Whenuapai Wastewater Servicing Scheme Package 1

Ecological Impact Assessment

Prepared for Watercare Services Ltd
Prepared by Beca Limited

9 November 2023

Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
1	Jessica Schofield	Draft for Technical Review	04/04//2022
2	Jessica Schofield	Updated following construction changes	20/06/2022
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Document Acceptance

Action	Name	Signed	Date
Prepared by	Jessica Schofield Kimberley D'Souza		9/11/2023
Reviewed by	Raymond Chang		9/11/2023
Approved by	Jenny Vince		9/11/2023
on behalf of	Beca Limited		

Executive Summary

Beca Ltd has been commissioned on behalf of Watercare Services Ltd (Watercare) to prepare an Ecological Impact Assessment (EcIA) to support consenting requirements associated with Whenuapai Redhills: Package 1 Project (the Project). The works are located between Brigham Creek Road (north), the South-Western Motorway (west), Northside Drive (south) and Mamari Road (east). These works will provide a new wastewater pipeline and pumpstation to accommodate for the growth of the North West region of Auckland.

Three key elements are involved in these project works: a new gravity pipeline, a new pump station with an emergency wastewater overflow outfall into the stream, and a new rising main with a culvert.

Ecological site investigations have recently been undertaken by Tonkin & Taylor Ltd (T&T) over a series of site visits and surveys for a similar geographic area to inform a Plan Change application by Oyster Capital for Spedding Block. T&T's investigations of the area were undertaken between January and February 2020, July 2020, and a wetland specific site visit was undertaken in September 2020 to identify key terrestrial and freshwater ecological features across the site. This report *Tonkin & Taylor (2021) Plan Change Assessment of Ecological Effects – Spedding Block, Whenuapai* dated 3 September 2021; has been referred to, where appropriate, to avoid duplication of efforts. Additionally, site visits have been carried out by Beca in August 2023 to undertake baseline wetland surveys.

The potential adverse ecological effects identified as part of this EcIA are as follows:

Potential temporary construction stage effects:

- Sediment runoff and/or discharge of sediment laden water into streams
- Hydrological and physical disturbance to degraded natural wetlands
- Temporary reduction in fish passage
- Potential injury and/or mortality to fish
- Potential injury and/or mortality to bats
- Potential injury and/or mortality of lizards
- Disturbance to birds
- Removal of riparian vegetation

Potential permanent operational effects:

- Loss and disturbance to in-stream habitat
- Permanent loss of a section of degraded Wetland D

Effects management and mitigation proposed in this report to address these effects include implementation of environmental management during construction including:

- Native fish salvage and management plan
- Bat management
- Lizard management
- Bird management
- Wetland Monitoring and Reinstatement Plan
- Wetland and riparian vegetation restoration and planting plan
- Stream compensation

With the implementation of the mitigation measures listed above, the overall level of the ecological effects associated with these works is **Low**, with minimal residual adverse effects expected.

1 Introduction

The Whenuapai Redhills: Package 1 Project (the Project) is located between Tamiro Road, Brigham Creek Road (north), South-Western Motorway (west), Northside Drive (south) and Mamari Road (east). These works will provide a new wastewater pipeline and pumpstation to accommodate for the growth in the Whenuapai catchment.

Three key elements are involved in these project works: construction of a gravity main, a pump station with an emergency wastewater overflow outfall to the stream, and a rising main with culvert across Sinton Stream. In relation to potential ecological effects, these works will involve earthworks within the riparian yard and a wetland area, vegetation removal within a riparian area, and groundwater diversion and dewatering.

Beca has been commissioned on behalf of Watercare to prepare an Ecological Impact Assessment (EcIA) to support an application for resource consents for these proposed construction works.

1.1 Purpose and Scope

The purpose of this EcIA is to quantify the ecological values of the habitat and species within the proposed works footprint, and to determine the ecological impacts of the proposed works to construct the pipeline, rising main, and pump station.

The scope of this report includes the following:

- A desktop-based review of information held by Auckland Council and other publicly accessible reports, data, and information
- Site visits examining wetland, freshwater, and riparian habitat features affected by the area of works
- An assessment of the ecological values in the works area
- An assessment of ecological effects and recommended mitigation prepared in general accordance with the EIANZ Ecological Impact Assessment Guidelines (Roper-Lindsay et al., 2018)

1.2 Project Description

The Project aims to provide wastewater servicing capacity for approximately 10,240 dwellings, or 30,720 people, in the Whenuapai catchment. This growth is projected to occur by 2041. The Project includes the following five key components (see Figure 1):

1. A **Pump Station** at a point where the Whenuapai and Redhills Catchments meet at 23-27 Brigham Creek Road, with an emergency overflow outfall to the Sinton Stream
2. A **Gravity Main Pipeline** (approximately 700m long and 375 – 475 mm in diameter) between Whenuapai Village Pump Station on Tamiro Road and the new pump station
3. A **Rising Main** (approximately 1.4km long and 500 mm in diameter) between the Pump Station and a proposed new break pressure chamber on Mamari Road (the boundary of Package 2)[1].
4. A **Culvert** (approximately 63 m long including wing wall and rip rap) to provide access for the rising main across Sinton Stream.

[1] An extension of the rising main is part of 'Package 2' and will be designed to connect to the planned Northern Interceptor Phase 2 tunnel and deliver flows from the Whenuapai Catchment to the Rosedale Wastewater Treatment Plant for treatment. Package 2 is subject to a separate consent application.

5. A **Break Pressure Chamber** which connects to the Massey Connector rising main (proposed under Package 2).

The Project extends from the existing Whenuapai Village pump station site in Tamiro Road in the north, across Brigham Creek Road, to Spedding Road in the south. Refer to Beca Assessment of Effects on the Environment (AEE) for further specification of the relevant regulatory framework.

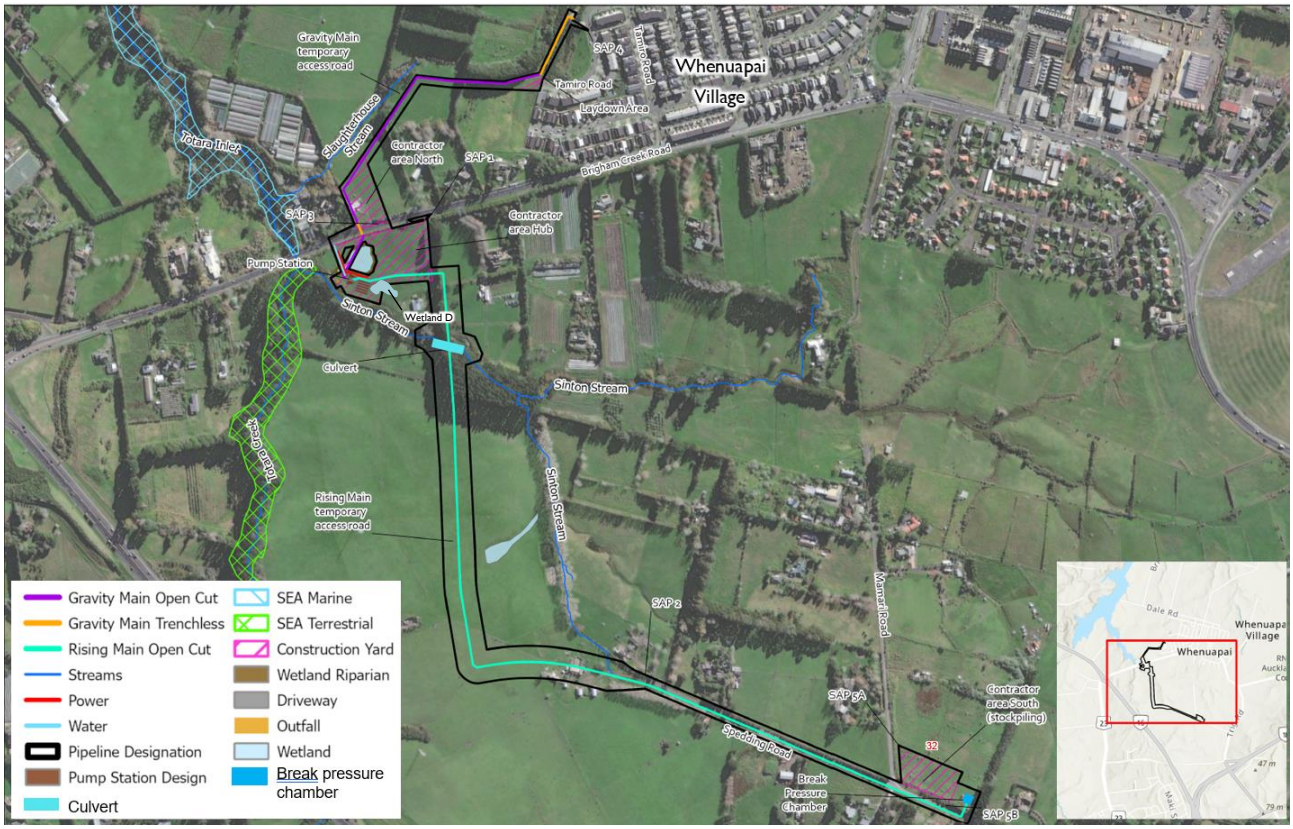

Figure 1. Package 1 – 'the Project' overview

1.2.1 Proposed Works Methodologies

The proposed works to construct the new pump station, gravity pipeline, and rising main will require works over a period of up to approximately 30 months. The gravity pipeline is intended to run underground for its full length. The rising main pipe will be primarily underground but will cross Sinton Stream via a culvert. Both pipelines will be installed predominantly by conventional open cut trenching to be opened and closed progressively, with trenchless methods used for a short section beneath Brigham Creek Road and near the existing Whenuapai Village pump station. The pump station will be predominately underground requiring excavation depths of approximately 9.5 m, constructed near Sinton Stream and a wetland area. For use during construction, a temporary metalled hardstand area of approximately 5,000 m^2 will be installed near the pump station and wetland. The construction of an emergency overflow outlet from the pump station wet well is required comprising an outlet of a new pipe, wingwall and rip rap on the bank of Sinton Stream. This will allow for the discharge into Sinton Stream if the pumping station becomes overloaded with wastewater.

2 Site Location and Ecological Context

The Site (refer Figure 2) is located in the suburb of Whenuapai, Auckland on the northeast border of the North-Western motorway. It sits within the Tamaki Ecological District which was historically characterised by taraire and pūriri forest, but has been subject to extensive vegetation clearance and landform modification for urban use over time (McEwen, 1987). Prior to any development, the Site would have been covered by a mixture of Pūriri forest (WF7), and Kauri, Podocarp, broadleaved forest (WF11) (Singers & Rogers, 2014). Currently, the site and surrounding land is predominantly pastoral lifestyle blocks.

The Site is within a predominantly rural-residential agricultural area in a Future Urban zoned area. The Site is within a High Use Aquifer Management Area, subject to a high number of water takes/allocations (Auckland Council, n.d.). There are a series of streams in the vicinity of the site area which discharge downstream into the Tōtara Inlet and Brigham Creek (Sinton and Slaughterhouse Streams). These eventually discharge into an arm of the Waitematā Harbour. Tōtara Creek is classified as a terrestrial Significant Ecological Area (SEA_T_2034) and Brigham Creek as a marine Significant Ecological Area (SEA_M2_57b) (refer Figure 2 for location). The key ecological areas and features within the Project vicinity are detailed in Section 5 below.

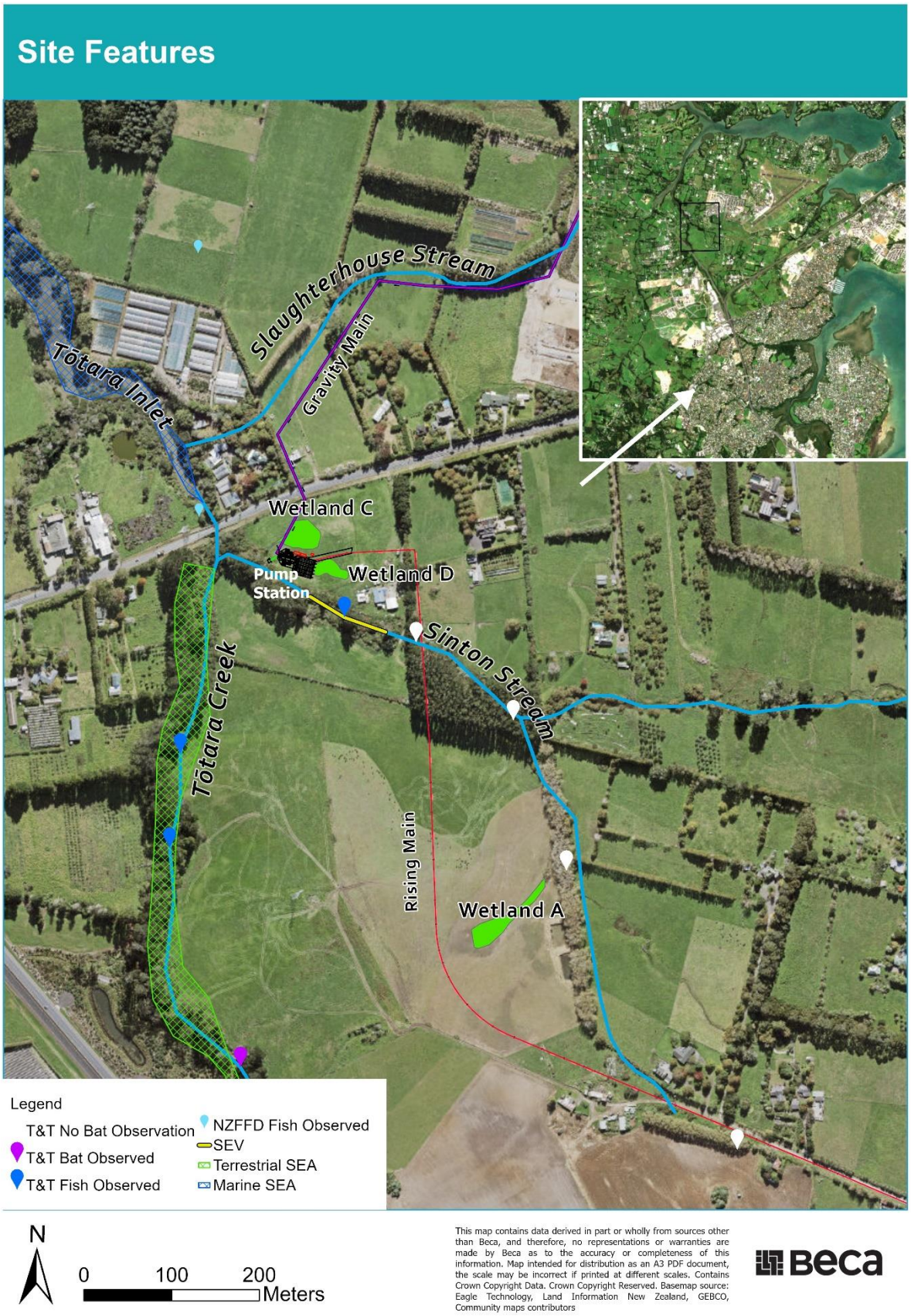

Figure 2: Site in relation to surrounding landscape features and fauna alongside gravity main, pumpstation, and rising main alignment.

