i>Pomaderris kumeraho</i>	Endemic - Not Threatened
Kutakuta	<i>Eleocharis sphacelata</i>	Native - Not Threatened
Mamaku	<i>Cyathea medullaris</i>	Native - Not Threatened
Mānuka	<i>Leptospermum scoparium</i>	At Risk - Declining
Mātātā / Water Fern	<i>Histiopteris incisa</i>	Native - Not Threatened
Mingimingi	<i>Leucopogon fasciculatus</i>	Endemic - Not Threatened
Moreton Bay Fig	<i>Ficus macrophylla</i>	Exotic - Not Threatened
Oioi / Jointed Wire Rush	<i>Apodasmia similis</i>	Endemic - Not Threatened
Pampas	<i>Cortaderia sellona</i>	Exotic - Not Threatened
Paspalum	<i>Paspalum dilatatum</i>	Exotic - Not Threatened
Pink Bindweed	<i>Calystegia sepium</i> subsp. <i>roseata</i>	Endemic - Not Threatened
Pohuehue	<i>Muehlenbeckia complexa</i> var. <i>complexa</i>	Native - Not Threatened
Pohutukawa	<i>Metrosideros excelsa</i>	Threatened - Nationally Vulnerable
Raupō	<i>Typha orientalis</i>	Native - Not Threatened
Red Pondweed	<i>Potamogeton cheesemanii</i>	Native - Not Threatened
Silverfern	<i>Cyathea dealbata</i>	Endemic - Not Threatened
Smilax	<i>Asparagus asparagoides</i>	Exotic - Not Threatened
Swamp Twig Rush	<i>Machaerina juncea</i>	Endemic - Not Threatened
Sweet vernal	<i>Anthoxanthum odoratum</i>	Exotic - Not Threatened
Sydney Golden Wattle	<i>Acacia longifolia</i>	Exotic - Not Threatened
Tangle Fern	<i>Gleichenia dicarpa</i>	Endemic - Not Threatened
Water pepper	<i>Persicaria hydropiper</i>	Exotic - Not Threatened
Wharangi	<i>Melicope ternata</i>	Endemic - Not Threatened
Woolly Nightshade	<i>Solanum mauritianum</i>	Exotic - Not Threatened
Yorkshire Fog	<i>Holcus lanatus</i>	Exotic - Not Threatened

### 4.1.3 Birds

Birds were recorded as heard or seen on the golf course fairways and greens and immediate surrounds such as the wetland and scrub areas described as above.

A total of 14 species were observed. These included 7 native species, 1 endemic, 6 exotic or introduced species. None of the observed species are threatened.

Bird observations recorded in the *Natural Areas of the Rodney Ecological District Protected Natural Areas Programme*, Northland Conservancy (PNAP) (DOC, 2012) have been included as it is expected that a handful of these species could be anticipated to pass through or temporarily utilise the wetland surrounds and identified scrub areas. The Golf Course Wetland and surrounds within this report are included in the PNAP site **Mangawhai Harbour, Sandspit and Surrounds (ROD014)**.



Figure 4-13 White faced Heron (*Egretta novaehollandiae*) observed on the edge of the wetland

Here 3 endemic species are noted and one Nationally Critical native. Australasian bittern has been recorded along with wrybil (*Anarhynchus frontalis*), Northern New Zealand Dotterel (*Charadrius aquilonius*). The publication notes observations of North Island Fern Bird (*Bowdleria punctata vealeae*).

Overall, no evidence of indigenous or migratory bird nesting sites were observed. Bird habitat on the site was considered of moderate quality.

