Takapau Wastewater Discharge to Land – Freshwater Ecological Impact Assessment

Section 92 Response

Prepared for Central Hawke's Bay District Council
Prepared by Beca Limited
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Revision History

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Document Acceptance

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Prepared by	Sandy Huang		19/08/21
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Approved by	Rachael Shaw		19/08/21
on behalf of	Beca Limited		

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Appendices

1 Introduction

The purpose of this report is to determine the ecological values of the freshwater features and the ecological impacts of the treated wastewater discharge to land within the project site in response to the section 92 request associated with the discharge of treated wastewater from the Takapau Wastewater Treatment Plant (WWTP) to adjacent farmland via irrigation.

Central Hawkes Bay District Council (CHBDC) is in the process applying for resource consents for the discharge of treated wastewater from Takapau WWTP. The treated wastewater currently undergoes treatment in a single oxidation pond. Pond treated wastewater is discharged to a wetland alongside the Makaretu River and eventually to the Makaretu River near the Burnside Road bridge.

The preferred option for long term management of collected wastewater at Takapau is to continue treating in the oxidation pond system, with some enhancements, and to irrigate most of the treated wastewater to land on adjacent farmland and to discharge to the Makaretu River when storage has been exhausted and flow in the river is above a predetermined minimum. This diversion of treated wastewater to land will be conducted using a staged discharge methodology. The proposed irrigation area is shown in Figure 1 below.

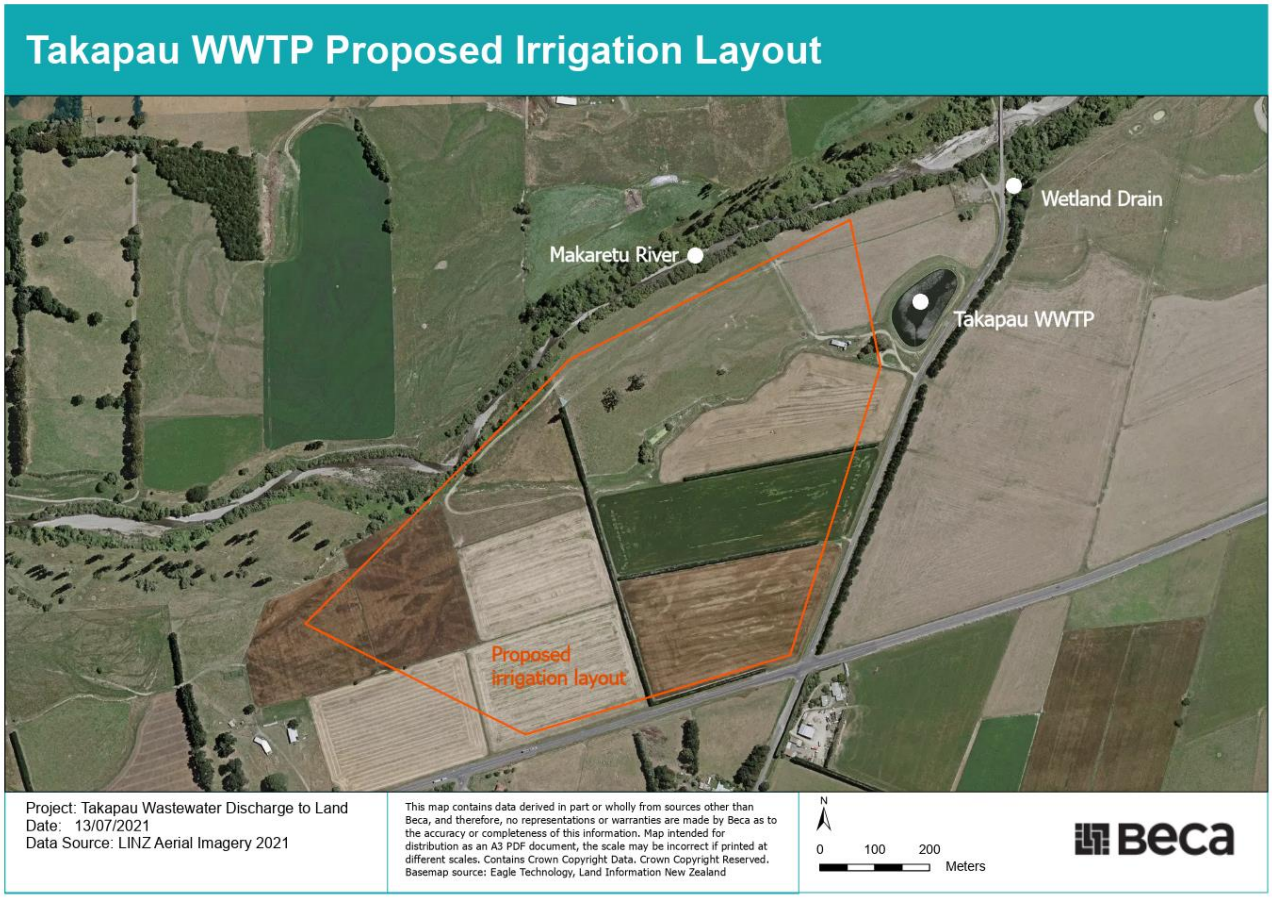

Figure 1. The proposed irrigation layout for the land discharge of the Takapau WWTP.