3 Methodology

This report has been informed by a desktop review of existing information, field investigations (undertaken by others) and a site walkover by Beca Ltd as outlined below.

3.1 Desktop Review

A desktop based review was undertaken by Beca Ltd using ecological information from the following sources:

- Auckland Council GeoMaps data and geospatial layers including catchment and hydrology, ecosystems potential extent, SEAs;
- Previous Report: *Tonkin & Taylor Ltd, 2021. Plan Change Assessment of Ecological Effects – Spedding Block, Whenuapai.*
- New Zealand Freshwater Fish Database (NZFFD) (Crow, 2017); and
- Other publicly accessible reports or information.

The Tonkin & Taylor Ltd (T&T) report delineated the two 'natural wetlands' that are assessed in this report. A delineated 'natural wetland' is subject to regulation under the National Environmental Standards for Freshwater Regulations 2022 (NES FW 2022) (Ministry for the Environment, 2022b). Beca Ltd accept and rely on the wetland delineation and have used this as the basis for the assessment in this report.

3.2 Field Investigation

Comprehensive ecological field investigations were carried out by T&T between January and February 2020, and in July 2020, and along with a wetland specific site visit in September 2020. Data from this report has been used where appropriate and a brief description of methods are outlined below. Refer to (Tonkin & Taylor Ltd, 2021) for further details regarding the field investigation methods.

In addition, several site visits were undertaken by Beca between 2020 - 2023 including:

- A site walkover as part of the initial scoping on 28 February 2020 to view the Project location and identify any other ecological features of key importance.
- Following the identification of two potential wetlands (via desktop survey), detailed investigations were conducted on the 5th July 2022 in general accordance with the New Zealand Wetland Delineation Protocols (WDP) to classify potential wetlands and delineate extent where necessary (Clarkson, 2018; Clarkson, 2014; Fraser et al., 2018; Ministry for the Environment, 2021a, 2021b; see Figure 4 for overview).
- A third site visit in August 2023 to collect baseline samples and conduct wetland surveys at Wetland C and Wetland D.

The remaining ecological features have been identified and delineated through the T&T field investigations which we reference here and did not seek to validate separately.

3.2.1 Automatic Bat Monitoring

T&T deployed eight Department of Conservation (DOC) Automatic Bat Monitors (ABMs) across the site, targeting potential roosting trees and areas of likely bat foraging for a total of 20 nights in March 2020. This was to identify the presence of the long-tailed bat (*Chalinolobus tuberculatus*) with a conservation status of 'Nationally Critical'.

3.2.2 Vegetation assessment

Terrestrial habitat assessments were also completed following 'Rapid Ecological Assessment' methodology developed by Auckland Council (2012) to capture the species composition and ecological value of terrestrial vegetation at the site.

3.2.3 Fish and macroinvertebrate sampling

T&T undertook a fish survey was within Sinton Stream and Tōtara Creek. A combination of un-baited fyke nets (n = 3) and Gee minnow traps (GMTs) (n = 6) were deployed over one night in July 2020. Macroinvertebrate samples were taken with kick nets in Sinton Stream in July 2020.

3.2.4 Stream Ecological Valuation (SEV) for Sinton Stream

A Stream Ecological Valuation (SEV) (Storey, et al., 2011) was carried out by T&T for the impact reach where culvert construction will take place at Sinton Stream on 27th October 2020. The methodology includes a fish survey, aquatic macroinvertebrate sampling, cross-sections to record habitat characteristics such as depth and substrate, and qualitative assessment of attributes such as channel modification and riparian vegetation class. Different weightings are given to the different collections of attributes and the values of a stream are quantified based on the performance of 14 ecological functions, which fall under broader categories of hydraulic, biogeochemical, habitat provision and biodiversity (Storey, et al., 2011). These functions are used to determine an overall SEV value between 0 (a stream with the minimum ecological valuation) and 1 (a stream with the maximum ecological valuation) which is interpreted alongside SEV values for reference streams of the same stream type. Interpretation of SEV scores is given in Table 1.

Table 1. Interpretation of SEV scores (adopted from Neale et al., 2016).

Score	Category
0 – 0.4	Poor
0.41 – 0.60	Moderate
0.61-0.80	Good
0.81+	Excellent

An Ecological Compensation Ratio (ECR) can be calculated from SEV scores for an impact and mitigation reach by determining the difference between potential SEV scores after restoration at both reaches in comparison to their current values multiplied by a factor to account for lag in time before commensurate biodiversity values are achieved at the mitigation reach.

ECR = [(SEVi-P – SEVi-I) / (SEVm-P – SEVm-C)] × 1.5

- *SEVi-P is the potential SEV value for the site to be impacted.*
- *SEVi-I is the predicted SEV value of the stream to be impacted after impact.*
- *SEVm-C is the current SEV value for the site where environmental compensation is applied.*
- *SEVm-P is the potential SEV value for the site where environmental compensation is applied.*

Restoration length required = (impact area x ECR) / restoration channel width

3.2.1 Wetland delineation assessment of Wetlands A and C

A wetland delineation assessment to determine the wetland extent was undertaken by a suitably qualified ecologist from T&T during visits in both July and September 2020. The presence of two 'natural wetlands' (natural Wetland A and natural Wetland C) was confirmed during these visits.

3.2.2 Classification of additional potential wetland areas

Desktop screening for 'natural wetlands' was undertaken by Beca for each block of land using ArcGIS Pro 2.9.0 desktop geospatial software with a particular focus on the confirmed pipe alignment that had not previously been assessed by T&T. GIS data and ecological information were used from the following sources:

- Google Earth and LINZ aerial photography;
- Auckland Council geospatial layers;
- Retrolens historical imagery;
- Manaaki Whenua soil information from S-map (Manaaki Whenua, 2021);
- Freshwater Ecosystems of New Zealand (FENZ) historic wetland typology geospatial layer (Leathwick et al., 2010).

The topography and underlying geology of the site was first examined using contours, modelled overland flow paths and S-Map to understand where 'wet' areas might be located. The site was then examined for any predicted (prehuman arrival) wetland extents as modelled by Ausseil et al. (2008) and shown in FENZ geospatial layers (Leathwick et al., 2010). Subsequently, recent aerial imagery from Google Earth (accessed June 2022) and LINZ (accessed June 2022) were visually inspected for wetland features. The photography was analysed for hydrophytic plant communities using visual cues such as colour, shape, texture, and location. Particular attention was also paid to low stature vegetation which may be indicative of rushlands, and sharp changes in vegetation composition. The aerial imagery was also explored for any evidence of inundation (a primary indicator of wetland hydrology), and soil saturation (a secondary indicator of wetland hydrology).

To delineate the wetland boundary adjacent to the works area, a suspected boundary was determined using visual clues such as changes in topography and vegetation. Where boundaries were unclear, paired sample plots were established to help substantiate the boundary location where possible

Weather was cloudy with showers at the time of the site visit and 41.7mm mm of rain had accumulated in the two weeks prior (Whenuapai Aws; NIWA, 2021).

3.2.3 2023 Beca Wetland Survey (Wetland C and D)

As mentioned in the above section, wetland delineations were undertaken by T&T and their information has been utilised in this report. However, an additional site survey was undertaken to the location of the proposed pump station on 28th August 2023 on a calm and sunny day. The purpose of this field survey was to collect baseline assessment to inform the Wetland Monitoring and Reinstatement Plan (see Section 7.2.5) for Wetland C. During this survey another, previously unmapped, wetland feature was identified in the location of the proposed pump station (Wetland D).

Therefore, a wetland survey in general accordance with the Wetland Delineation Protocols (Ministry for the Environment, 2022c) was undertaken at this feature. This included:

- One wetland vegetation plot in an area of representative vegetation to identify species and record percentage coverage.
- An approximate boundary of the vegetation extent.
- One soil pit dug to a depth of approximately 25 – 30 cm to visually assess soils in accordance with the Hydric Soils Field Identification Guide (Fraser et al., 2018b).
- Hydrological investigation in line with the Wetland Delineation Hydrology Tool (Ministry for the Environment, 2021).

3.2.4 Wetland Data Analysis (Wetland D)

Following the field survey of the additional wetland area (further referred to as Wetland D), the data was analysed in accordance with the WDP. When applying the vegetation tests, a dominance test score of 50% and a prevalence index value of 2.9 – 3.1 is considered to be marginal, and the assessment is considered along with other indicators of wetland conditions such as soil and hydrology. Where hydric soils and hydrological indicators were present in proximity to the vegetation plot and there were no notable gradient changes, then the marginal vegetation results are interpreted as a positive for a wetland.

Mapping of the wetland boundary does not provide an exact extent as wetlands exhibit a gradation in vegetation, hydrology, and soils, the boundary can shift based on seasonal variations.

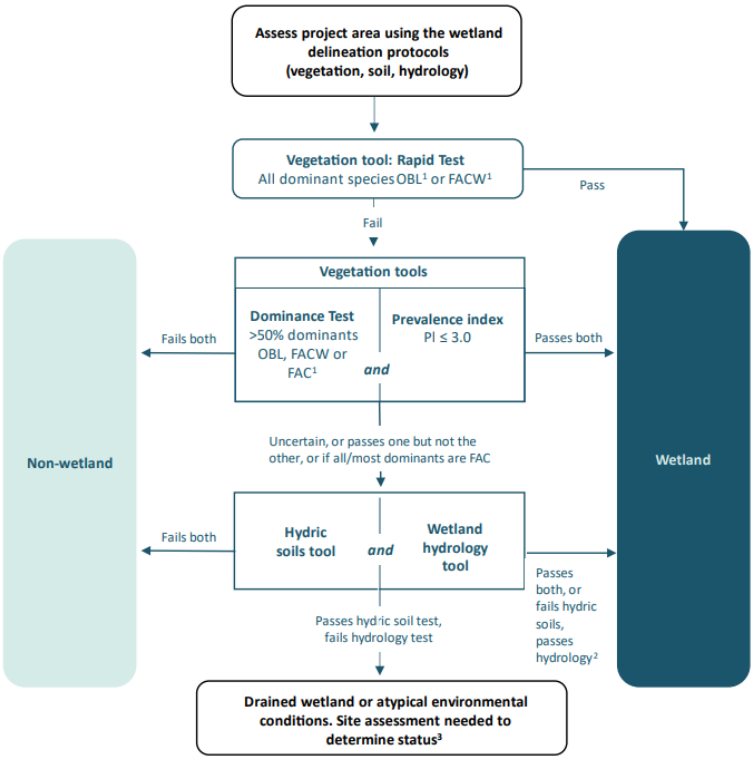

Figure 3. Assessing 'natural wetland' and 'natural inland wetland' status under the NPS-FM (MfE, 2022).

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 a series of tables in Appendix 1. In summary:

- Particular attributes are considered when determining ecological value or importance. These relate to matters such as representativeness, the rarity and distinctiveness, diversity and patterns, and the broader ecological context;
- The value of terrestrial species is determined from the following factors; whether species are native or exotic, have threatened conservation status, and their abundance and commonality at the Project site;

- Ecological Values are scored based on an expert judgement, and qualitative and quantitative data collected. The freshwater features assessment has additionally been guided by an adaption to the EIANZ methodology to provide linkage to some of the common stream ecological value assessment methodology.

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. This provides a magnitude of effect as determined by the criteria set out in Appendix 1.

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.

4 Wetland Classification

Figure 4. Potential wetland areas identified, investigated during site visit on 5th July 2022.