Table 4-2 Bird species list

Common Name	Scientific Name	Record From	Conservation Status (Robertson Et al, 2017)
Australasian Bittern	<i>Botaurus poiciloptilus</i>	DoC PNAP 2012	Native – Nationally Critical
Australasian Harrier	<i>Circus approximans</i>	On site observation	Native – Not Threatened
California Quail	<i>Callipepla californica</i>	On site observation	Exotic – Not Threatened
Common Myna	<i>Acridotheres tristis</i>	On site Observation	Exotic – Not Threatened
Eastern Rosella	<i>Platycercus eximius</i>	On site Observation	Exotic – Not Threatened
European Starling	<i>Sturnus vulgaris</i>	On site Observation	Exotic – Not Threatened
North Island Fern Bird	<i>Bowdleria punctata vealeae</i>	DoC PNAP 2012	Endemic - At Risk - Declining
House Sparrow	<i>Passer domesticus</i>	On site Observation	Exotic – Not Threatened
Sacred Kingfisher	<i>Todiramphus sanctus</i>	On site Observation	Native – Not Threatened
Northern NZ Dotterel	<i>Charadrius aquilonius</i>	DoC PNAP 2012	Endemic - Recovering
Pukeko	<i>Porphyrio melanotus</i>	On site Observation	Native – Not Threatened
Silvereye	<i>Zosterops lateralis</i>	On site Observation	Native – Not Threatened
Song Thrush	<i>Turdus philomelos</i>	On site Observation	Exotic – Not Threatened
Spur Winged Plover	<i>Vanellus miles novaehollandiae</i>	On site Observation	Native – Not Threatened
Tui	<i>Prothemadera novaeseelandiae</i>	On site observation	Endemic – Not Threatened
Welcome Swallow	<i>Hirundo neoxena</i>	On site Observation	Native – Not Threatened
White-Faced Heron	<i>Egretta novaehollandiae</i>	On site Observation	Native – Not Threatened
Wrybill	<i>Anarhynchus frontalis</i>	DoC PNAP 2012	Endemic – Nationally Vulnerable

#### 4.1.4 Lizards

Potential lizard habitat was searched and included long rank grasses, ground covers, trees and under logs or materials offering suitable refuge. No At Risk or Threatened lizard species were observed. Numerous plague skink (*Lampropholis delicata*) were observed across multiple locations around the wetland, scrub and fairway areas of the golf course.

The wetland and associated shrublands could prove to be suitable habitat for elegant gecko (*Naultinus elegans*) but no existing records or observations support this. DOC PNAP report for the Rodney Ecological District show records for the wider site **Mangawhai Harbour, Sandspit and Surrounds (ROD014)** for Moko Skink (*Oligosoma moco*) and Forest Gecko (*Mokopirirakau granulatus*). These are from different less modified habitats and some distance from the golf course. It is unlikely these species are present.

Table 4-3 Lizard species list

Common Name	Scientific Name	Record From	Conservation Status (Burns et al, 2017)
Plague/Rainbow Skink	<i>Lampropholis delicata</i>	On site Observation	Introduced – Pest

#### 4.1.5 Freshwater Fish

A freshwater fish survey was not undertaken as part of this assessment

## 4.2 Regional Policy Statement for Northland

Table 4-1 Provides an assessment of the Mangawhai Golf Course Wetland, immediate surrounds and identified scrub and exotic vegetation area on site for determining the significance of areas of indigenous vegetation and significant habitats of indigenous fauna within the Northland region, Regional Policy Statement (RPS) for Northland (Appendix 5, 2016, 2018).

The Mangawhai Golf Course Wetland upon inspection was confirmed as swamp of low to medium fertility and meets the criteria in Appendix 5 in terms of minimum thresholds, vegetation, presence of rare or threatened taxa and hydrology. It also triggers Appendix 5 assessment criteria on Representativeness, Rarity/Distinctiveness and Ecological Context.

Northland Regional Council Online Biodiversity maps show the Mangawhai Golf Course Wetland as a known natural wetland. It is incorrectly displayed as a saltmarsh on the mapping portal. There is perhaps a metadata error here and the appropriate NRC staff have been advised of the required correction.

Table 4-4 Appendix 5 Assessment Criteria Northland Regional Policy Statement for Northland