A resource consent application has been lodged with Hawkes Bay Regional Council (HBRC). Further information has been requested by HBRC to assess the ecological effects of the discharge to land as follows:

Section 92 Questions

Question 24: *As identified on the site visit, a drainage channel/waterway bisects the site along the toe of the upper terrace and is within the proposed irrigation area. Please provide an assessment of the potential effects of the irrigation to land on this channel and surrounding area. In addition, please provide comment whether the 20m setback proposed at Condition 9 will be suitable for this channel.*

Question 29: *Please provide an assessment of the ecological values of the overland flow path of the existing discharge (proposed HRLP) with comment on the effect on staged reduction in direct discharge to this overflow path that is proposed.*

Question 30: *Please provide an assessment of the ecological value of the existing drainage channels located within the proposed area of irrigation (including the ephemeral overland flow channel identified in point 23, above).*

In response to these questions, the scope of this report includes:

- A desk-based review of publicly accessible reports or information.
- A site visit to the location of the proposed discharge on the 22nd of June 2021.
- An assessment of the ecological values of the Site and the receiving environment.
- An assessment of ecological effects and recommended mitigation prepared in general accordance with the EIANZ Ecological Impact Assessment Guidelines (Roper-Lindsay et al., 2018).

2 Site Location and Ecological Context

Takapau WWTP is located at Burnside Road adjacent to the Makaretu River Bridge in the Central Hawkes Bay, approximately 2 km North-East of Takapau (Figure 2). The adjoining land use is predominantly pastoral. Treated wastewater is discharged, via an effluent chamber, to a wetland drain before flowing freely into the Makaretu River.

The site is within the Heretaunga ecological district, in the Hawkes Bay ecological region (McEwen, 1987). The district includes a number of aggrading rivers, extensive broad plains, river terraces, and hill country composed of Pleistocene and Holocene gravels and alluvium (McEwen, 1987). It is one of the driest areas in the North Island with frequent summer droughts (McEwen, 1987). The district has undergone extensive modification with a large proportion of land converted to pasture and horticultural land (McEwen, 1987).

The site is in the Makaretu River sub-catchment, which is contained within the wider Tukituki catchment. The Makaretu River sub-catchment is approximately 80 km^2 and is in the south-western, inland area of the Hawke's Bay Region. The sub-catchment is a linear feature draining from the southwest in the foothills of the Ruahine Ranges (at approximately 400 m MSL) onto the Ruataniwha Plains (Forbes, A.; Stepheson, B.; Cameron, F.; Herbert, S; Bell, 2011).