The two additional potential wetland locations (in addition to those already canvassed by T&T) were identified in the vicinity of the project works via desktop observations as these were observed to be areas of contour depression adjacent to the stream (potential wetland 1) and sloping down towards a stream

(potential wetland 2) (Figure 4). Areas such as this are considered indicators of potential wetlands. A site visit was undertaken on 5th July 2022 to delineate these potential wetland areas. After completing a wetland assessment (refer Appendix 4) following the wetland delineation protocols, these areas were confirmed to be **not** areas of natural wetland.

Neither of the two areas are modelled as historic wetland (Ausseil et al., 2008; Leathwick et al., 2010). In historic aerial imagery from 1959 (Figure 5). Potential wetland 1 consists of a stream channel and potential adjacent riverine wetland vegetation located within the floodplain. Potential wetland 2 consists solely of pasture in 1959, however since this time the area has been excavated for a silage storage area and drainage channel. This excavation has subsequently formed an area of contour depression.

These two potential wetland areas are mapped in Figure 4 and were investigated during the site visit in accordance with the methodology described in Section 3.2.2.

Figure 5. Aerial imagery from 1959 showing approximate locations of potential wetland areas (sourced from Auckland Council Geomaps, accessed 28/7/2022).

5 Ecological Features and Values

The following section assesses the current ecological values for the project (Figure 2). The potential ecological value of existing streams has also been assessed, following reasonable restoration as directed by the National Policy Statement: Freshwater Management (NPS FM) 2020. The key ecological features within the Project site for which value has been assessed are:

- Sinton Stream;
- Slaughterhouse Stream;
- Wetland A;
- Wetland C;
- Wetland D;

- Vegetation;
- Terrestrial Fauna.

5.1 National Policy Statement for Indigenous Biodiversity

The National Policy Statement for Indigenous Biodiversity (NPS-IB, 2023), which is newly gazetted and came into effect on 7th August 2023, seeks to maintain indigenous biodiversity across New Zealand so that there is at least no overall loss in indigenous biodiversity. The NPS-IB highlights the need for a cautionary approach to considering effects on indigenous biodiversity both within and beyond Significant Natural Areas (SNAs) and including areas supporting highly mobile fauna. Increased indigenous vegetation cover in urban and non-urban environments is promoted, as is information gathering and monitoring of indigenous biodiversity (Ministry for the Environment, 2023). At the same time, the NPS-IB recognises and allows for activities which contribute to New Zealand's social, economic, cultural, and environmental wellbeing.

At the date of the preparation of this report, the NPS-IB had not been incorporated into the AUP. However, many prevailing policy directions are contained in the AUP. A key area of difference is the AUP's reference to Significant Ecological Areas (SEAs), in contrast to the NPS-IB's process for determining Significant Natural Areas (SNAs).

The NPS-IB provides criteria for identifying SNAs in a matrix in Appendix 1 of the NPS-IB. These categories include representativeness, diversity and pattern, rarity and distinctiveness, and ecological context. An assessment for SNAs has not been undertaken within the Auckland region yet.

In the context of the project footprint, the riparian vegetation alongside Totara Creek has been identified as a terrestrial SEA (see Figure 2) in the AUP, where it meets the criteria for Threat Status and Rarity. The identified SEA is located adjacent to the project footprint and no clearance of habitat is currently proposed for this area.

Aside from the riparian vegetation, the remainder of the project footprint comprises of exotic and native grassy cover, exotic trees, scattered areas of native plants, and two low value wetlands (refer to the EcIA for the regional consent[2]). Additionally, land use is predominantly pastoral in this area.

As vegetation and habitat were surveyed as part of the scope of this report, there is adequate information available to apply an initial review by professional judgement to determine whether a feature may be an SNA (in accordance with Appendix 1:NPS-IB). The criteria met for this SEA (Threat Status and Rarity) outlined in the AUP (Chapter L: Schedule 3) has a similar set of sub-factors to the NPS-IB Rarity and Distinctiveness Criterion (Appendix 1: Section C). Both criteria stipulate that in order for the area to be considered as having significant ecological value it has to have rare/distinctive indigenous vegetation that is uncommon within the region/district and/or provide habitat for an indigenous species that is listed as Threatened or At Risk. For this reason, the SEA classified at Totara Creek is expected to meet the criteria for an SNA classification.

Therefore, the information available from the site visit indicates that the riparian vegetation along Totara Creek would meet the criteria for an SNA. However, as this area is located adjacent to the works area and no clearance is proposed for this area, the loss of vegetation/habitat has not been further considered within this report. Notwithstanding this, consideration has been given to the potential presence of long-tailed bats, which are classified as a highly mobile fauna species in Appendix 2 of the NPS-IB, and any potential effects on individuals during the construction phase of works (See Section 6).

[2] Beca Limited. (2023). Whenuapai Wastewater Servicing Scheme Package 1: Ecological Impact Assessment. Prepared for Watercare Services Limited.

5.2 Sinton Stream

Sinton Stream flows from east to west across the site, discharging into Tōtara Inlet and into Brigham Creek (refer Figure 2). The downstream reach of Sinton Stream is permanent with water flowing year-round. In-stream habitat heterogeneity is present (i.e., pool, riffle, run habitats). It has a mix of exotic and indigenous riparian vegetation providing moderate shading, including a large stand of pine trees (*Pinus* sp.) (Figure 6). Immediately downstream of the pine stand is a culvert approximately 5.1 m in stream length, identified to be flowing unimpeded through low flow conditions.

Figure 6. Sinton Stream crossing area pine shelter belt vegetation to be removed (top). Riparian vegetation at the proposed emergency overflow location at Sinton Stream (bottom). Image taken during Beca site visit 3 December 2021.

5.2.1 Stream Ecological Valuation

An SEV was completed for a 100 m reach of the Sinton Stream (refer Figure 2). The reach in its current ecological condition scored highest for its biogeochemical function (optimal oxygen availability and no surface reaching macrophytes) and hydraulic functionality (natural channel with no modifications), and lowest for biodiversity (riparian area low diversity) (see Table 2).The table below provides a score for Sinton Stream ecological value in its current form, and a score assuming future proposed riparian restoration. The overall SEV score of 0.69 for the stream in its current form demonstrates that it displays 'Good' ecological condition (Table 2).

Table 2: SEV scores for the Sinton Stream for four key ecological functions. Refer to Appendix 2 for detailed scorings.

Function Category	Sinton Stream Current	Sinton Stream Reach Potential assuming Restoration
Hydraulic	0.72	0.96
Biogeochemical	0.82	0.91
Habitat Provision	0.39	0.43
Biodiversity	0.42	0.27
SEV (excl IFI and FFI)	0.69	0.83
Overall mean SEV score	0.646	0.717

5.2.2 Freshwater Fish

The New Zealand Freshwater Fish Database (NZFFD) show records of several native fish species immediately upstream of the Project extent (Table 3) within Tōtara Creek. A similar range of species is expected to be present in Sinton Stream, as both Tōtara Creek and Sinton Stream are upstream tributaries of Tōtara Inlet. No fish records were available within Slaughterhouse Stream. Fish trapping at Tōtara Creek and Sinton Stream using fyke nets and gee minnow traps during the site survey by Tonkin & Taylor Ltd (2021) caught one shortfin eel (*Anguilla australis*), three longfin eel (*Anguilla dieffenbachii*), 41 inanga (*Galaxias maculatus*), nine banded kokopu (*Galaxias fasciatus*), and freshwater shrimp. Due to the presence of several native fish species, two of which have the conservation status of 'At Risk – Declining', the ecological value of fish present is assessed as **High**.

Table 3: Fish species recorded as present in Tōtara Creek in the NZFFD (Crow, 2017). Conservation status assigned using Dunn et al., (2018).

Species	Conservation Status	Abundance	Year Recorded
Shortfin eel (*Anguilla australis*)	Not Threatened	13	2019
Longfin eel (*Anguilla dieffenbachii*)	At risk - declining	13	
Banded kokopu (*Galaxias fasciatus*)	Not Threatened	3	
Inanga (*Galaxias maculatus*)	At risk - declining	1	
Common bully (*Gobiomorphus cotidianus*)	Not Threatened	244	
Crans bully (*Gobiomorphus basalis*)	Not Threatened	7	
Koura (*Paranephrops spp.)*	At risk - declining	2	
Rudd (*Scardinius erythrophthalmus*)	Introduced and Naturalised	4	

5.2.3 Macroinvertebrates

Macroinvertebrate Community Index (MCI) samples were taken by T&T for macroinvertebrates in Sinton Stream. These identified Sinton Stream to have an MCI value of 85 and QMCI of 3.8. This MCI value is classified within attribute band 'D' under the NPS FM (2020) below the national bottom line MCI value of 90 and QMCI value of 4.5, indicating poor macroinvertebrate diversity. These were noted to have been taken

post heavy rainfall in 48 hours prior to visit which may have influenced taxa richness somewhat, however it is likely this that these samples are representative of a stream system impacted by the surrounding agricultural land use. Therefore, the macroinvertebrate ecological value is classified as **Low**.

5.2.4 Overall

The reach of Sinton Stream at the Project site is assessed as having **Moderate** ecological value. This is based on the value of the sparse predominantly exotic vegetation providing partial shading (Low-Moderate), moderate fish diversity with several 'At risk' species (Very High, refer Section 5.2.2), degraded macroinvertebrate community (Low, refer Section 5.2.3), agricultural catchment (Low-Moderate).

The NPS FM 2020 directs a value assessment to consider the potential restored value of any freshwater feature being impacted. Following reasonable restoration (fencing and native vegetation planting) as directed by the NPS FM 2020, the stream could have increased effective habitat provision for fauna but will still be affected by the agricultural and developing residential – industrial catchment. Therefore, potential ecological value is assessed as **Moderate**.

5.3 Slaughterhouse Stream

Slaughterhouse Stream flows from east to west, discharging into Tōtara Inlet (refer Figure 2). There are several mature exotic trees surrounding the stream in shelterbelt patches, providing low to moderate shading value and is otherwise surrounded by farmland and lifestyle properties. This is a permanent stream with low flow rates and a natural channel bed comprised of predominantly stiff clay.

No information on fish present in this stream is available so the value of in-stream fauna cannot be considered for this stream in the assessment. However, because it connects to Tōtara Inlet it is likely it has a similar diversity of species to Sinton Stream.

There is sparse mixed native and exotic vegetation surrounding the stream and providing partial shading (with a Low-Moderate value). There is also a natural incised stream bank and surrounding agricultural uses in the catchment (contributing to a Low value rating). Therefore, the reach of Sinton Stream at the Project site is assessed as having a **Low-Moderate** ecological value in its current condition.

The NPS FM 2020 directs a value assessment to consider the potential restored value of any freshwater feature being impacted. Following reasonable restoration as directed by the NPS FM 2020, the stream could have increased effective habitat provision for fauna but will still be affected by the agricultural and developing residential – industrial catchment. Therefore, the potential ecological value of Slaughterhouse Stream is assessed as **Moderate**.

5.4 Wetlands

Three wetlands which meet the criteria of a *natural inland wetland* are located the project area. Two wetlands have been assessed by T+T, and one has been assessed, in 2023, by Beca ecologists. As Wetlands A, C, and D are all similar in terms of characteristics an overall ecological value score has been provided in Section 5.4.4.

5.4.1 Wetland A

Wetland A is located approximately 60 m east of the rising main and associated designation (refer Figure 2). This wetland has been delineated in Tonkin & Taylor Ltd (2021) and has been classified as a 'natural wetland', therefore subject to regulation under the NES FW (2020).

The wetland is within a slight topographical depression, which may be a historic tributary or flow path to the Sinton stream. The wetland area is highly modified and degraded as it is in a paddock with unrestricted stock

access. Exotic pasture grasses form the dominant cover (~88%), *Juncus edgariae* (~10%), and *Ranunculus repens*, *Plantago major*, *Trifolium repens*, and *Rumex obtusifolius* (~2%) (see Figure 7).

5.4.2 Wetland C

Wetland C is located approximately 10 m north of the proposed pump station location (refer Figure 2). This wetland is affected by the wastewater gravity pipe and pump station works and classified as a 'natural wetland' and therefore subject to regulation under the NES FW (2022).

This wetland has been delineated in Tonkin & Taylor Ltd (2021), and further vegetation surveys were undertaken by Beca ecologists in 2023. It has originally formed within a small overland flow path depression sloping towards Sinton Stream, however, has expanded over the last 1- 2 years likely from the abnormal weather conditions. Whilst the wetland extent is not well defined due to historical modification, this wetland has been delineated based on topographical depression changes and the extent of presence of wetland vegetation. Vegetation is dominated by soft rush (*Juncus effusus*), creeping buttercup (*Ranunculus repens*), and yorkshire fog (*Holcus lanatus*) (Figure 7). It is ephemeral, in terms of that it expands and contracts in extent seasonally based on hydrological conditions.

5.4.3 Wetland D

Wetland D is located adjacent to the proposed location for the pump station and will be directly impacted during the construction activities.

The wetland is located on a slope and likely receives surface water runoff, which has been extensive over the last 7- 8 months from the wetter-than-usual summer and winter experienced throughout Auckland in 2023. These conditions may have contributed (alongside other factors) to a relatively recent establishment and expansion of this wetland. Prior site visits undertaken in 2020 and 2021 had no indication of wetland characteristics in this area.