CRITERIA		ASSESSMENT
<b>1. Representativeness</b>		<b>Mangawhai Golf Course Wetland and Scrub Areas</b>
a)	Regardless of its size, the ecological site is largely indigenous vegetation that is representative, typical or characteristic of the natural diversity at the relevant and recognised ecological classification and scale to which the ecological site belongs.  i) If the ecological site comprises largely indigenous vegetation types; and ii) Is typical of what would have existed circa 1840; or iii) Is represented by faunal assemblages in most of the guilds expected for the habitat type; or	<b>Yes</b> -Wetland -, predominantly indigenous vegetation and representative of a wetland ecosystem. Exotic species are present around the edges and associated dryland areas; the site has been historically modified in extent and hydrology, overall there is a moderate diversity of species expected in terms of vegetation and fauna.  The Wetland is perhaps typical of what would have existed 1840 over a much wider area of consolidated historic dunes in basins and flow paths. However, these areas were likely be ephemeral and dynamic with shifting sands.  <b>No</b> - Scrub areas identified - these consist of a canopy of kanuka with manuka with exotics. Understorey and groundcovers are absent across a number of these sites and subject to exotic species incursion. Some native replanting has occurred in places along the margins with exotic amenity plantings.
b)	The ecological site i) Is a large example of indigenous vegetation or habitat, or ii) Contains a combination of landform and indigenous vegetation and that is considered to be a good example of its type at the relevant and recognised ecological classification and scale.	<b>No</b> - site and vegetation or habitat is limited to the wetland extent and immediate surrounds  Dryland parts associated with the wetland fringe have exotic canopy species and understorey layers.
<b>2. Rarity/Distinctiveness</b>		

a)	<p>The ecological site comprises indigenous ecosystems or indigenous vegetation types that:</p> <ul style="list-style-type: none"> <li>i) Are either Acutely or Chronically Threatened land environments associated with LENZ level 4; or</li> <li>ii) Excluding manmade wetlands, are examples of wetland classes that either otherwise trigger Appendix criteria or exceed any of the following area thresholds. <ul style="list-style-type: none"> <li>a) Salt Marsh greater than 0.5 hectares in area; or</li> <li>b) Shallow water (lake margins and rivers) greater than 0.5 hectares</li> <li>c) Swamp greater than 0.4 hectares</li> <li>d) Bog greater than 0.2 hectare in area or;</li> <li>e) Wet heathlands greater than 0.2 hectares in area or;</li> <li>f) Marsh; Fen; Ephemeral wetland or seepage / flush greater than 0.05 hectares in area</li> </ul> </li> </ul>	<p><b>Yes</b> - Mangawhai Golf Course Wetland is a swamp and triggers Appendix 5 Significance criteria as it exceeds (0.9 hectares) the 0.4 hectares size threshold</p> <p>Terrestrial areas on site were formally apart of Dune systems or shrublands and have remnant or regenerated areas of associated species with exotic species. They remain due to their steep topography.</p>
b)	<p>Indigenous vegetation that supports one or more indigenous taxa that are threatened etc.</p>	<p><b>Yes</b> - manuka, manuka nationally vulnerable Potential habitat for Elegant Gecko, NI fern Bird, Australasian Bittern.</p>
c)	<p>The ecological site contains indigenous vegetation that is:</p> <ul style="list-style-type: none"> <li>i) Endemic to Northland-Auckland region; or</li> <li>ii) At its distributional limit within the Northland region</li> </ul>	<p><b>No</b> - indigenous vegetation on site is common and widely distributed.</p>
d)	<p>The ecological site contains indigenous vegetation that:</p> <ul style="list-style-type: none"> <li>i) Is distinctive of a restricted occurrence; or</li> <li>ii) Is part of an ecological unit that occurs on an originally rare ecosystem; or</li> <li>iii) Is an indigenous ecosystem and vegetation type that is naturally rare or has developed as a result of an unusual environmental factor(s) that occur or are likely to occur in Northland; or</li> </ul>	<p><b>No</b> - vegetation is not distinctive or restricted in occurrence, a rare ecosystem or developed due to unusual environmental factors.</p>
<p><b>3. Diversity and pattern</b></p>		
a)	<p>Indigenous vegetation or habitat of indigenous fauna contains a high diversity of:</p> <ul style="list-style-type: none"> <li>i) Indigenous ecosystem or habitat types; or</li> <li>ii) Indigenous taxa;</li> </ul>	<p><b>No</b> - has reduced diversity relative to the original habitat type and associated taxa.</p>
b)	<p>Changes in taxon composition reflecting the existence of diverse natural features of ecological gradients; or</p>	<p><b>No</b> - some diversity but similar composition and taxa.</p>
c)	<p>Intact ecological sequences.</p>	<p><b>No</b> - wetland is an isolated island surround by a golf course. Area has been historically modified; exotic species are common. Sequences are patchy, incomplete or no longer exist.</p>
<p><b>4. Ecological context</b></p>		
a)	<p>Indigenous vegetation or habitat of indigenous fauna is present that provides or contributes to an important linkage or network, or provides an important buffering function; or</p>	<p><b>Yes</b> - the wetland site could be considered as an important linkage or network and provides a wetland habitat.</p>
b)	<p>The ecological site plays an important hydrological, biological or ecological role in the natural functioning of riverine, lacustrine, palustrine, estuarine, plutonic (including karst), geothermal or marine system; or</p>	<p><b>Yes</b> - the wetland plays an important hydrological, biological or ecological role. Home to species restricted to wetlands and coastal environment. Filters runoff from Golf course and stormwater from Molesworth Drive</p>
c)	<p>The ecological site is an important habitat for critical life history stages of indigenous fauna including breeding / spawning, roosting, nesting, resting, feeding, moulting, refugia or migration staging point (as used seasonally, temporarily or permanently</p>	<p><b>Yes</b> - site is an important habitat for critical life history stages – bird resting and feeding observed.</p>