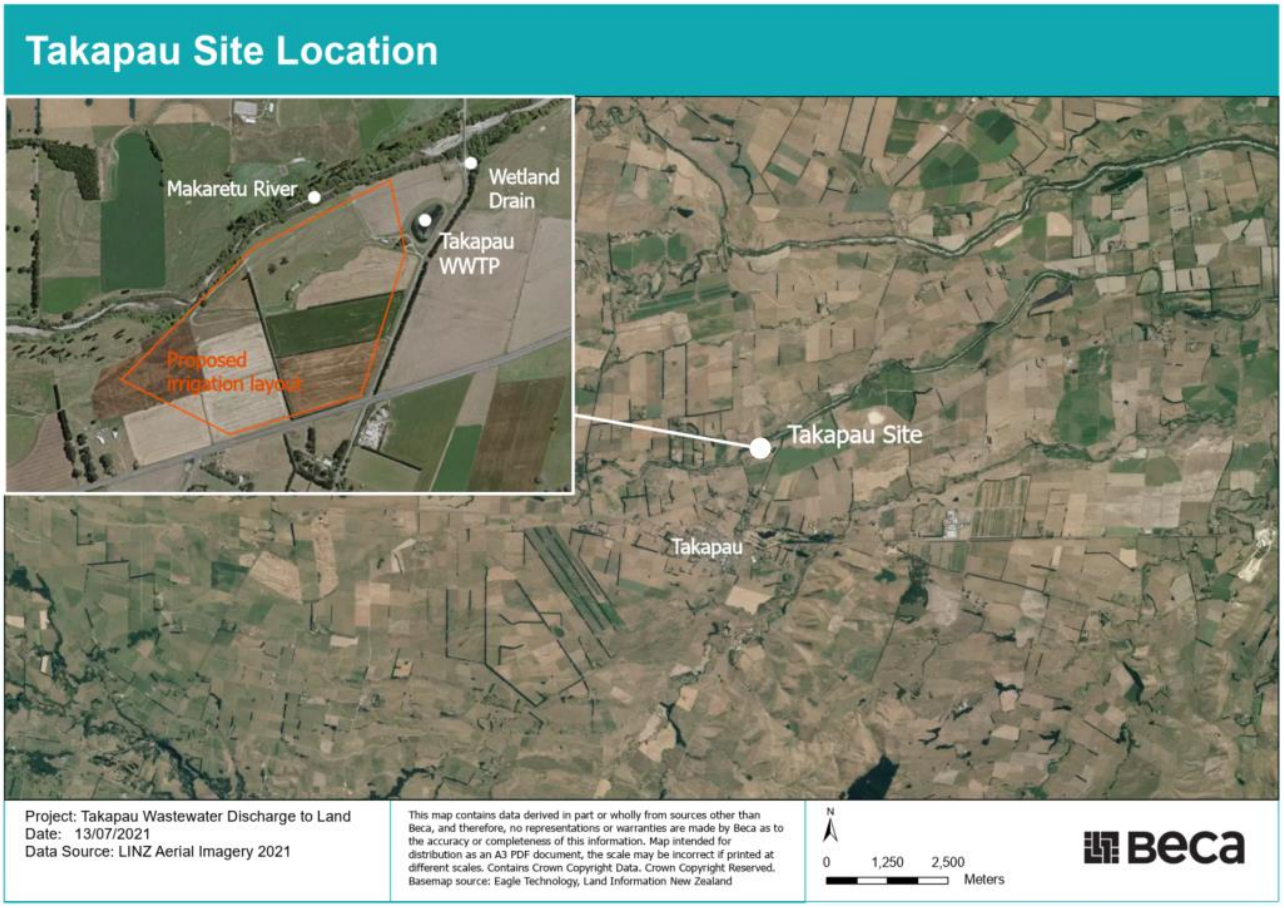

Figure 2. The Takapau site within the surrounding environment.

3 Methodology

3.1 Desktop review

A desk-based study was undertaken using ecological information from the following sources:

- Hawkes Bay Regional Council geospatial layers including catchment and hydrology layers
- Freshwater Environments of New Zealand (FENZ) estimated historic extent of wetlands in New Zealand geospatial layer.
- Google Earth and LINZ aerial imagery
- Retrolens historical imagery
- Other publicly accessible reports or information

3.2 Field Investigations

A site visit was undertaken on the 22nd June 2021 to conduct a wetland delineation and habitat assessments to provide a high-level indication of baseline ecological condition and assess the potential effects of discharge of treated wastewater to land on the ecological values of the site. The weather was overcast and in the two weeks preceding the site visit there had been 123 mm of rainfall (Waipawa EWS; NIWA, 2021).

3.2.1 Wetland Delineation

The Resource Management Act 1991 (RMA) defines wetlands as, "*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 National Environmental Standards for Freshwater (2020; NES:FW) sets out controls relating to developments relating to 'natural wetlands'. 'Natural wetlands' are defined in the NES:FW (via the National Policy Statement for Fresh Water Management (2020; NPS-FM) as:

'… a wetland (as defined in the Act) that is not:

a) A wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or

b) A geothermal wetland; or

c) *Any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain-derived water pooling*.'

A desktop and field assessment of ecology, hydrology, wetland and catchment characteristics was undertaken to classify the potential wetland (e.g. non-wetland, artificial wetland, or natural wetland) in accordance with the Landcare Research wetland delineation procedure (Figure 3; Clarkson, 2018).

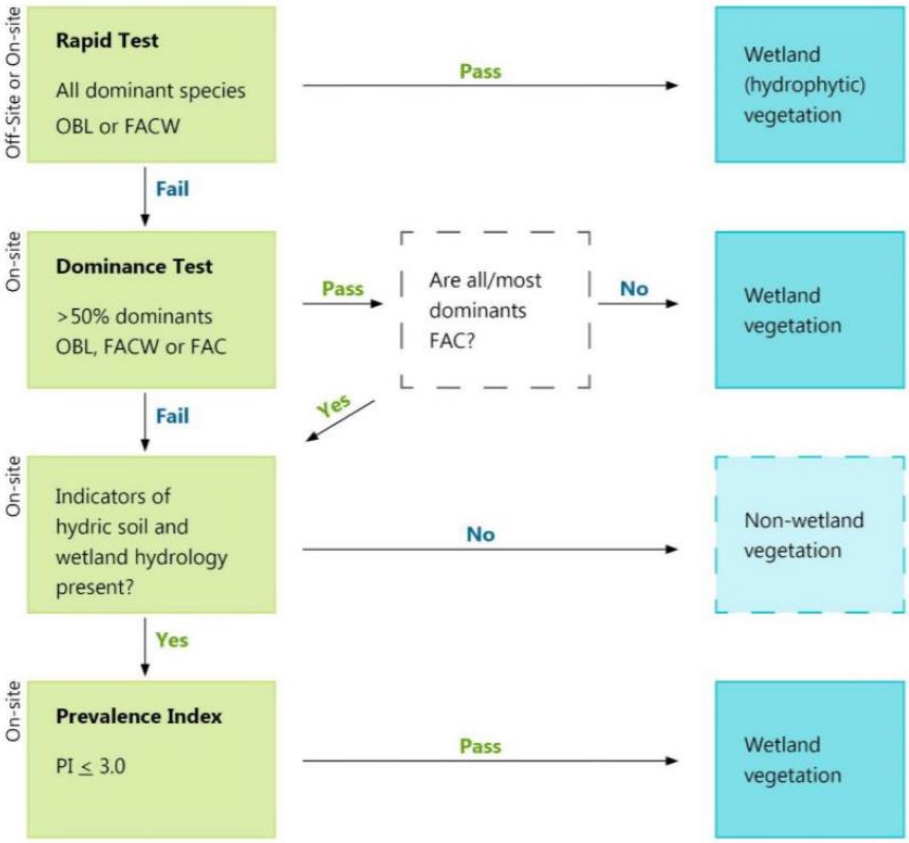

Figure 3. Landcare Research hydrophytic (wetland) vegetation delineation tool. Wetland indicator status abbreviations: FAC = facultative; FACW = facultative wetland; OBL = obligate wetland.