Vegetation within the wetland comprises of primarily exotic species and includes soft rush, creeping buttercup, yorkshire fog, and creeping bent (*Agrostis stolonifera*) (Figure 7). Soils were saturated, sticky, and plastic with some mottling and several indicators of hydrology were present. Soil samples were collected at one location (Appendix 5: Figure 5A) and underwent particle size distribution analysis. The results from this indicate that the planting wilting point (PWP) and field capacity (FC) occurs when soil moisture is between 10 – 29%, which would equate to between 20 – 56 mm of water in the soil.

The full results of the wetland delineation can be found in Appendix 5, and indicates that this area passes all three tests, therefore, meeting the criteria of a *natural inland wetland* under the NPS-FM (2022).

The vegetation boundary was mapped visually, primarily on the basis of where the vegetation indicated by the presence of *Juncus effusus* assembly appeared to change between the 'wetland' feature and non-wetland area. This is not well defined due to its highly modified nature, and it is important to note that it is likely that the boundary could be subject to seasonal changes to wetland vegetation that causes contraction and expansion. Overall, Wetland D is approximately 578 m^2 in size.

5.4.4 Ecological Value of Wetlands

As Wetlands A, C, and D are all similar in terms of characteristics an overall ecological value score has been provided. These wetlands are dominated by exotic species with no Threatened or At Risk vegetation identified, they are located in highly modified environments which has led to them being degraded pasture wetlands, and they provide little to no suitable habitat for any At Risk or Threatened wetland birds. For this reason, and as supported by the assessment undertaken by T+T, these wetlands have **Low** ecological value.

Figure 7. Wetlands identified within the project site. Wetland A (bottom), Wetland C (middle), and Wetland D (top).

5.5 Vegetation

Pasture grasses cover most of the terrestrial landscape, with exotic trees and shrubs forming shelter belts and riparian margins. Vegetation species along the riparian area of Sinton Stream are mostly exotic mature tree species with the presence of common native species with conservation status 'Not Threatened' (Table 4). Vegetation species alongside the riparian area of Slaughterhouse Stream include predominantly exotic mature trees. There is mixed native vegetation growing adjacent to existing Whenuapai Village Pump Station in the open space zone.

Table 4: Vegetation species observed within the Site.

Common Name	Scientific Name	Conservation Status	Location
-	*Eucalyptus spp.*	Exotic	Sinton Stream and Slaughterhouse Stream riparian area
Sugi Conifer	*Cryptomeria japonica*	Exotic	
Monterey Cypress	*Cupressus macrocarpa*	Exotic	
Pine	*Pinus radiata*	Exotic	Sinton Stream riparian area
Glossy Privet	*Ligustrum lucidum*	Exotic	
-	*Coprosma robusta*	Not Threatened	
Wheki	*Dicksonia squarrosa*	Not Threatened	
Ponga	*Alsophila dealbata*	Not Threatened	
Tauhinu	*Pomaderris amoena*	Not Threatened	
Red matipo	*Myrsine australis*	Not Threatened	
Black poplar	*Populus nigra*	Exotic	Slaughterhouse Stream riparian area
Weeping Willow	*Salix babylonica*	Exotic	
Mānuka	*Leptospermum scoparium var. scoparium*	At Risk – Declining	Open space zone
tī kōuka/Cabbage Tree	*Cordyline australis*	Exotic	
Harakeke/Flax	*Phormium tenax*	Exotic	

Vegetation present at the Project site comprises indigenous and exotic species (moderate representativeness), common weedy species along with native species with one species having 'At Risk – Declining' conservation status (moderate rarity/distinctiveness, low diversity and pattern). The vegetation present also forms a buffer from surrounding agricultural activities and an ecological corridor for freshwater fauna (moderate ecological context).

Overall, the vegetation in the open space zone and the riparian vegetation alongside both Sinton Stream and Slaughterhouse Stream is considered to have **Moderate** ecological value.

5.6 Terrestrial Fauna

5.6.1 Bats

An automatic bat survey was undertaken by Tonkin & Taylor Ltd (2021) to record long-tailed bat (*Chalinolobus tuberculatus*) activity. Two general locations were assessed:

1. Sinton Stream - the riparian margin and shelter belt vegetation
2. Tōtara Creek corridor

Long-tailed bat activity was recorded at two locations along the Tōtara Creek corridor, approximately 300 m from the works at the closest point (Figure 2). Whilst a high level of activity was not recorded during the survey, the long-tailed bat species have a conservation status of 'Threatened – national critical' and therefore the ecological value of any bats present is assessed as **Very High**.

5.6.2 Lizards

No records are present for native lizards within the site area. Incidental observations recorded in Tonkin & Taylor Ltd (2021) identified only the exotic Plague Skink (*Lampropholis delicata*) as present. It is possible the native copper skink (*Oligosoma aeneum*) species may be present within the areas where construction is planned due to presence of suitable habitat along riparian margins within rank pasture grasses and leaf litter. The ecological value of any lizards present is assessed as **Low** due to the limited likelihood of uncommon, 'At Risk' species being present.

5.6.3 Birds

Several common indigenous and exotic native birds species were observed within the site or have recorded observations within the vicinity as identified in Tonkin & Taylor Ltd (2021) during a site visit (refer to list in Table 5). All birds observed have the conservation status of either 'Introduced and Naturalised' or native 'Not Threatened'.

Table 5: Birds observed during Tonkin & Taylor Ltd (2021) site visit. Conservation status assigned using (Robertson et al., 2016).

Common Name	Scientific Name	Conservation Status
Welcome shallow	*Hirundo neoxena*	Not Threatened
White-faced heron	*Egretta novaehollandiae*	Not Threatened
Skylark	*Alauda arvensis*	Introduced and Naturalised
Paradise shelduck	*Tadorna variegata*	Not Threatened
Swamp harrier	*Circus approximans*	Not Threatened
Pukeko	*Porphyrio melanotus*	Not Threatened
Sacred kingfisher	*Todiramphus sanctus*	Not Threatened
Silvereye	*Zosterops lateralis*	Not Threatened
Kereru	*Hemiphaga novaeseelandiae*	Not Threatened
Spur-winged plover	*Vanellus miles*	Not Threatened
Yellowhammer	*Emberiza citrinella*	Introduced and Naturalised

The ecological value of the bird species present is assessed as **Low** due to the observed presence of introduced species or species of 'Not Threatened' status only.

6 Assessment of Ecological Effects

This section considers the potential temporary and permanent operational effects of the Project (without any recommended ecological management actions). The potential ecological effects of the Project include but are not limited to:

Temporary construction stage effects:

- Sediment runoff and/or discharge of sediment laden water into streams
- Physical and hydrological disturbance to Wetland C and D
- Temporary reduction in fish passage
- Potential injury and/or mortality to native fauna
- Disturbance to birds
- Removal of riparian vegetation

Permanent operational effects:

- Loss and disturbance to in-stream habitat
- Alteration of hydrology to Wetland C
- Alteration to hydrology and soils of Wetland D

6.1 Magnitude of Effects

Temporary effects

6.1.1 Sediment runoff and/or discharge of sediment laden water into streams

The construction of the pump station and culvert in the stream may result in sediment runoff into Sinton stream if not appropriately controlled. Discharge of sediment is also possible during the open trenching of the wastewater pipe, as the pipe runs adjacent to Slaughterhouse Stream and Sinton Stream for a section.

Sediment laden water or runoff during construction may impact ecological health of the streams by reducing water clarity and light attenuation, may smother benthic organisms upon settling, and reduce visibility for any fish present. A Erosion and Sediment Control Plan (ESCP) (refer Apendix H of the AEE) outlines the necessary methods to manage the risk of uncontrolled sediment runoff and discharge of sediment laden water into Slaughterhouse Stream, Sinton Stream, and Wetland C from the open cut pipe trenching works. Wetland A will not be affected as it is more than 40 m away from the pipe trenching works. The ESCP has been developed in accordance with industry best practice guidelines following Auckland Council GD05 - Guidance for Erosion and Sediment Control. With this management method, the management of effect is assessed as **Low.**

6.1.2 Temporary reduction in fish passage

For works to construct the culvert the temporary diversion of Sinton Stream is required. This involves the implementation of a cleanwater stream diversion channel lined with geotextile cut around the works site over an approximate 83 m length adjacent to the diverted reach of Sinton Stream, with geotextile-lined clay fill coffer dams at the entry and exit to the channel. The temporary diversion is expected to be in place for approximately 12 weeks. This will result in a temporary restriction of fish passage in the main stream, however still allows for water and fish to travel between up- and downstream of the diverted reach The magnitude of effect of this diversion is considered **Moderate**, with an overall **High** level of adverse effect, as the diversion may result in the temporary loss of in-stream functionality and disturbance to the natural passage of fish and other fauna.

6.1.3 Potential injury and/or mortality of native fauna

Freshwater fish

Works in the stream to construct the culvert in Sinton Stream may result in the potential injury and/or mortality of fish species present within the 71 m length of stream affected by the culvert works if not appropriately managed, indirectly from habitat degradation from the in-stream works or directly from injury during the works. As fish are protected under the Wildlife Act 1953 and there are two fish species noted to be present with a conservation status of ‘At Risk – Declining’, the magnitude of effect is **Moderate,** with an overall **High** level of effect.

Bats

The clearing of riparian vegetation along the Sinton and Slaughterhouse Stream riparian margin may affect terrestrial fauna habitat. Clearance of the stand of pine trees or other mature trees may result in damage to bat roosts if present. Mature trees with large diameters and cavities, flaking bark and split branches potentially offer bat roost habitat, therefore these mature pines trees have the potential to be used intermittently as bat roost trees. Bat activity has been detected along Tōtara Creek but not along the Sinton Stream, therefore the magnitude of effect of removal of these trees with very low likelihood of bats present is identified to be **Low**, with an overall **Very Low** level of effect, as the removal may result in the loss of a minor proportion of the range of these indigenous bat species protected under the Wildlife Act 1953.

Lizards

The riparian vegetation clearance at Sinton and Slaughterhouse Streams has the potential to cause injury and/or mortality of native copper skink if present on the site. Any lizards present would likely only be impacted if areas of long rank grass or where substantive leaf litter in the riparian zone is removed or disturbed. Given that no native lizards have been recorded in the area and although potential suitable habitat is present in the riparian zones, the magnitude of effect is expected to be **Low,** with an overall **Very Low** level of effect.

6.1.4 Disturbance to birds

The riparian vegetation clearance at Sinton and Slaughterhouse Streams are likely to result in temporary disturbance to avifauna. Due to their highly mobile nature, it is likely that direct impacts on birds will be largely avoided as they are expected to disperse to other habitats away from the riparian vegetation during the period of vegetation clearance. However, any nests present particularly in the mature pine trees may be damaged, and due to the length of the period of works there is risk of disturbance during the nesting season. The magnitude of this effect is expected to be **Low,** with an overall **Very Low** level of effect.

6.1.5 Minimisation of loss of natural wetland habitat at Wetland C

Groundwater drawdown and application of water

The temporary diversion and dewatering of groundwater will be required as a result of the pipe trenching for installation of 475 mm diameter PVC pipe and for construction of the pump station for a period for up to 2.5 years. This has the potential to alter the hydrological conditions of the wetland, subsequently influencing the vegetation community, which may impact the ecological value and functioning of Wetland C. The proposed construction methodology allows for the recharge of a portion of the diverted groundwater to be directed into Wetland C. This will be designed to maintain the winter extent of Wetland C for the duration of works. After the works cease "*groundwater levels are expected to return back to similar levels as prior to construction*" (Tonkin & Taylor Ltd, 2023, p.32).

During construction, the extent of Wetland C and the typical soil moisture content will be monitored through a Wetland Monitoring and Reinstatement Plan, which is detailed in Section 7. Overall, with the proposed dispersal of water to the wetland, these construction activities are not expected to result in any substantial effects to the hydrology of Wetland C.

Vegetation removal and soil disturbance

Construction access is required through Wetland C via a temporary access road adjacent to the alignment of the proposed pipeline. The road is expected to be 6 m wide and comprised of 300-400 mm of aggregate (refer to Construction Methodology by Brian Perry Civil, 2021). This works will result in the removal of vegetation and disturbance of the soil profile, however, will be removed following completion of construction and the area impacted reinstated as wetland.

Sediment runoff

Trenching works through Wetland C and the construction of the pump station directly adjacent may result in sediment runoff into the natural wetland. While wetlands naturally trap sediments as one of their ecosystem functions, this wetland has already been degraded by livestock grazing pressure and it may not be able to effectively buffer the sediment runoff. Any sediment runoff has the potential to temporarily degrade the ecological value and functioning of the wetland.

Summary

Overall, there is a potential risk of degradation of ecological value and function due to these works, particularly in relation to vegetation removal and sediment runoff, therefore the magnitude of effect is assessed as **Moderate**, with an overall **Low** level of effect.

6.1.6 Temporary loss of Wetland D and changes to hydrology and soils

The proposed location of the pump station is adjacent to Wetland D and the construction will require the excavation of soil to a depth of 3.5 m to remove the soil substrate (refer to the AEE for a full methodology)[3]. This is expected to result in the temporary clearance of approximately 140 m^2 of Wetland D including the removal of both vegetation and the alteration of the soil profile. This temporary clearance amounts to a quarter of Wetland D's extent.