## 5 Assessment of Ecological Effects

### 5.1 Proposed Works

The proposed works involve the installation of a network of subsurface pipes and dripper lines or sprinklers throughout the Mangawhai Golf Course. Current proposals (Figure 5-1) show this is confined to fairways and some of the putting greens. Potentially the areas identified as Scrub and Exotic Vegetation areas may also receive irrigation of treated wastewater.

Figure 5-1 Proposed Wastewater Irrigation System



Figure 5-2 Proposed Wastewater Irrigation System

This network will then receive the MCWWTP treated wastewater which will be discharged through the dripper lines and sprinklers. The installation of this subsurface network and pipes and associated drippers / sprinklers will require only minor excavation of soil grass and turf and will be located just beneath the surface. The pipe and dripper network can also be installed over a period of a couple of weeks. No vegetation clearance is proposed at the wetland, surrounds or scrub or exotic vegetation areas.

#### 5.1.1 Irrigation Strategy

It is proposed to utilise an irrigation deficit process. Whereby irrigation of wastewater will only occur from December 1 through to March 31 each year. This period will ensure that soil moisture levels are the most optimal to receive irrigation, limiting the risk of runoff occurring. The system will also not irrigate during periods of high or prolonged rainfall.

In terms of the proposed discharge volumes, quality and coverage the following values are applicable;

- Upto 1000m<sup>3</sup> are proposed per day over the 126-day term.
- This equates upto 7.9m<sup>3</sup> per day
- This will be irrigated over an area of 35 hectares over the course which equates to 2.3 mls per m<sup>2</sup> per day.

A high standard of treatment is regularly achieved by the plant the vast majority of the time meeting Category 1 Standards defined in New Zealand guidelines. However, due to the capacity of the sand filters, periodically the treated wastewater bypasses the tertiary polish and testing results may be elevated. There is currently little guidance in New Zealand for the beneficial reuse of treated wastewater for non-potable municipal use: e.g.: irrigation for parks and sports fields. Guidance in similar reuse applications in New Zealand has been taken from international sources.

The Guidelines for Environmental Management – Use of Reclaimed Water (2003) from the Environment Protection Authority Victoria, Australia explain that the required level of treatment and water quality objectives vary depending on the nature of the end-use scheme.

The guidelines outline four classes (A – D) of reclaimed water that represent the minimum standards for biological treatment and pathogen reduction for defined categories of use (Appendix C). The required level of treatment increases with potential for higher exposure levels, reflecting the risks associated with uses. It should be noted that in addition to minimum levels of treatment, a specific reclaimed water use may also be subject to site management controls to ensure protection of public health, agriculture and the environment.

Class A, B and C reclaimed water are acceptable for non-potable urban use. The potential level of exposure to reclaimed water determines the class suitable for both urban and municipal reuse schemes. The potential level of exposure is influenced by several factors including:

- Distance from residential or public access areas,
- Use of signage and/or fencing to restrict site access,
- Irrigation method used, and/or
- use of restricted watering times (e.g. night-time watering).