3.2.2 Watercourse Assessment (Ecoline)

Watercourse assessments were completed on the 22nd of June 2021 following methods outlined in the Watercourse Assessment Methodology: Infrastructure and Ecology Document (Version 2.0) at a representative reach to assess the baseline condition of the existing watercourse. Data collected included: channel condition and morphology, bank and channel modification, stream bank erosion, debris jams, streambed substrate composition, channel shade and riparian vegetation.

3.3 Assessment methodology

A desktop assessment of ecological effects was undertaken in accordance with Ecological Impact Assessment (EcIA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems (Roper-Lindsay et al., 2018).

The EIANZ guidelines set out a methodology to assign ecological value to species and ecosystems based on four assessment criteria which are consistent with significance assessment criteria set out in the Proposed National Policy Statement for Indigenous Biodiversity (2019) Appendix 1: Criteria for identifying significant indigenous vegetation and significant habitat of indigenous fauna. These are reproduced in this report as Appendix 1 Tables 1.1-1.4. In summary:

- Attributes are considered when considering ecological value or importance. They relate to matters such as representativeness, the rarity and distinctiveness, diversity and patterns, and the broader ecological context.

- Determining Factors for valuing terrestrial species; terrestrial species span a continuum of very high to negligible, depending on aspects such as whether species are native or exotic, have threat status, and their abundance and commonality at the site impacted
- Ecological Values are scored based on an expert judgement, qualitative and quantitative data collected.

Once ecological values have been identified and valued, the severity of potential impacts is assessed by determining the change from baseline ecological values likely to occur as a result of the proposal/project along the lines of a magnitude of effect as determined by the criteria set out in Appendix 1:Table 1.5.

Finally, once these two factors have been determined (the ecological value and the magnitude of effect), an overall level of effect on each of the identified ecological values is assessed (Appendix 1:Table 1.6).

4 Section 92 Questions

4.1 Question 29

Please provide an assessment of the ecological values of the overland flow path of the existing discharge (proposed HRLP) with comment on the effect on staged reduction in direct discharge to this overflow path that is proposed.

4.1.1 Ecological Value

The **overland flow path** (hereafter referred to as Site 1; Figure 4) was identified as a potential wetland based on desktop information and then ground-truthed during a site visit on 22nd June 2021 using the Wetland Delineation Protocol (Clarkson, 2018). A full list of vegetation recorded in these areas is included in Appendix 2.

Site 1 is located on the Makaretu River edge below the Takapau WWTP and is the current point of discharge (Figure 5). It has an area extent of approximately 331m². It consists of silt and sludge, with two small open water bodies approximately 20m² and 9m² in area extent, and 10cm deep. The banks are approximately 50cm in height and gradually flattens out.

Site 1 is dominated by watercress (*Nasturtium spp*.) and mercer grass (*Paspalum distichum*). Other species present include flax (*Phormium tenax*), broadleaf dock (*Rumex obtusifolius*), cabbage tree (*Cordyline australis*), sedges (*Carex* spp.), and curled dock (*Rumex crispus*). Site 1 passed the Rapid Test, Dominance Test, and the Prevalence Test.

Indicators of hydric soil were not assessed as a soil sample using the auger could not be safely obtained.

Based on historical imagery from 1943 (see Figure 6; Retrolens), this area may have been part of a riverine wetland associated with the floodplains of the Makaretu River. However, its hydrology has been significantly modified by land use change and is currently driven by the Takapau WWTP discharges. Therefore, the NPS-FM 'constructed wetland' exclusion criteria applies, and Site 1 was classified as an induced (reverted) wetland. Given this, the constructed wetland does not meet the definition of a 'natural wetland' in terms of the NES:FW.

Overall, Site 1 is assessed as having **Low** current ecological value based on moderate ratings for Rarity/Distinctiveness, and low ratings for representativeness, diversity and pattern, and ecological context (Table 1).

Table 1. Scoring and justification for assigned ecological value to Site 1.

Matter	Rating	Justification
Representativeness	Low	Constructed wetland sustained by Takapau WWTP discharge.
Rarity/Distinctiveness	Moderate	Wetland ecosystem. Nationally common indigenous species.
Diversity and Pattern	Low	Low diversity. Excavation and bank modification.
Ecological context	Low	Buffering functions. Surroundings dominated by agricultural land-use.

Figure 4. Site 1 at the time of site visit on 22nd June 2021, showing the 20m2 water body (top left and right), 9m2 water body (bottom left), and general vegetation (bottom right).

Figure 5. Site 1 identified as a potential wetland (indicated by purple polygon) and its location.