Core penetration tests (CPT) undertaken in the vicinity of Wetland D by T+T indicate that soil behaviour type (SBT) in the top 0.3 m of the soil profile is clean sands shifting to stiff silts/clay between 0.3 – 1 m below ground (test pit # CPT-111 and CPT-112) (Tonkin & Taylor Ltd, 2023). This indicates that the top 1 m of the soil within this area is largely impermeable, but the top 0.3 m is more permeable, therefore allowing for water infiltration, but limited percolation further into the soil layer. The resulting effect is that soil saturation is expected to occur within the top 0.3 m of the soil layer, and once saturation is achieved further water input drains into the lower lying section of the land (Wetland C). This was evident during the site visit undertaken in August 2023, where soils were completely saturated within Wetland C, with areas of pooled and above ground water, whereas soils were wet in Wetland D, but any groundwater infiltration was much more gradual. For this reason, it is expected that Wetland D hydrology is primarily from surface water runoff during rainfall events, with some groundwater connection.

Despite this, the alteration of the soil profile of a quarter of Wetland D has the potential to limit water retention within the remaining extent of the wetland. Therefore, to minimise hydrological impacts and maintain wetland extent, it is proposed that dewatered water (from the excavation works) is discharged into Wetland D (as is being done for Wetland C), and this is detailed within Section 7.3.3 of this report. During construction, the extent of Wetland D and the typical soil moisture content will be monitored through a Wetland Monitoring and Reinstatement Plan, which is detailed in Section 7.

For this reason, the magnitude of effect is assessed as **High**, with an overall **Low** level of adverse effect. As this is expected to result in the major alteration of the composition and structure of the wetland, with potential to impact the remaining extent of the wetland from the changes to the adjacent soil profile and hydrology.

6.1.7 Removal of riparian vegetation

Clearing of riparian vegetation around Slaughterhouse and Sinton streams is required for the pipeline, the pipe bridge, and pump station construction. Removal of this predominantly exotic riparian vegetation may result in the loss of its buffer function, resulting in reduced prevention of runoff from surrounding paddocks entering the stream, reduced temperature regulation due to a reduction in shading, reduced organic inputs (leaf litter), and increased likelihood of bank erosion until the riparian area is restored (Collier et al., 1995). The riparian vegetation clearance is assessed as a **Moderate** magnitude of effect until new plantings mature over a moderate length time scale, with an overall **Moderate** level of effect.

[3] Beca Limited. (2023). Whenuapai Wastewater Servicing Scheme Package 1 – Notice of Requirement: Assessment of Effects on the Environment. Prepared for Watercare Services Limited.

Permanent Effects

6.1.8 Loss and disturbance to in-stream habitat

The construction of the culvert within Sinton Stream and the emergency overflow outfall, including the placement of riprap to prevent scour will disturb the in-stream and bank-side habitat. The section of the stream where the riprap and culvert are placed will be permanently modified, and this section of natural channel permanently lost, however fish passage will be sufficiently maintained due to the design of the 3500 x 3500 m concrete box culvert (with natural compacted clay bed, with no height/grade alterations). Sheet piling to support the stream embankment may disrupt the bank and riparian habitat integrity, with geotextile placed to prevent erosion.

To compensate for the loss of natural stream channel due to the construction of a culvert in Sinton Stream, and Environmental Compensation Ratio (ECR) was calculated from the SEV assessment of the impact reach (refer Storey et al., 2011).

It is noted that T&T considered permanent disturbance of a 71 m reach of Sinton Stream for the basis of calculating an ECR. However, the drawings available illustrate that the permanent effects of the proposed culvert crossing are 63 m in total. We have therefore provided an updated ECR based on a disturbed length of stream at 63 m.

The ECR identified that to compensate for the loss of 63 m of stream length (culvert length of 43.14 m, with a 5 m length of wingwall and 5m length of rip rap at each end of the culvert) due to the construction of the culvert crossing, 426 m of stream would be required for compensation based on the calculated ECR of 6.75:1 The calculation utilises the SEV values (determined by T&T) excluding IFI and FFI biotic functions as recommended in (Storey et al., 2011).

ECR

ECR = [(SEVi-P – SEVi-I) / (SEVm-P – SEVm-C)] × 1.5.

= [(0.83-0.2)/(0.83-0.69)]*1.5

= 6.75

Compensation Length

Compensation Length = [(impact length * stream width)* ECR)]/restoration channel width

= [(63.14*1.92)*6.75)]/1.92

= 426.2 m (818.3 m^2) total stream bed area

There is 440 m of Sinton Stream available and 474 m of Sinton A Stream available in terms of area for riparian plantings, therefore all restoration can be completed within the impacted stream.

In the EcIA prepared by T+T for the proposed subdivision works undertaken by Oyster Capital Limited, the loss of stream from the installation of a culvert at Sinton Stream has resulted in a total offset requirement of 544.5 m of offset (823 m^2) at both stream sections[4]. This is proposed to be offset as follows:

1. Plant 20 m both sides of Sinton Stream below the culvert, 297 m length, 570.2 m^2 streambed area
2. Plant 10 m on true left bank of SintonA, 247.5 m, 253.7 m^2 streambed area

[4] Tonkin & Taylor Limited. (2023). Ecological Impact Assessment: Stage 1 Subdivision and Roading. Prepared for Oyster Capital Limited.

This is a greater amount of mitigation proposed, therefore is considered appropriate to offset for the loss of permanent stream extent.

Additionally, the construction of the culvert and associated wing walls and riprap into the Sinton Stream will result in disturbance in the stream bed, impacting the heterogeneity of the river and disrupting fauna habitat. Although the culvert is designed specifically for low flow conditions, has a natural clay layer, and will not impede fish passage, this will result in the loss of a section of natural stream therefore the overall magnitude of effect is **High**, with an overall **High** level of effect.

6.1.9 Alteration of hydrology of Wetland C

The permanent occupation of a 475mm diameter PVC pipe approximately 2.8 m beneath the ground level of Wetland C is unlikely to result in the loss of extent or value of Wetland C in the long term. Minor alteration of soil profile will occur but at a depth that is not expected to alter the species composition or extent of wetland vegetation which is generally shallow rooted (typically within 1m of the ground level). The *Groundwater and Settlement Effects Report* by Tonkin & Taylor (2023) notes that once the pipeline is completed the manhole and pump station infrastructure will be a closed or watertight system. Therefore, "*groundwater levels are expected to return back to similar levels as prior to construction"* (Tonkin & Taylor Ltd, 2023, p.32). Once recharging of diverted groundwater into Wetland C ceases, the wetland is expected to also return to its original hydrologic conditions (Tonkin & Taylor Ltd, 2023).

The occupation of the pipe is also not anticipated to result in a material reduction in surface or groundwater flows through the wetland (Tonkin & Taylor Ltd, 2023). The magnitude of a potential alteration of hydrology because of the permanent occupation of the pipe is **Negligible**, with an overall **Very Low** level of effect**.**

6.1.10 Potential for the permanent alteration of Wetland D hydrology and soils

The clearance of ~ 140 m^2 of vegetation and soil (to a depth of 3.5 m) amounts to a quarter of the current (winter) extent of Wetland D. This clearance, albeit temporary (during construction), is expected to potentially impact the remaining 438 m^2 extent of Wetland D (see Section 6.1.6 for soil behaviour assessment).

In the short term, the earthworks and dewatering works for the pump station installation is expected to alter the hydrology of the wetland with a quarter of Wetland D being removed, therefore altering the soil profile. Because of this, there is potential that water retention within the remaining extent of Wetland D will not be sufficient to maintain its extent for the duration of the works. This is being addressed through water recharged into the wetland. However, following works completion if not managed appropriately, there is potential that in the long term, the altered soil profile of a quarter of Wetland D means will limit the potential for natural vegetation re-instatement to occur and there is potential that this area of wetland extent may permanently be lost.

For these reasons, the temporary works is expected to result in the permanent alteration of Wetland D. This is assessed as a **High** magnitude of effect with an overall **Low** level of effect, due to the major loss/alteration to the existing baseline conditions of Wetland D.

6.1.11 Summary of effects

Table 6: Summary of potential unmitigated ecological effects during these works.

Impact	Ecological component	Ecological Value (habitat or species)	Magnitude of Effect	Current Level of Effect (unmitigated)
Temporary				
Sediment runoff and/or discharge of sediment laden water into streams	Sinton Stream	Moderate	Low	Low
	Slaughterhouse Stream	Low-Moderate		Low

Impact	Ecological component	Ecological Value (habitat or species)	Magnitude of Effect	Current Level of Effect (unmitigated)
Sediment runoff and/or discharge of sediment laden water into wetland	Wetland C	Low	High	Low
Temporary reduction in fish passage	Sinton Stream	Moderate	Moderate	Moderate
Potential injury and/or mortality to fish	Freshwater fish	Very High	Moderate	High
Potential injury and/or mortality to bats	Bats	Very High	Low	Moderate
Potential injury and/or mortality of lizards	Lizards	Low	Low	Very Low
Disturbance to birds	Birds	Low	Low	Very Low
Temporary loss of degraded natural wetland habitat (due to groundwater drawdown, vegetation removal, excavation/trenching, and sediment runoff)	Wetland C	Low	Moderate	Low
	Wetland D	Low	High	Low
Removal of riparian vegetation	Sinton Stream	Moderate	Moderate	Moderate
	Slaughterhouse Stream	Low-Moderate		Moderate
	Vegetation	Moderate		Moderate
Permanent				
Loss and disturbance to in-stream habitat	Sinton Stream	Moderate	High	Moderate
Wetland disturbance and alteration to hydrology/soils	Wetlands C	Low	Negligible	Very Low
	Wetland D	Low	High	Low

7 Effects Management Recommendations

7.1 Effects Management

The following section recommends ecological management actions to remedy or mitigate the potential effects outlined in Section 6 above.

7.2 Minimisation

7.2.1 Native Fish Management Plan

Prior to in-stream works proceeding it is recommended that the impact reach be isolated (using stop-nets) and fish present in this section be caught and translocated to a suitable aquatic habitat (preferably downstream within Sinton stream). It is recommended that a Native Fish Management Plan is developed and implemented to minimise any potential impacts to native fish within the affected stream reach. This management plan should outline the procedures to salvage and safely relocate the native fish out of the impacted reach prior to instream works being undertaken. This will likely involve isolating the impact reach using stop-nets and a combination of trapping, slow dewatering and sorting through dewatered materials to

capture and safely relocate fish outside of the works zone. The stop-nets should be retained within the stream until the works are completed, to make sure that no fish re-enter this section of the stream.

7.2.2 Bat management

It is recommended that where there is vegetation removal of mature trees in riparian areas (in particular part of the Pine tree stand at Sinton Stream and the shelterbelt area at Slaughterhouse Stream) that these sites are surveyed for suitability of bat roost habitat. This should be done before clearance work begins by a suitably qualified ecologist to avoid the injury or mortality of roosting long-tailed bats in accordance with the Wildlife Act 1953.

7.2.3 Lizard management

Native lizards are protected under the Wildlife Act 1953 and the construction activities have the potential to impact native skink species. It is recommended that a lizard survey is completed prior to construction by a suitably qualified herpetologist confirm the presence/absence of lizards within the construction footprint prior to the commencement of works.

If native lizards are found to reside within the site, a lizard management plan will be required. Management will need to be developed and implemented by a DOC-permitted lizard ecologist (herpetologist), and prior to the start of works, adverse effects on native skinks present at the site will need to be mitigated by relocating them to protected, suitable habitat. Should lizard salvage and relocation be determined to be required, typical actions are expected to be the capture and release by an experienced herpetologist, outside of winter months and in accordance with Department of Conservation Wildlife Authority requirements. A lizard release site will need to be secured and should be under pest control both prior to and following relocation. The release site should also be monitored for lizard presence, abundance and habitat suitability outside of winter months.

All herpetology work should be carried out by a herpetologist who is experienced in lizard salvage and relocation operations and holds a current Wildlife Act Authority Permit to survey or undertake salvage and relocations.

7.2.4 Bird management

Vegetation clearance within the riparian areas may result in the disturbance of birds, particularly is nesting is occurring. Direct impacts to birds are expected to be avoided as they are anticipated to disperse to other habitats during the period of vegetation clearance. However, it is possible that bird nests could be present in the riparian vegetation planned for clearing. Therefore, risk of possible disturbance or ham could be reduced by undertaking vegetation clearance outside of nesting season (for most species between September and February). If this is not possible, the riparian areas planned for vegetation clearance will be survey for the presence of bird nest before clearance works begins by a suitably qualified ecologist in accordance with the Wildlife Act 1953.

7.3 Remediation

7.3.1 Wetland and riparian vegetation remediation and planting

Wetland C

As the Wetland C disturbance is unable to be avoided for pipe trenching and the associated access road, it will be remedied by planting of the wetland following construction. Wetland remediation will include the recontouring of land within the wetland that has been trenched to return the area to its original landform level, and planting of native wetland species appropriate to improve the ecological value and restore the

functioning of this natural ecosystem. The aim of this remediation is to provide at least the values lost by the construction of the trench and temporary access.

A planting plan has been developed by Watercare to allow for the native revegetation of areas of vegetation removal and construction works surrounding the pump station and Wetland C (see Appendix 3). This plan specifies new native plantings in the wetland near the pump station, and new plantings flax and sedges above the pump station surrounding the permanent hardstand. Native trees will be planted around the pump station for amenity.

As base flows through the wetland are unlikely to be materially reduced, effects management have not been specifically proposed with regard to this.