Only Class A reclaimed water may be used for residential or municipal reuse schemes where there is a high exposure potential to humans due to limited controls on public access. Class B and C reclaimed water may be used for municipal schemes provided public access to irrigated areas can be controlled e.g. restricted water times, fencing and/or restricted access periods to ensure areas are dry before access by humans. The type of irrigation can also influence the class of reclaimed water used, the extent of public access control required, and the design of the runoff control required. The reclaimed water quality limits required for municipal irrigation are based on spray irrigation.

For the purposes of this assessment the assumed wastewater quality meets **Class C** under the EPA Victoria Guidelines (2003) shown below.

Table 5-1 Class C values of reclaimed water and corresponding standards for biological treatment and pathogen reduction

Class	WATER QUALITY OBJECTIVES – MEDIAN UNLESS SPECIFIED	TREATMENT PROCESSES	RANGE OF USES – USES INCLUDE ALL LOWER CLASS USES
Class 'C'	<ul style="list-style-type: none"> <li>&lt;1,000 E Coli cfu/100ml</li> </ul>	Secondary and Pathogen reduction (including helminth reduction for cattle grazing uses schemes)	<p><b>Urban (non-potable)</b> with uncontrolled access public access</p> <p><b>Agricultural:</b> e.g.; human food crops cooked/processed, grazing/fodder for livestock</p> <p><b>Industrial:</b> Systems with no potential worker exposure</p>

## 5.2 Potential Effects from Proposed Works

The following actual and potential ecological effects are expected from the installation and operation of the irrigation network.

### 5.2.1 Earthworks and Land Disturbance

While the golf course is largely constructed on sandy soils there will be areas with more mature soil development, or modified soils through course construction. Earthworks and or land disturbance activities involved in the installation of the subsurface pipes dripper lines and sprinkler network have the potential to generate sediment, which if not dealt with correctly could have adverse downstream effects. Sedimentation into waterways can have numerous negative impacts on aquatic and wetland environments This could include smothering of low growing vegetation, groundcovers and seedlings within the wetland.

Prior to any construction being undertaken, an erosion and sediment control plan should be prepared and implemented following best practice guidelines (e.g. GD05). Assuming an erosion and sediment control plan is implemented the effects of sediment on the wetlands and aquatic ecosystems would be less than minor.

### 5.2.2 Discharges of Treated Wastewater

A high-level hydrology and soil assessment (WSP 2021) determined that it is feasible to discharge water to the golf course over the December to March period, via a deficit irrigation process. It is proposed that treated wastewater will be irrigated over an area of 35 hectares on the course which equates to 2.3 mls per m<sup>2</sup> per day. This is a low rate of irrigation and provided wastewater is irrigated to areas of relatively good depth the soil is capable in accepting these rates.

Soil areas where the topsoil has been exposed for long periods of time are showing signs of hydrophobicity. This is where the sand particles repel water due to non-polar waxy compounds coating the sand particles. This may cause increased runoff, and therefore these areas should be avoided for irrigation.

However, the this is only one component for assessing the overall impact of the proposed discharge activity. It is recommended that a nutrient management assessment be undertaken to analyse how much of the nutrients from the wastewater would be fixed in the soil or taken up by vegetation and how much would be lost to the surrounding environment and ground water system. This

assessment will influence the final irrigation system design and placement and avoidance of onsite features.

The Mangawhai Golf Course Wetland has been identified as a swamp wetland type. Swamps are the most fertile type of wetland and receive much of their water as runoff from surrounding land. In this case the wetland receives runoff from the golf course and stormwater from Molesworth Drive via a series of drains and swales. While swamps are resilient and can cope with small amounts of added nutrients entering the system, it is important to maintain these inputs to as close to natural levels. The course already receives a slow release fertiliser to maintain the turf of the fairways and greens, the effect of this on the wetland is currently unknown.

Elevated nutrient levels of nitrogen and phosphorus entering the wetland from the proposed irrigation of wastewater on the greens and in close proximity to the wetland could result in changes to the nutrient status of the water within.

Likely outcomes of this could include changes to the vegetation composition to species that prefer elevated levels of fertility, including exotic weed species. Algal blooms are also possible with fluctuating water levels and increases in temperature over the dryer summer months (Cooke, 1991). These changes to the natural character should be avoided.