Figure 6. Aerial imagery of the river and potential wetland from 1943 (left, Source: Retrolens), and 2021 (right). Site 1 is indicated by a purple polygon in the imagery from 2021

4.1.2 Magnitude of Effects

A potential ecological effect of discharge of treated wastewater to land on Site 1 is **Alterations to hydrology**.

The reduction of discharge from Takapau WWTP to Makaretu River through Site 1, will reduce the amount of water entering Site 1. Site 1 is considered an induced wetland with the discharge supporting its hydrologic functions. Therefore, the cessation of discharge will potentially cause Site 1 to cease being a wetland and is therefore assessed as having a **High** magnitude of effect.

4.1.3 Overall Level of Effects

The Overall Level of Effect on Site 1 is considered **Low**, as its Ecological Value was Low, and the Magnitude of Effect was high.

4.2 Questions 24 and 30

(24) As identified on the site visit, a drainage channel/waterway bisects the site along the toe of the upper terrace and is within the proposed irrigation area. Please provide an assessment of the potential effects of the irrigation to land on this channel and surrounding area. In addition, please provide comment whether the 20m setback proposed at Condition 9 will be suitable for this channel.

(30) Please provide an assessment of the ecological value of the existing drainage channels located within the proposed area of irrigation (including the ephemeral overland flow channel identified in point 23, above).

4.2.1 Ecological Value

a. Existing drainage channel (Site 2)

The **existing drainage channel** (hereafter referred to as Site 2; Figure 7) was identified as a potential wetland based on desktop information and then ground-truthed during a site visit on 22nd June 2021 using the Wetland Delineation Protocol (Clarkson, 2018). A full list of vegetation recorded in these areas is included in Appendix 2.

Site 2 is approximately 319m² and is situated to the southwest on the property (Figure 8). The surroundings consist of pasture grass, thistles, and some willows. It is not fenced to exclude stock. The presence of a Maimai suggests that Site 2 is used for duck shooting.

Site 2 was a small, elongated depression with steep banks of approximately 10m on only one side. A large amount of inorganic debris and building rubble has been discarded into the channel. The landscape characteristics suggest that the site may be seasonally dry. It contained approximately 30cm deep of surface water, but this was likely due to recent rain. Stock are not excluded from the area and damage from stock is evident (the area is currently used for stock watering).

Site 2 is dominated by willow weed (*Persicaria maculosa*) and mercer grass (*Paspalum distichum*). Other species present include marsh cudweed (*Gnaphalium uliginosum*), watercress (*Nasturtium spp*.), and curled dock (*Rumex crispus*). It passed the Rapid Test, Dominance Test, and the Prevalence Test.

A sample soil revealed pale low chroma colours and mottling indicating hydric soil conditions. The soil past 40cm depth was also wet.

Based on the above, Site 2 is classified as an ephemeral wetland.

Overall, Site 2 is assessed as having **Low** ecological value based on low ratings for representativeness, rarity/distinctiveness, and diversity and pattern and ecological context (Table 2).

Table 2. Scoring and justification for assigned ecological value to Site 2.

Matter	Rating	Justification
Representativeness	Low	Ephemeral wetland, seasonally dry.
Rarity/Distinctiveness	Low	Dominated by exotic species.
Diversity and Pattern	Low	Low diversity. Ongoing stock access.
Ecological context	Low	Modified habitat subject to stock access, discarded inorganic debris, and duck shooting activity. Surroundings dominated by agricultural land-use.

Figure 7. Site 2 at the time of site visit.