Planting the disturbed area of wetland and wetland margins should provide sufficient improvement of the wetland habitat affected by pipe trenching and construction of the temporary access track through the wetland area.

Riparian

The planting plan also specifies the re-plantings to occur in the riparian zone of Sinton Stream disturbed by the pump station works. Additionally, re-plantings with indigenous plant species comprising a variety of heights (small shrubs and larger trees) at other areas of vegetation removal is recommended, in the Sinton and Slaughterhouse stream riparian areas disturbed by open trenching.

The reinstatement of plantings and the removal of any exotic weed species present should provide sufficient management and remediation of any vegetation loss during the works, and assist to improve and maintain the ecological and indigenous habitat functionality of the stream habitat

Over medium to long term time scales, the plantings are expected to result in a net positive enhancement of the riparian and wetland areas.

7.3.2 Wetland Monitoring Plan for Wetland C during Construction Phase

A Wetland Monitoring and Reinstatement Plan[5] has been prepared and will be implemented for the duration of the dewatering and discharge activities during the construction phase of works to address potential impacts on both Wetland C and D.

In relation to Wetland C, this Plan provides a detailed methodology of the types and frequency of monitoring data to be collected from Wetland C over the course of the construction works. A baseline assessment of vegetation and soil has been collected in August 2023, which will provide the wet winter extent of Wetland C, from which changes will be compared to.

The main purpose of this Plan is to monitor the response of Wetland C during the continuous discharge of groundwater and identify if there have been any changes to the soil profile or vegetation community during this time. The Plan will also outline the response measures to be implemented, should changes to wetland structure and composition are identified, this will include potential changes to discharge quantity.

Following this, the wetland remediation planting will be undertaken as detailed in Section 7.3.1.

[5] Beca Limited, 2023. Whenuapai Wastewater Servicing Scheme Package 1: Wetland Monitoring and Reinstatement Plan. Prepared for Watercare Limited.

7.3.3 Wetland Reinstatement and Monitoring of Wetland D

As discussed under Section 7.3.2, a Wetland Monitoring and Reinstatement Plan has been prepared and will be implemented for the duration of the dewatering and discharge activities during the construction phase of works to address potential impacts on both Wetland C and D.

The proposed excavation works for the pump station are considered temporary works only, as once the pump station works is completed, the area will be reinstated. However, these works will result in the entire removal (soil and vegetation) of a quarter of Wetland D. This is expected to impact the hydrology of the wetland, potentially impacting the remaining extent of Wetland D too. Additionally, once works are completed, there is uncertainty as whether Wetland D will naturally re-vegetate due to excavation altering the soil profile.

As such, recommendations have been made within the Wetland Monitoring and Reinstatement Plan to make sure there is no net loss of extent and value to Wetland D both during and after construction works (Sections 4 and 5). This is briefly outlined below:

1. During the construction phase of works dewatered water from the excavation will be discharged into Wetland D (as is being done for Wetland C) in an effort to minimise any hydrological changes that may occur from the excavation a quarter of the wetland and to maintain the hydrological extent of the remaining extent of Wetland D.
2. Following works completion, the soil profile of Wetland D will be reinstated, and the area planted with appropriate native wetland species. Further details on the reinstatement guidelines are outlined within Section 4 of the Wetland Monitoring and Reinstatement Plan.
3. Wetland D will be monitored over a period of two years to make sure that the pre-development extent and value of Wetland D is achieved.

7.4 Compensation

7.4.1 Stream compensation

The loss and modification of a 63m length (121 m^2) of natural channel bed of the Sinton Stream as a result of the culvert crossing has the potential to negatively impact the overall ecological value of the stream. The Environmental Compensation Ratio (ECR) was calculated to be 6.75:1 (refer Storey et al., 2011). This requires a minimum 426.2 m in length of stream to be compensated. To compensate for the impact of this channel modification, a reach of Sinton stream is proposed to be enhanced with riparian habitat features, including planting 20m on both sides of Sinton Stream below the culvert (297m in length, 570.2m^2 of streambed area) and planting 10m on the true left bank of SintonA (247.5m in length, 253.7m^2 of streambed area). This will improve and maintain the ecological and indigenous habitat functionality of the Sinton stream freshwater environment.

With this implementation, this will achieve no net loss of ecological value at Sinton Stream and will likely result in an improved riparian area downstream of the culvert installation over a medium-to-long term time scale.

7.5 Overall Effects Assessment with Recommendations

A summary of the overall level of ecological effects following any related management measures is provided below in Table 7.

Table 7: Overall level of ecological effects with effect management implemented.

Impact	Ecological component	Ecological Value (habitat or species)	Effects management	Revised Magnitude of Effect	Revised/ Overall Level of Effect
Temporary					
Sediment runoff and/or discharge of sediment laden water into streams	Sinton Stream	Moderate	Erosion and Sediment Control	Low	**Low**
	Slaughterhouse Stream	Low-Moderate			**Low**
Sediment runoff and/or discharge of sediment laden water into wetland	Wetland C	Low	Erosion and Sediment Control	Low	**Very Low**
Temporary reduction in fish passage	Sinton Stream	Moderate	Native fish salvage	Low	**Low**
Potential injury and/or mortality to fish	Freshwater fish	Very High	Native fish salvage	Negligible	**Low**
Potential injury and/or mortality to bats	Bats	Very High	Survey for suitable bat roost habitat in clearance areas	Negligible	**Low**
Potential injury and/or mortality of lizards	Lizards	Low	Lizard survey to confirm presence/absence	Low	**Very Low**
Disturbance to birds	Birds	Low	Avoid nesting season or undertake nest checks	Negligible	**Very Low**
Temporary loss of degraded natural wetland habitat (due to groundwater drawdown, vegetation removal, sediment runoff)	Wetland C	Low	Wetland vegetation reinstatement and monitoring during construction	Low	**Very Low**
	Wetland D	Low	Wetland monitoring during construction, and reinstatement of soil and vegetation	Low	**Very Low**
Removal of riparian vegetation	Sinton Stream	Moderate	Riparian vegetation restoration	Low	**Low**
	Slaughterhouse Stream	Low-Moderate			**Low**
	Vegetation	Moderate			**Low**
Permanent					
Loss and disturbance to in-stream habitat	Sinton Stream	Moderate	Stream Compensation	Low	**Low**
Alteration to hydrology	Wetland C	Low	Wetland vegetation reinstatement and drip irrigation	Low	**Very Low**
	Wetland D	Low	Drip irrigation and wetland reinstatement	Low	**Low**

8 Conclusion

The construction activities required to build the wastewater gravity pipeline, pump station, and rising main may result in the adverse ecological impacts identified in this report. Appropriate measures to address these adverse ecological effects have been detailed and are required to be implemented to manage the effects of the construction works. To manage the impact of the works the implementation of the following have been proposed:

- Native fish salvage and management plan
- Bat management
- Lizard management
- Bird management
- Wetland monitoring for Wetland C
- Wetland monitoring and reinstatement for Wetland D
- Wetland and riparian vegetation restoration and planting plan for Wetland C
- Stream compensation

The overall level of ecological effects of the proposed construction works are **Low**, assuming the implementation of all recommended effects management measures. This means that effects will be discernible, but the underlying character, composition, and attributes of the existing baseline condition will be similar to pre-development circumstances over a short to medium term time scale.

Overall, if managed as recommended there may be a net gain in ecological value due to increased indigenous dominance in Wetland C and the riparian areas, which also has the potential to provide increased habitat for native fauna over a medium to long term time scale.

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Appendix 1 – Ecological Impact Assessment Guidelines

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10 Limitations

This report has been prepared by Beca Ltd solely for Watercare. This report is prepared solely for the purpose of the assessment of potential ecological effects of the proposed works (Scope). The report has been prepared to support a resource consent application and may be used by the Client and others in subsequent processes to consider the application to which the assessment pertains. The contents of this report may not be used by the Client for any purpose other than in accordance with the stated Scope.

Ecological Impact Assessment Guidelines

Assigning Ecological Value

The freshwater habitat features were assessed considering each of the attributes in Table A 1, and terrestrial habitat features were assessed considering attributes in Table A 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 A 3.

Table A 1. Attributes that may be considered when assigning ecological value to a freshwater site or area (adapted from Roper-Lindsay et al., 2018).

Value	Explanation	Characteristics
Very High	A reference quality watercourse in condition close to its pre-human condition with the expected assemblages of flora and fauna and no contributions of contaminants from human induced activities including agriculture. Negligible degradation e.g., stream within a native forest catchment	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 120 or greater. EPT richness and proportion of overall benthic invertebrate community typically high. SEV scores high, typically >0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat natural and unmodified.
High	A watercourse with high ecological or conservation value but which has been modified through loss of riparian vegetation, fish barriers, and stock access or similar, to the extent it is no longer reference quality. Slight to moderate degradation e.g., exotic forest or mixed forest/agriculture catchment.	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 80-100 or greater. EPT richness and proportion of overall benthic invertebrate community typically moderate to high. SEV scores moderate to high, typically 0.6-0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy. No pest or invasive fish (excluding trout and salmon) species present. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat largely unmodified.
Moderate	A watercourse which contains fragments of its former values but has a high proportion of tolerant fauna, obvious water quality issues and/or sedimentation issues. Moderate to high	Benthic invertebrate community typically has low diversity, species richness and abundance.

Value	Explanation	Characteristics
	degradation e.g., high-intensity agriculture catchment.	Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments. Benthic community typically with dominant species or group of species. MCI scores typically 40-80. EPT richness and proportion of overall benthic invertebrate community typically low. SEV scores moderate, typically 0.4-0.6. Fish communities typically moderate diversity of only 3-4 species. Pest or invasive fish species (excluding trout and salmon) may be present. Stream channel and morphology typically modified (e.g., channelised) Stream banks may be modified or managed and may be highly engineered and/or evidence of significant erosion. Riparian vegetation may have a well-established closed canopy. Habitat modified.
Low	A highly modified watercourse with poor diversity and abundance of aquatic fauna and significant water quality issues. Very high degradation e.g., modified urban stream	Benthic invertebrate community typically has low diversity, species richness and abundance. Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments. Benthic community typically with dominant species or group of species. MCI scores typically 60 or lower. EPT richness and proportion of overall benthic invertebrate community typically low or zero. SEV scores low to moderate, typically less than 0.4. Fish communities typically low diversity of only 1-2 species. Pest or invasive fish (excluding trout and salmon) species present. Stream channel and morphology typically modified (e.g., channelised). Stream banks often highly modified or managed and maybe highly engineered and/or evidence of significant erosion. Riparian vegetation typically without a well-established closed canopy. Habitat highly modified.

Table A 2. Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/ habitat/community (Roper-Lindsay et al., 2018).

Matters	Topics for which criteria are needed
Representativeness	Criteria for representative vegetation and aquatic habitats: Typical structure and composition Indigenous species dominate Expected species and tiers are present Thresholds may need to be lowered where all examples of a type are strongly modified Criteria for representative species and species assemblages: Species assemblages that are typical of the habitat Indigenous species that occur in most of the guilds expected 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 utilization
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

Table A 3. Rating system for assessing ecological value of a freshwater or terrestrial system (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.
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 A 4) to species for the purposes of assessing actual and potential effects of activities.

Table A 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	Locally uncommon/rare, not nationally threatened or at risk
Low	Not threatened nationally, common locally

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 A 5.

Table A 5. Summary of the criteria for describing the magnitude of effect (Roper-Lindsay et al., 2018).

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

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 Overall Level of Effects

The overall level of effect on each ecological feature identified within the zone of influence were determined by considering the and the Value of impacted ecological habitat and species, and the Magnitude of impacts identified above (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 below.

Table A 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 unlikely to be acceptable on ecological grounds alone and should be avoided. Where avoidance is not possible, a net gain in biodiversity values may be appropriate.

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Appendix 2 – SEV Scores Sinton Stream

Table 2A: Detailed SEV scores for Sinton Stream (Tonkin & Taylor Ltd, 2021).

Function category	Report section*	Function	Variable (code)	Sinton Stream	Sinton Potential
			Vchann	0.93	0.95
			Vlining	0.98	0.99
			Vpipe	1.00	1.00
Hydraulic	**4.1**	**NFR**	**=**	**0.95**	**0.96**
			Vbank	0.92	0.92
			Vrough	0.73	0.96
Hydraulic	**4.2**	**FLE**	**=**	**0.67**	**0.88**
			Vbarr	0.30	1.00
Hydraulic	**4.3**	**CSM**	**=**	**0.30**	**1.00**
			Vchanshape	0.90	0.96
			Vlining	0.98	0.99
Hydraulic	**4.4**	**CGW**	**=**	**0.95**	**0.98**
			Hydraulic function mean score	**0.72**	**0.96**
			Vshade	0.74	0.90
biogeochemical	**4.5**	**WTC**	**=**	**0.74**	**0.90**
			Vdod	1.00	1.00
biogeochemical	**4.6**	**DOM**	**=**	**1.00**	**1.00**
			Vripar	0.85	1.00
			Vdecid	1.00	1.00
biogeochemical	**4.7**	**OMI**	**=**	**0.85**	**1.00**
			Vmacro	1.00	1.00
			Vretain	0.94	0.98
biogeochemical	**4.8**	**IPR**	**=**	**0.94**	**0.98**
			Vsurf	0.37	0.37
			Vripfilt	0.82	0.96
biogeochemical	**4.9**	**DOP**	**=**	**0.59**	**0.66**
			Biogeochemical function mean score	**0.82**	**0.91**
			Vgalspwn	0.00	0.00
			Vgalqual	0.00	0.75
			Vgobspwn	0.20	0.20
habitat provision	**4.10**	**FSH**	**=**	**0.10**	**0.10**
			Vphyshab	0.79	0.99
			Vwatqual	0.47	0.55
			Vimperv	0.70	0.50
habitat provision	**4.11**	**HAF**	**=**	**0.69**	**0.76**

			Habitat provision function mean score	**0.39**	**0.43**
			Vfish	0.67	0.00
Biodiversity	**4.12**	**FFI**	**=**	**0.67**	**0.00**
			Vmci	0.02	0.02
			Vept	0.00	0.00
			Vinvert	0.12	0.12
Biodiversity	**4.13**	**IFI**	**=**	**0.05**	**0.05**
			Vripcond	0.55	0.76
			Vripconn	1.00	1.00
Biodiversity	**4.14**	**RVI**	**=**	**0.55**	**0.76**
			Biodiversity function mean score	**0.42**	**0.27**
SEV (excl IFI and FFI)				**0.69**	**0.83**
Overall mean SEV score (maximum value 1)				**0.646**	**0.717**

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Appendix 3 – Watercare Planting Schedule

Table 3A: Schedule of plantings around wetland, stream, and pump station supplied by Watercare.