The golf course wetland is a low to medium fertility wetland as identified by the NRC biodiversity report and evidenced by species favouring these conditions. The current wetland condition should be maintained and the amount of nutrients entering should be limited.

It is recommended for irrigation areas that suitable buffers or setbacks from drains and swales be established as a minimum to reduce the risk of concentrated runoff and leaching entering the wetland during heavy rainfall events.

Recent guidelines released by Landcare Research recommend a minimum setback of 10m to reduce nutrient and other contaminant inputs for land with slopes <10° and 20m for land steeper than 10° (Fenemor, Samarasinghe, 2020).

A similar buffer should be established around the wetland or irrigation of wastewater avoided in this area as a precautionary measure.

Further planting of appropriate species along riparian setback/buffer areas including drains that feed into the wetland to increase uptake and filtration is recommended.

The scrub and exotic terrestrial vegetation areas identified would likely benefit from being irrigated. This may however increase the need to control exotic pest plant species.

Sub surface iron pans need to be considered when managing irrigation.

## 5.3 Assessment of the Overall Level of Effect

### 5.3.1 Ecological Values

The EIANZ guidelines requires ecological values to be assessed and ranked. It is considered that the value of the golf course is '**High**' due to the following;

- The Mangawhai Golf Club Wetland is a Significant Natural Wetland as it triggers Appendix 5 of the Northland Regional Policy Statement, as it exceeds (0.9 hectares) the 0.4-hectare size threshold for a swamp type wetland.
- Contains habitats that support Threatened, Nationally Vulnerable, and At Risk - Declining plant and bird species (i.e. kanuka and manuka).

- Contains indigenous vegetation or habitat of indigenous fauna is present that provides or contributes to an important linkage or network (NRC Appendix 5 RPS).
- The wetland plays an important hydrological, biological and ecological role. It is home to species restricted to wetlands. It also filters runoff from the golf course and storm water from Molesworth Drive (NRC Appendix 5 RPS).
- The site is an important habitat for critical life history stages of indigenous fauna, namely resting and feeding (as used seasonally, temporarily or permanently) (NRC Appendix 5 RPS).

It should be noted however that the one of the reasons for these areas receiving a High value assessment rating is due to the presence of kanuka and manuka and pohutukawa. These species have been added to the threatened species list in 2017 due the threat of potential declines that may result from the spread of myrtle rust (*Austropuccinia psidii*). However, these species are still common, regionally in the case of manuka, and nationally in the case of kanuka, with the potential impact of myrtle rust on these species still unclear.

## 5.4 Magnitude of Effect

The EIANZ guidelines require an evaluation of the magnitude of effects on ecological values based on footprint size, intensity and duration. The combined magnitude of the effect is considered to be **'Low'**, on the basis the proposal follows recommendations outlined in regard to undertaking nutrient management assessment to analyse how much of the wastewater nutrients would be fixed in the soil or taken up by vegetation and irrigation deficits. This assessment can also be used to inform the detailed design of the irrigation system including its overall placement and avoidance of onsite features.

The establishment of riparian setbacks and buffers on the drainage network and potential avoidance of irrigation in proximity of the wetland is proposed. Further planting of appropriate species along riparian setback areas including drains to increase uptake and filtration is recommended. Terrestrial shrublands offer potential irrigation options. The risks are pest plant invasion and increased runoff in steeper areas.

Should these be adopted the underlying character, composition and baseline condition will not be dissimilar to the pre-system environment.

## 5.5 Overall level of Effect Rating

As per the EIANZ guidelines, Table 3-1 shows the EIANZ matrix outlining criteria to describe the overall level of ecological effects. It is considered that there will be a **'Low'** level of effect on wetland and terrestrial vegetation ecological values resulting from the installation and operation of the proposed treated wastewater from the Mangawhai Community Wastewater Treatment Plant.

## 6 Recommendations

The following ecological management measures are recommended to ensure that any foreseeable ecological effects associated with the works are adequately managed and minimised.

### 6.1 Measures to Reduce Effects of Sediment

While the site has largely sandy soils an appropriate erosion, sediment and containment controls should be installed prior to the earthworks associated with the installation of the pipeline, to reduce the risk of any sediment and/or contaminants entering waterways and onto the wetland environment. This should be guided by a plan prepared by a suitably experienced professional following guidelines set out in Auckland Council Guidance Document 05 2016.