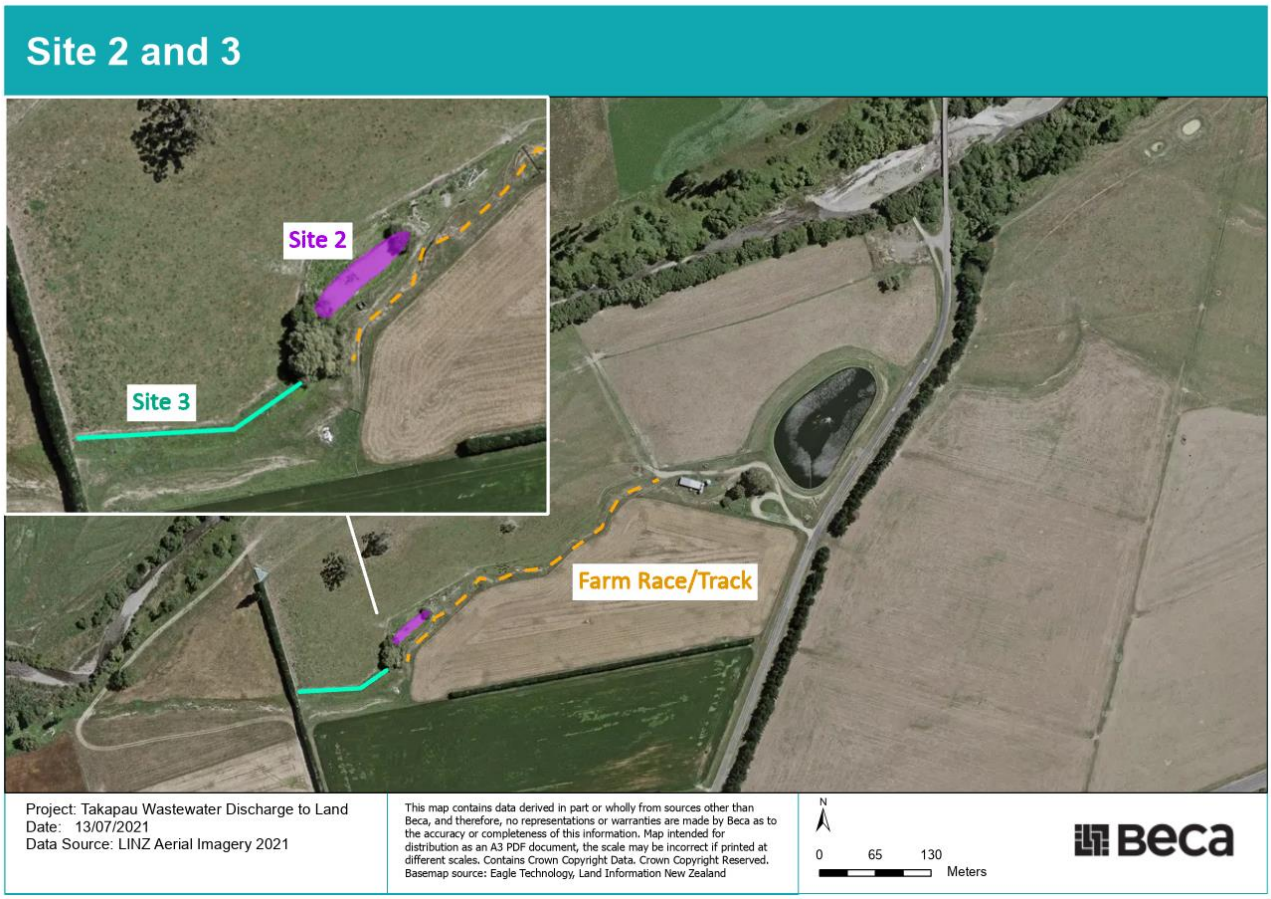

Figure 8. Site 2 indicated by purple polygon and Site 3 indicated by light blue line, as well as their locations.

b. Ephemeral overland flow channel (Site 3)

The **ephemeral overland flow channel** (hereafter referred to as Site 3; Figure 7) is artificially constructed and flows towards Site 2. To the east of Site 2, no overland flow path was present, only a farm race (as identified on Figure). Banks are approximately 60cm high and channel is approximately 2m wide, contains rooted vegetation throughout, and appears to be dug out. It is surrounded by grazed pasture and is not fenced to exclude stock.

Site 3 has been classified as a modified overland flow path due to the absence of surface water during the site visit, despite recent rain, and the rooting of terrestrial vegetation across the cross-sectional width of the channel. Species present included pasture grass, plantain (*Plantago* spp.), clover (*Trifolium* spp.), and narrow-leaved dock (*Rumex acetosa*).

Site 3 are assessed as having **Very Low** freshwater ecological value based on very low ratings for representativeness, and low ratings for rarity/distinctiveness, diversity and pattern, and ecological context (Table 3).

Table 3. Scoring and justification for assigned ecological value to Site 3.

Matter	Rating	Justification
Representativeness	Very Low	Significant channel modification has reduced habitat heterogeneity and riparian vegetation is largely absent.
Rarity/Distinctiveness	Low	Dominated by exotic species.
Diversity and Pattern	Very Low	Natural diversity and pattern compromised. Ongoing stock access.

Matter	Rating	Justification
		No flow – Low flow conditions. Little habitat complexity.
Ecological context	Low	Highly modified habitat subject to stock access, lack of riparian habitat.

Figure 7. Site 3 at the time of site visit looking toward Site 2.

4.2.2 Magnitude of Effects

A potential ecological effect of discharge of treated wastewater to land on Site 2 and 3 are **Alterations to hydrology** and the **Degradation of water and habitat quality.**

a. Alterations to hydrology

Treated wastewater discharged to land will percolate through the soil and drain into Site 2 and Site 3 on the adjacent farm. This will potentially cause a minor change in the hydrological regime by increasing soil moisture and the amount of water at Site 2 and Site 3. This is expected to cause no more than a minimal shift away from existing baseline conditions and thus is assessed as having a **Low** magnitude of effect.

b. Degradation of water and habitat quality

Discharge of treated wastewater, and eventually UV treated wastewater, to land via irrigation will be partially offset by a reduction in fertiliser application onto the farmland. However, overall, there will be a slight increase in nutrient losses to groundwater at the Site.

Nevertheless, the increase in nutrient inputs into Site 2 and Site 3 is assessed as a **Low** magnitude of effect, based on the expectation that it will cause a minor shift away from existing baseline conditions.

4.2.3 Overall Level of Effects

The ecological effects of the proposed treated wastewater discharge have been avoided in the first instance by designing the system to ensure application rates are matched to the soils and storage is provided for so over irrigation and runoff do not occur.