PLANT SCHEDULE							
Code	***Botanical Name***	**Common Name**	**Unit/ Grade**	**Max. Growth Size (H x W)**	**Plant Spacing (mm)**	**Percentage Mix**	**TOTAL (no.)**
Wetland Riparian Planting							
CAR GEM	Carex geminata	Cutty Grass	1L/PB2	1.0 x 1.0m	750	10%	180
CAR VIR	Carex virgata	Pukio / Swamp Sedge	1L/PB2	1.0 x 1.0m	750	20%	360
COR FUL	Cortaderia fulvida	Toetoe	1L/PB2	1.5 x 1.5m	1000	30%	300
PHO COO	Phormium cookianum	Whararíki / Mountain Flax	1L/PB2	1.5 x 1.5m	1000	10%	100
PHO TEN	Phormium tenax	Harakeke / NZ Flax	1L/PB2	3.0 x 2.0m	1000	30%	300
Pump Station Low Amenity Planting							
CAR TES	Carex testacea	Grass / Sedge	2L/PB3	0.6 x 0.6m	500	20%	530
CAR VIR	Carex virgata	Pukio / Swamp Sedge	1L/PB2	1.0 x 1.0m	500	20%	530
COR FUL	Cortaderia fulvida	Toetoe	1L/PB2	1.5 x 1.5m	1000	10%	66
DIA NIG	Dianella nigra	Turutu	2L/PB3	0.5 x 0.5m	500	10%	265
PHO 'EG'	Phormium 'Emerald Gem'	Dwarf Flax	2L/PB3	0.6 x 0.6m	500	20%	530
PHO 'JS'	Phormium 'Jack Spratt'	Ornamental Flax	2L/PB3	0.6 x 0.6m	500	20%	530
Pump Station Screening Planting							
HEB STR	Hebe stricta	Koromiko	2L/PB3	2.5 x 1.5m	1000	25%	31
KUN ERI	Kunzea ericoides	Kanuka	2L/PB3	10.0 x 4.0m	2000	25%	31
LEP SCO	Leptospermum scoparium	Manuka	2L/PB3	4.0 x 3.0m	2000	25%	31
PHO TEN	Phormium tenax	Harakeke / NZ Flax	1L/PB2	3.0 x 2.0m	1000	25%	31
		Mahoe					
Stream Bank Reinstatement Planting							
COR FUL	Cortaderia fulvida	Toetoe	1L/PB2	1.5 x 1.5m	1000	30%	92
PHO COO	Phormium cookianum	Whararíki / Mountain Flax	1L/PB2	1.5 x 1.5m	1000	30%	92
PHO TEN	Phormium tenax	Harakeke / NZ Flax	1L/PB2	3.0 x 2.0m	1000	40%	122
						Sub Total	4121

TREE SCHEDULE						
Code	***Botanical Name***	**Common Name**	**Unit/ Grade**	**Max. Growth Size (H x W)**	**Plant Spacing (mm)**	**TOTAL**
CA	Cordyline asutralis	Cabbage Tree / Ti Kouka	PB18	10.0 x 2.0m	as shown	26
DD	Dacrycarpus dacrydioides	Kahikatea / White Pine	PB18	30.0 x 10.0m	as shown	6
MR	Melicytus ramiflorus	Mahoe / Whiteywood	PB18	5.0 x 4.0m	as shown	3
PR	Plagianthus regius	Manatu / Ribbonwood	PB18	12.0 x 4.0m	as shown	7
VL	Vitex lucens	Puriri	PB18	10.0 x 10.0m	as shown	3
					Sub Total	45

Planting Locations

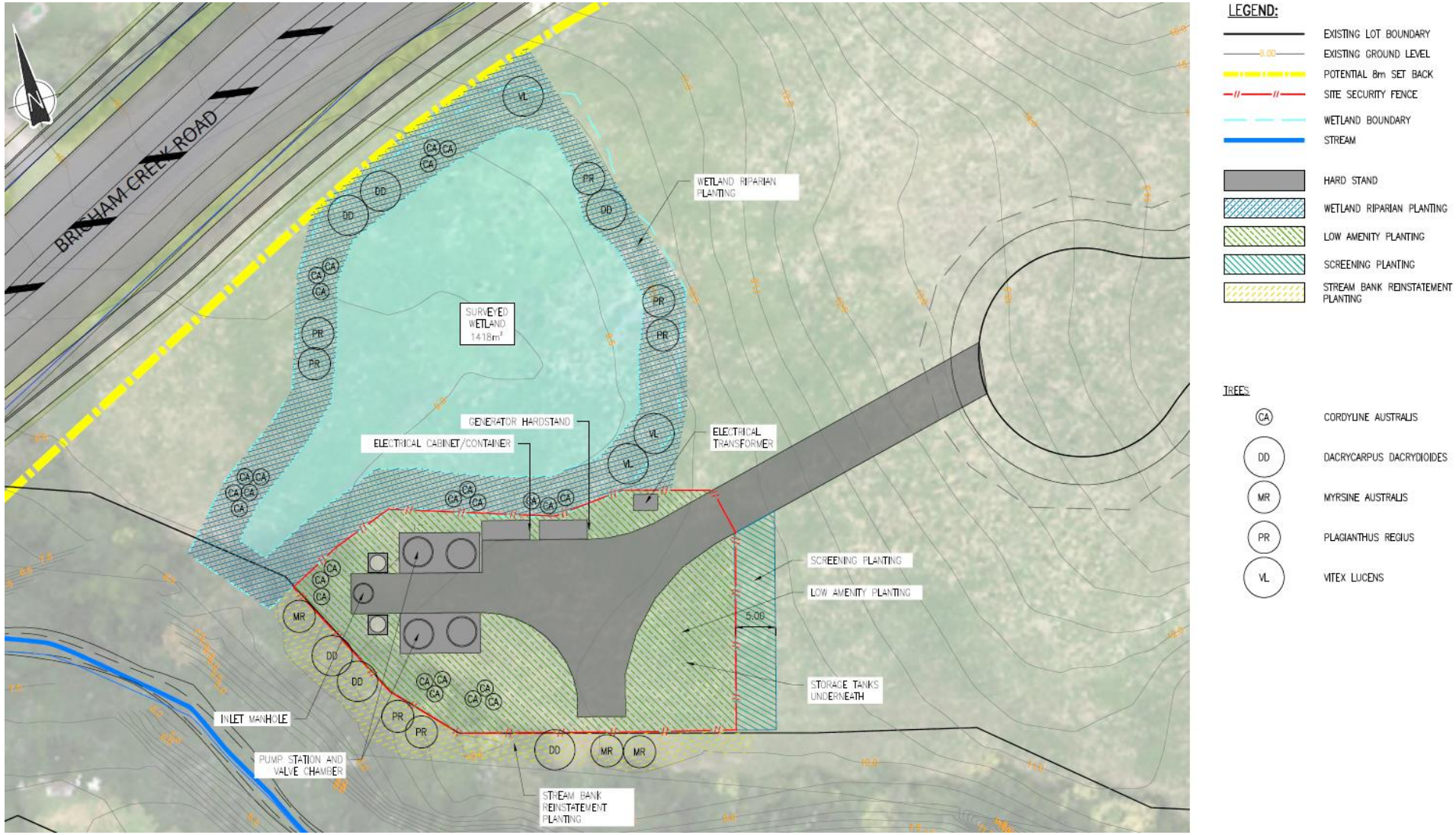

Figure 3A: Location of plantings in riparian area, wetland area, and above proposed pump station.

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Appendix 4 – Plot Results of Potential Wetlands 1 and 2

Potential Wetland 1

Potential wetland 1 is located on a low-lying river terrace that slopes down to Slaughterhouse stream. The putative wetland area is discussed in terms of vegetation, soils, and hydrology below (refer Figure 4a for the locations of each plot).

Four vegetation plots were completed within the potential wetland area, and one at the toe of a slope further south. Results of these investigations are shown in Table 4a and 4c.

Plots 1-2 both consisted predominantly of pasture species and non-hydric vegetation and thus were assessed as non-wetland.

Plot 4 was located along at the edge of Slaughterhouse stream and consisted almost solely of creeping buttercup with a small amount of Yorkshire fog. This plot passed the dominance test, returned an uncertain prevalence index (between 2.5 and 3.5) and had saturated soils (primary indicator of hydrology; 1C), likely due to its proximity to the stream and recent rainfall. However, soils were not typically hydric and no FACW or OBL species were present within the plot or surrounding area (excluding macrophytes growing within the stream channel itself). As vegetation is not adapted to wet conditions, this area is considered to be a non-wetland.

Plots 5 and 6 were located on the river terrace. Plot 5 was dominated by creeping buttercup, Yorkshire fog and Geranium sp. Plot 6 was dominated by creeping buttercup, mock strawberry and hedge woundwort. Both plots passed the dominance test, returned uncertain prevalence index scores (between 2.5 and 3.5) and had saturated soils (primary indicator of hydrology; 1C). However, as it is likely that soils were only saturated due to recent rainfall, and no FACW or OBL species were present within the plot or surrounding area, these areas are also assessed as non-wetland. In addition, a depression within the main river channel was colonised by taro (*Colocasia esculenta*) of approximately 2m^2 area with no other FACW or OBL species surrounding the location. Taro is a FACW species however this area was very localised, and we do not consider that this species is indicative or representative of the vegetation cover across this potential wetland extent.

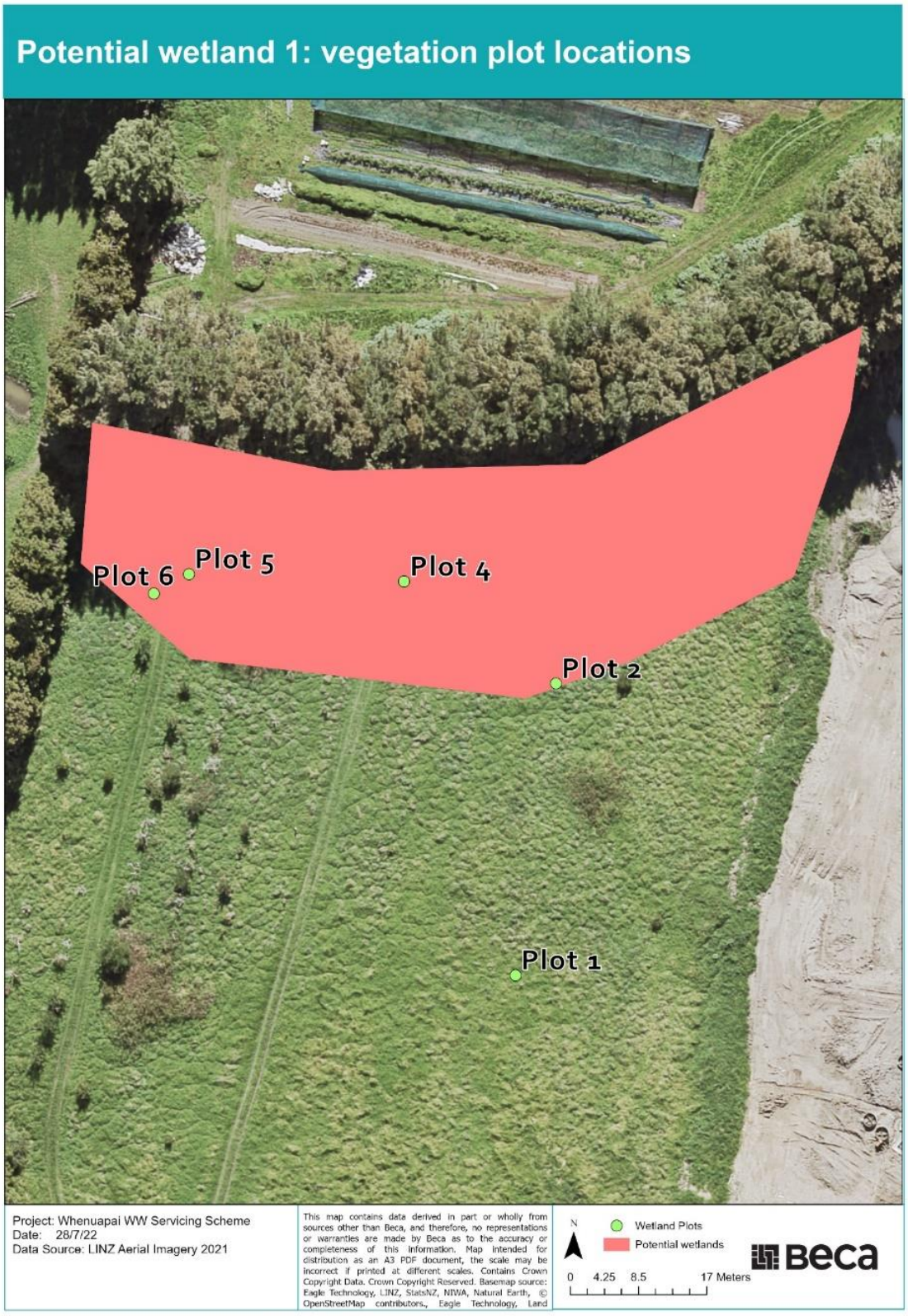

Figure 4a. Locations of vegetation plots completed within and adjacent to Potential Wetland 1.