### 6.2 Undertake a Nutrient Management Assessment

A high-level hydrology and soil assessment determined that it is feasible to discharge water to the golf course over the December to March period, via a deficit irrigation process. However, this is only one component for assessing the overall impact of the proposed discharge activity. It is recommended that a nutrient management assessment be undertaken to analyse how much of the nutrients from the wastewater would be fixed in the soil or taken up by vegetation and how much would be lost to the surrounding environment ground water system. This assessment will influence the final irrigation system design and placement and avoidance of onsite features.

### 6.3 Measures to Reduce Raising the Wetland Fertility level

It is recommended that suitable buffers or setbacks from drains and swales be established as a minimum to reduce the risk of concentrated runoff and leaching entering the wetland from heavy rainfall events.

Recent guidelines released by Landcare Research recommend a minimum setback of 10m to reduce nutrient and other contaminant inputs for land with slopes <10° and 20m for land steeper than 10° (Fenemor, Samarasinghe, 2020).

A similar buffer area should be established around the wetland or irrigation of wastewater avoided in this area as a precautionary measure. Irrigation during periods of heavy or prolonged rain should be delayed and recommence once soil moisture levels have receded.

As a consent condition the water in the wetland could be monitored to understand changes to nutrient levels from the proposed irrigation from baseline conditions.

Further planting of appropriate species along riparian setback areas including drains is recommended to increase uptake and filtration.

## 7 Conclusions

The Kaipara District Councils capacity to discharge treated wastewater to land at its current treatment facility is nearing its limit. Additional capacity is required to keep pace with expected population increases and the resulting connections to the Mangawhai Community Wastewater Scheme. The neighbouring Mangawhai Golf Course is one option providing a large area to discharge over with the dual benefit of providing irrigation to the fairways and greens.

The ecological features of the site were assessed as being **'High'** due to the wetland area on site subject to this report being considered a Significant Natural Wetland as it exceeds (0.9 hectares) the size threshold for a swamp type wetland. The wetland contains habitats that support Threatened, Nationally Vulnerable, and At Risk - Declining plant and bird species (i.e. kanuka and manuka). This indigenous vegetation and habitat provide and contributes to an important linkage or network. The wetland also plays an important hydrological, biological ecological role and is an important habitat for critical life history stages of indigenous fauna.

Under the National Environmental Standards for Freshwater Water (NES:FM 2020) Rule 45 outlines that earthworks or land disturbance within a 10m setback from a natural wetland is a Discretionary Activity for constructing 'specified infrastructure'. Discharges within 100m setback from a natural wetland are also a Discretionary Activity. How the proposal now fits within this new legislation needs to be considered.

The combined magnitude of the effect is considered to be 'Low', on the basis that treated wastewater will be irrigated over an area of 35 hectares on the course at a rate of 2.3 mls per m<sup>2</sup> per day. This is a low rate of irrigation and provided wastewater is irrigated to areas of relatively good depth the soil is capable in accepting these rates without ponding, runoff. A nutrient management assessment is recommended to analyse how much of the nutrients from the wastewater would be fixed in the soil or taken up by vegetation and how much would be lost to the surrounding environment ground water system. This assessment will influence the final irrigation system design and placement and avoidance of onsite features.

Monitoring of the wetland is recommended to identify any changes to nutrient levels from baseline conditions in order make any necessary adjustments irrigations rates.

Implementation of minimum setbacks and buffers on the drainage network and potential avoidance of irrigation in proximity of the wetland will also reduce the risk of adverse effects. This combined with planting of appropriate species along riparian setback areas including drains is recommended to increase uptake and filtration.

Should these recommendations be adopted the underlying character, composition and baseline condition will not be dissimilar to the pre-system environment.

Therefore, it is considered that there will be a **'Low'** overall level of effect on wetland and terrestrial vegetation ecological values resulting from the installation and operation of the proposed irrigation system delivering treated wastewater from the Mangawhai Community Wastewater Treatment Plant.

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# Appendix A Proposed Wastewater Irrigation System

Mangawhai Golf Course



Sourced from the LINZ Data Service and licensed for reuse under the CC BY 4.0 licence.