The Overall Level of Effect on both Site 2 and 3 are considered **Low**, as their Ecological Values were Low and Very Low respectively, and the Magnitude of Effect was Negligible for both.

5 Conclusion

In response to Question 29 as part of the Section 92 request:

Question 29: *Please provide an assessment of the ecological values of the overland flow path of the existing discharge (proposed HRLP) with comment on the effect on staged reduction in direct discharge to this overflow path that is proposed.*

The overland flow path (Site 1) was assessed as having **Low** ecological value. As its hydrologic functions are currently supported by the Takapau WWTP discharge, the wetland is expected to no longer exist following a reduction in the volume of treated wastewater discharged. This is assessed as having a **High** magnitude of effect. Site 1 is considered to be constructed wetland does not meet the definition of a 'natural wetland' in terms of the NES:FW.

Therefore, the Overall Level of Effect of staged reduction in direct discharge to this overland flow path (Site 1) that is proposed is **Low**. Overall effects are summarised in Table 4.

In response to Questions 24 and 30 as part of the Section 92 request:

Question 24: *As identified on the site visit, a drainage channel/waterway bisects the site along the toe of the upper terrace and is within the proposed irrigation area. Please provide an assessment of the potential effects of the irrigation to land on this channel and surrounding area. In addition, please provide comment whether the 20m setback proposed at Condition 9 will be suitable for this channel.*

Question 30: *Please provide an assessment of the ecological value of the existing drainage channels located within the proposed area of irrigation (including the ephemeral overland flow channel identified in point 23, above).*

Both the drainage channels (Site 2) and ephemeral overland flow channel (Site 3) were found to be compromised by land use pressures and were assessed as having **Low** and **Very Low** ecological values respectively. The ephemeral overland flow channel at Site 3 flows towards Site 2 and is not connected to the Makaretu River.

Given the Very Low ecological value of Site 3, lack of connection to the Makaretu River and absent surface water despite recent rain, a 20m setback may not be necessary to mitigate potential effects for this site.

The proposed discharge has been designed to minimise effects on the receiving environment by ensuring application rates are matched to the soils and storage is provided for so over irrigation and runoff do not occur. As such, it is expected to result in a low increase in nutrient inputs into Site 2 and 3 or a minor shift from baseline conditions, and is assessed as a **Low** magnitude of effect.

Therefore, the Overall Level of Effect to the drainage channels (Site 2) and ephemeral overland flow channel (Site 3) is **Very Low.** Overall effects are summarised in Table 4.

Table 4. Summary of potential ecological effects on ecological values including magnitude, level of effects and recommended mitigation measures

Potential ecological effect	Ecological component	Ecological Value	Magnitude of Effect (unmitigated)	Overall Level of Effect	Effects Management
Alterations to hydrology	Overland flow path (Site 1)	Low	High	Low	None
	Existing drainage channel (Site 2)	Low	Low	Very Low	
	Ephemeral overland flow channel (Site 3)	Very Low	Low	Very Low	
Degradation of water and habitat quality	Existing drainage channel (Site 2)	Low	Low	Very Low	Reduction in fertiliser application to adjacent farmland to partially offset nutrient application via wastewater irrigation.
	Ephemeral overland flow channel (Site 3)	Very Low	Low	Very Low	

6 References

Clarkson, B. (2018). *Wetland Delineation Protocols. Contract Report: LC3354.*

Forbes, A.; Stepheson, B.; Cameron, F.; Herbert, S; Bell, T. (2011). *Tukituki Catchment Terrestrial Ecology Characterisation. HBRC Plan No.4294*. https://www.epa.govt.nz/assets/FileAPI/proposal/NSP000028/Evidence-Submitters-evidence/0ecae7685f/Gerard-Land-Design-Evidence-Sara-Gerard-Appendix.pdf

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NIWA. (2021). *CliFlo: New Zealand National Climate Database*.

Roper-Lindsay, J., Fuller, S. A., Hooson, S., Sanders, M. D., & Ussher, G. T. (2018). *Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition*. Environmental Institute of Australia and New Zealand.

1

Appendix 1 – Ecological Impact Assessment (EIANZ methodology)

Appendix 1: Ecological Impact Assessment Guidelines

Assigning Ecological Value

Freshwater and terrestrial habitat

The ecological values of freshwater and terrestrial systems (riparian vegetation, habitats and species present) potentially impacted by the works were assessed against the following attributes:

- Representativeness;
- Rarity or distinctiveness;
- Diversity or pattern; and
- Ecological context.

These attributes are described in Table 1.1 and Table 1.2 below.

Table 1.1. Matters that may be considered when assigning ecological value to a freshwater site or area.

Matters	Attributes to be assessed
Representativeness	Extent to which site/catchment is typical or characteristic Stream order Permanent, intermittent or ephemeral waterway Catchment size Standing water characteristics
Rarity/distinctiveness	Supporting nationally or locally threatened, at risk or uncommon species National distribution limits Endemism Distinctive ecological features Type of lake/pond/wetland/spring
Diversity and pattern	Level of natural diversity Diversity metrics Complexity of community Biogeographical considerations - pattern, complexity, size, shape
Ecological context	Stream order Instream habitat Riparian habitat Local environmental conditions and influences, site history and development Intactness, health and resilience of populations and communities Contribution to ecological networks, linkages, pathways Role in ecosystem functioning – high level, proxies

Table 1.2. Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/ habitat/community.