- MD50 PN10 PE100
- MD63 PN10 PE100
- 80mm Class C PVC (RRJ)
- 100mm PN12 PVC (RRJ)
- 150mm PN9 PVC (RRJ)
- 2-core 1.5mm Wire
- 2-Core 2.5mm Wire

- 50mm Ball Valve HBV50
- 50mm Ball Valve HBV50
- 80mm Isolation Valve
- 100mm Sluice Valve (RRJ)
- 150mm Sluice Valve DI (RRJ)
- Toro Flex 34 VIH FC Nozzle FC #33
- Toro Flex 54 VIH FC Nozzle FC #54
- Water Supply

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**Parkland Products Ltd**

**Fairway Irrigation System - Wastewater**

**Mangawhai Golf Club**

**Designer:** BFR / BCG Update

**Date:** 10.07.2009    **Scale:** approx 1:1600



# Appendix B

## EIANZ Guidelines

Combined Assessment of Values Scoring  
Methods Tables 4 and 6

**Table 5 Factors to consider in assigning value to terrestrial species for EclA**

Determining factors	
Nationally Threatened species, found in the ZOI either permanently or seasonally	Very High
Species listed as At Risk – Declining, found in the ZOI, either permanently or seasonally	High
Species listed as any other category of At Risk, found in the ZOI either permanently or seasonally	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 6. Scoring for sites or areas combining values for four matters in Table 4.**

Value	Description
Very High	Area rates High for 3 or all of the four assessment matters listed in <b>Table 4</b> . 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. 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.

# Appendix C

## Environmental Protection Authority Victoria Guidelines

The Guidelines for Environmental  
Management – Use of Reclaimed Water  
(2003) -Classes of Reclaimed Water and  
corresponding guidelines for biological  
treatment and pathogen reduction

CLASS	WATER QUALITY OBJECTIVES - MEDIANS UNLESS SPECIFIED	TREATMENT PROCESSES	RANGE OF USES - USES INCLUDE ALL LOWER CLASS USES
A	Indicative objectives: <ul style="list-style-type: none"> <li>• &lt;10 E. coli cfu/100ml</li> <li>• Turbidity &lt; 2 NTU</li> <li>• &lt;10 mg/l BOD</li> <li>• &lt;5 mg/l SS</li> <li>• pH 6 - 9</li> <li>• 1 mg/l Cl<sub>2</sub> residual (or equivalent disinfection)</li> </ul>	Tertiary and pathogen reduction with sufficient log reductions to achieve: <ul style="list-style-type: none"> <li>&lt;10 E. coli cfu/100ml</li> <li>&lt;1 helminth per litre</li> <li>&lt;protozoa per 50 litres</li> <li>&lt;1 virus per 50 litres</li> </ul>	<u>Urban (non-potable)</u> with uncontrolled public access  <u>Agricultural:</u> e.g. human food crops consumed raw  <u>Industrial:</u> open systems with worker exposure potential
B	<ul style="list-style-type: none"> <li>• &lt;100 E. coli cfu/100ml</li> <li>• &lt;20 mg/l BOD</li> <li>• &lt;30 mg/l SS</li> <li>• pH 6 - 9</li> </ul>	Secondary and pathogen (including helminth reduction for cattle grazing) reduction	<u>Agricultural:</u> e.g. dairy cattle grazing  <u>Industrial:</u> e.g. washdown water
C	<ul style="list-style-type: none"> <li>• &lt;1,000 E. coli cfu/100ml</li> <li>• &lt;20 mg/l BOD</li> <li>• &lt;30 mg/l SS</li> <li>• pH 6 - 9</li> </ul>	Secondary and pathogen reduction (including helminth reduction for cattle grazing use schemes)	<u>Urban (non-potable)</u> with controlled public access  <u>Agricultural:</u> e.g. human food crops cooked/processed, grazing/fodder for livestock  <u>Industrial:</u> systems with no potential worker exposure
D	<ul style="list-style-type: none"> <li>• &lt;10,000 E. coli cfu/100ml</li> <li>• &lt;20 mg/l BOD</li> <li>• &lt;30 mg/l SS</li> <li>• pH 6 - 9</li> </ul>	Secondary	<u>Agricultural:</u> non-food crops including instant turf, woodlots, flowers

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