Matters	Attributes to be assessed
Representativeness	Criteria for representative vegetation and aquatic habitats: Typical structure and composition Indigenous species dominate Expected species and tiers are present

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

The freshwater habitat features were assessed considering each of the attributes in Table 1.1, and terrestrial habitat features were assessed considering attributes in Table 1.2. Features of interest were subjectively given a rating on a scale of 'Very Low' to 'High' for each attribute and assigned a value in accordance with the description provided in Table 1.3.

Table 1.3. Rating system for assessing ecological value of terrestrial and freshwater systems (Roper-Lindsay et al. 2018)

Value	Description
Negligible	Feature rates Very Low for at least three assessment attributes and Low to Moderate for the remaining attribute(s).
Low	Feature rates Very Low to Low for most assessment attributes and moderate for one. Limited ecological value other than providing habitat for introduced or tolerant indigenous species.
Moderate	Feature rates High for one assessment attribute and Low to Moderate for the remainder, OR the project area rates Moderate for at least two attributes and Very Low to Low for the rest. Likely to be important at the level of the Ecological District.
High	Feature rates High for at least two assessment attributes and Low to Moderate for the remainder, OR the project area rates High for one attribute and Moderate for the rest. Likely to be regionally important.

Value	Description
Very High	Feature rates High for at least three assessment attributes. Likely to be nationally important.

Species

The EIANZ provides a method for assigning value (Table 1.4) to species for the purposes of assessing actual and potential effects of activities.

Table 1.4. Criteria for assigning ecological values to species

Ecological Value	Species
Very High	Threatened (Nationally Critical, Nationally Endangered, Nationally Vulnerable)
High	At Risk (Declining, Recovering, Relict, Naturally Uncommon)
Medium	Native – Not threatened
Low	Introduced

Assigning Magnitude of Impacts

The magnitude of impacts is determined by the scale (temporal and spatial) of potential impacts identified and the degree of ecological change that is expected to occur as a result of the proposed activity (Roper-Lindsay *et al*. 2018).

Based on the assessor's knowledge and experience, the magnitude of identified impacts on the ecological values within the project area and zone of influence were assessed and rated on a scale of 'Very High' to 'Negligible' based on the description provided in Table 1.5.

Table 1.5. Criteria for describing the magnitude of effects (Roper-Lindsay et al. 2018)

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

Assessment also considered the temporal scale at which potential impacts were likely to occur:

- Permanent (>25 years).
- Long-term (15-25 years).
- Medium-term (5-15 years).
- Short-term (0-5 years).
- Temporary (during construction)

Assessing the Level of Effects

The overall level of effect on each ecological feature identified within the zone of influence were determined by considering the magnitude of impacts and the values of impacted ecological features (Roper-Lindsay *et al*. 2018).

Results from the assessment of ecological value and the magnitude of identified impacts were used to determine the level or extent of the overall impacts on identified ecological features within the project area and zone of influence using the matrix described in Table 1.6.

Table 1.6. Matrix combining magnitude and value for determining the level of ecological impacts (Roper-Lindsay et al. 2018).

Effect Level		Ecological and/or Conservation Value				
		Very High	**High**	**Moderate**	**Low**	**Negligible**
	Very High	Very High	Very High	High	Moderate	Low
Magnitude	**High**	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

Results from the matrix were used to determine the type of responses that may be required to mitigate potential direct and indirect impacts within the project area and within the zone of influence, considering the following guidelines (Roper-Lindsay *et al*. 2018):

- A ‘Low’ or ‘Very Low’ level of impact is not normally of concern, though design should take measures to minimise potential effects.
- A ‘Moderate’ to ‘High’ level of impact indicates a level of impact that qualifies careful assessment on a case-by-case basis. Such activities could be managed through avoidance (revised design) or appropriate mitigation. Where avoidance is not possible, no net loss of biodiversity values would be appropriate.

A ‘Very High’ level of impact is are unlikely to be acceptable on ecological grounds alone and should be avoided. Where avoidance is not possible, a net gain in biodiversity values would be appropriate.

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Vegetation recorded within wetland vegetation plots onsite

Plot	Species	Scientific Name	Indicator status	Dominant
1	Watercress	*Nasturtium* spp.	OBL	Y
1	Mercer Grass	*Paspalum distichum*	FAC	Y
1	Cabbage Tree	*Cordyline australis*	FACW	
1	Sedge	*Carex* spp.	OBL	
1	New Zealand Flax	*Phormium tenax*	FACW	
1	Curled Dock	*Rumex crispus*	FAC	
1	Broadleaf Dock	*Rumex obtusifolius*	FAC	
2	Willow Weed	*Persicaria maculosa*	FACW	Y
2	Mercer Grass	*Paspalum distichum*	FACW	Y
2	Curled Dock	*Rumex crispus*	FAC	
2	Marsh Cudweed	*Gonocarpus micranthus*	FAC	
2	Watercress	*Nasturtium* spp.	OBL	