Table 4a. Plot results following the wetland delineation protocols for potential wetland 1.

Plot	Rapid Test	Pasture Test	Dominance Test	Prevalence Index	Hydrology	Soils	Classification	Notes
1	Fail	Pass - 94%	Fail - 0%	Fail - 3.9	Absent	Non-hydric	Non-wetland	Fails vegetation tests
2	Fail	Pass - 89%	Fail - 0%	Fail - 3.9	Absent	Subsoil hydric	Non-wetland	Fails vegetation tests
4	Fail	Fail - 5%	Pass - 100%	Uncertain - 3.0	Present (1C)	Non-hydric – silt loam	Non-wetland	Fails FAC-neutral test – no FACW or OBL species present. Soil saturation likely a result of recent rainfall and/or adjacent stream level.
5	Fail	Fail - 47%	Pass - 100%	Uncertain - 3.1	Present (1C)	Non-hydric – silt loam	Non-wetland	Fails FAC-neutral test – no FACW or OBL species present. Soil saturation likely a result of recent rainfall rather than wetland hydrology
6	Fail	Fail - 2%	Pass - 100%	Uncertain - 3.0	Present (1C)	Not investigated	Non-wetland	Fails FAC-neutral test – no FACW or OBL species present. Soil saturation likely a result of recent rainfall rather than wetland hydrology

Potential Wetland 2

Potential Wetland 2 consists of an excavated storage area historically for silage and an artificial watercourse that drains it. Four plots were completed here near the base of the storage area, and one further west along the drainage channel. Results of these investigations are shown in Table 4b and 4d.

Plots 8-11 were located downslope of the excavated storage area. Plot 8 consisted predominantly of creeping buttercup, creeping bent, and perennial ryegrass. This plot passed the dominance test, returned an uncertain prevalence index (between 2.5 and 3.5) and did not show any hydrology indicators. Creeping bent was the only FACW species, therefore vegetation largely considered to be not adapted to wet conditions and in the absence of hydrological indicators, this area is considered to be a non-wetland.

Plot 9 consisted predominantly of white clover, kikuyu, perennial ryegrass, and *Juncus australis*. As this plot passes the pasture test, and has no hydrology indicators or hydric soils, this area is considered to be non-wetland.

Plot 10 consisted predominantly of p*aspalum dilatatum* and bird's-foot-trefoil. This plot fails the dominance test and returned an uncertain prevalence index (between 2.5 and 3.5). This plot had saturated soils (primary indicator of hydrology; 1C) however it is likely that soils were only saturated due to recent rainfall, and no dominant FACW or OBL species were present within the plot or surrounding area, therefore these areas are also assessed as non-wetland.

Plot 11 was located within a localised depression of pooled water, dominated by Water pepper and Mercer grass (refer **Error! Reference source not found.**). This plot passes the vegetation tests and has surface water present (primary indicator of hydrology; 1A). As this area is formed within a constructed watercourse it is a localised constructed wetland.

Plot 12 was located further west along the drainage channel, dominated by broad-leaved plantain and creeping buttercup. This plot failed the vegetation test, had had saturated soils (primary indicator of hydrology; 1C) with clay mottling. However, as it is likely that soils were only saturated due to recent rainfall, and no FACW or OBL species were present within the plot or surrounding area, this is assessed as non-wetland.

Table 4b. Plot results from the wetland delineation protocols for potential wetland 2.

Plot	Rapid Test	Pasture Test	Dominance Test	Prevalence Index	Hydrology	Soils	Classification	Notes
8	Fail	Fail - 29%	Pass - 67%	Uncertain - 3.1	Absent	Not investigated	Non-wetland	
9	Fail	Pass - 77%	Fail - 0%	Fail - 3.7	Absent	Non-hydric – silt loam	Non-wetland	Fails vegetation tests
10	Fail	Pass - 75%	Fail - 0%	Uncertain - 3.4	Present (1C)	Not in investigated	Non-wetland	Soil saturation likely a result of recent rainfall rather than wetland hydrology.
11	Fail	Fail - 0%	Pass - 100%	Pass - 2.1	Present (1A)	Not investigated	Constructed Wetland	Formed within constructed watercourse
12	Fail	Fail - 36%	Fail - 50%	Fail - 3.6	Present (1C)	Hydric – clay loam with mottling	Non-wetland	Soil saturation likely a result of recent rainfall rather than wetland hydrology.

Figure 4b. Image of excavated storage area taken during site visit on 5th July 2022.

Figure 4e. : Locations of vegetation plots completed within, and adjacent to, Potential Wetland 2.

Table 4c. Species present and composition within each plot taken for potential wetland 1.

Plot number	Common name	Species name	Percentage	Dominant	Status	Pasture species	Biostatus
1	Creeping buttercup	*Ranunculus repens*	*5*	*no*	FAC	No	Exotic
1	Kiuyu	*Cenchrus clandestinus*	*90*	*yes*	FACU	Yes	Exotic
1	Lotus	*Lotus pedunculatus*	*2*	*no*	FAC	Yes	Exotic
1	Cocksfoot	*Dactylis glomerata*	*5*	*no*	FACU	Yes	Exotic
1	Blackberry	*Rubus fruticosus*	*1*	*no*	FAC	No	Exotic
2	Creeping buttercup	*Ranunculus repens*	*10*	*no*	FAC	No	Exotic
2	Cleavers	*Galium aparine*	*1*	*no*	FACU	No	Exotic
2	Cocksfoot	*Dactylis glomerata*	*90*	*yes*	FACU	Yes	Exotic
4	Creeping buttercup	*Ranunculus repens*	*100*	*yes*	FAC	No	Exotic
4	Yorkshire fog	*Holcus lanatus*	*5*	*no*	FAC	Yes	Exotic
5	Creeping buttercup	*Ranunculus repens*	*35*	*yes*	FAC	No	Exotic
5	Cocksfoot	*Dactylis glomerata*	*10*	*no*	FACU	Yes	Exotic
5	Yorkshire fog	*Holcus lanatus*	*45*	*yes*	FAC	Yes	Exotic
5		*Geranium homeanum*	*26*	*no*	FAC	No	Exotic
6	Creeping buttercup	*Ranunculus repens*	*60*	*yes*	FAC	No	Exotic
6	Yorkshire fog	*Holcus lanatus*	*2*	*no*	FAC	Yes	Exotic
6	Mock strawberry	*Potentilla indica*	*35*	*yes*	FAC	No	Exotic
6	Hedge woundwort	*Stachys sylvatica*	*25*	*yes*	FAC	No	Exotic
6	Cleavers	*Galium aparine*	*1*	*no*	FACU	No	Exotic

Table 4d: Species present and composition within each plot taken for potential wetland 2.

Plot number	Common name	Species name	Percentage	Dominant	Status	Pasture species	Bio status
8	Creeping buttercup	*Ranunculus repens*	*40*	*yes*	FAC	No	Exotic
8	Creeping bent	*Agrostis stolonifera*	*25*	*yes*	FACW	No	Exotic
8	White clover	*Trifolium repens*	*3*	*no*	FACU	Yes	Exotic
8	Broad-leaved dock	*Rumex obtusifolius*	*3*	*no*	FAC	No	Exotic
8	Broad-leaved plantain	*Plantago major*	*1*	*no*	FACU	No	Exotic
8	Perennial ryegrass	*Lolium perenne*	*25*	*yes*	FACU	Yes	Exotic
8	Cleavers	*Galium aparine*	*1*	*no*	FACU	No	Exotic
8	Cocksfoot	*Dactylis glomerata*	*1*	*no*	FACU	Yes	Exotic
9	Creeping buttercup	*Ranunculus repens*	*11*	*no*	FAC	No	Exotic
9		*Juncus australis*	*20*	*no*	FACW	No	Native
9	White clover	*Trifolium repens*	*50*	*yes*	FACU	Yes	Exotic
9	Broad-leaved dock	*Rumex obtusifolius*	*2*	*no*	FAC	No	Exotic
9	Broad-leaved plantain	*Plantago major*	*2*	*no*	FACU	No	Exotic
9	Perennial ryegrass	*Lolium perenne*	*30*	*no*	FACU	Yes	Exotic
9	Cleavers	*Galium aparine*	*1*	*no*	FACU	No	Exotic
9		*Cenchrus clandestinus*	*40*	*yes*	FACU	Yes	Exotic
10	Creeping buttercup	*Ranunculus repens*	*10*	*no*	FAC	No	Exotic
10		*Juncus australis*	*15*	*no*	FACW	No	Native
10	White clover	*Trifolium repens*	*15*	*no*	FACU	Yes	Exotic
10	Broad-leaved dock	*Rumex obtusifolius*	*2*	*no*	FAC	No	Exotic
10	Creeping bent	*Agrostis stolonifera*	*5*	*no*	FACW	No	Exotic
10	Yorkshire fog	*Holcus lanatus*	*2*	*no*	FAC	Yes	Exotic

10	Catsear	*Hypochaeris radicata*	*1*	*no*	FACU	No	Exotic
10	Paspalum	*Paspalum dilatatum*	*50*	*yes*	FACU	Yes	Exotic
10		*Cenchrus clandestinus*	*10*	*no*	FACU	Yes	Exotic
10	Lotus	*Lotus pedunculatus*	*20*	*no*	FAC	Yes	Exotic
11	Creeping buttercup	*Ranunculus repens*	*6*	*no*	FAC	No	Exotic
11	Mercer grass	*Paspalum distichum*	*20*	*yes*	FACW	No	Exotic
11	Water pepper	*Persicaria hydropiper*	*70*	*yes*	FACW	No	Exotic
11	Broad-leaved plantain	*Plantago major*	*1*	*no*	FACU	No	Exotic
11	Broad-leaved dock	*Rumex obtusifolius*	*1*	*no*	FAC	No	Exotic
12	Perennial ryegrass	*Lolium perenne*	*10*	*no*	FACU	Yes	Exotic
12	Paspalum	*Paspalum dilatatum*	*5*	*no*	FACU	Yes	Exotic
12	Broad-leaved plantain	*Plantago major*	*40*	*yes*	FACU	No	Exotic
12	Broad-leaved dock	*Rumex obtusifolius*	*1*	*no*	FAC	No	Exotic
12	Lotus	*Lotus pedunculatus*	*5*	*no*	FAC	Yes	Exotic
12	Catsear	*Hypochaeris radicata*	*5*	*no*	FACU	No	Exotic
12	Yorkshire fog	*Holcus lanatus*	*7*	*no*	FAC	Yes	Exotic
12	Cocksfoot	*Dactylis glomerata*	*15*	*no*	FACU	Yes	Exotic
12	Creeping buttercup	*Ranunculus repens*	*30*	*yes*	FAC	No	Exotic

Figure 4f. Soil pits and vegetation plots conducting across the two wetland sites. Top left & bottom right: Plot 9, top right and bottom left: Plot 2.

5

Appendix 5 – Wetland Delineation Results from Wetland D

Table 5a. Wetland species composition for Wetland D.

Common name	Species name	Percentage	Dominant	Status	Pasture sp?	Biostatus
Soft rush	*Juncus effusus*	*35*	*Yes*	FACW	No	Exotic
Creeping buttercup	*Ranunculus repens*	*40*	*Yes*	FAC	No	Exotic
Narrow-leaved plantain	*Plantago lanceolata*	*7*	*No*	FACU	Yes	Exotic
Yorkshire fog	*Holcus lanatus*	*25*	*No*	FAC	Yes	Exotic
Lotus	*Lotus pedunculatus*	*2*	*No*	FAC	Yes	Exotic
Creeping bent	*Agrostis stolonifera*	*20*	*No*	FACW	No	Exotic

Table 5b. Wetland delineation results for Wetland D.

Plot	Rapid Test	Pasture Test	Dominance Test	Prevalence Index	Hydrology	Soils	Classification	Notes
1	Fail	Fail	Pass	Pass – 2.63	Present	Hydric	Wetland	Wetland D is located on a slope, therefore expected to receive surface water flows. Soils were wet, and some groundwater infiltration occurred slowly.

Wetland D was located at in a sloping area in the local landscape, and one wetland plot was undertaken at Wetland D in an area of representative vegetation types. Vegetation passed both the dominance and prevalence test (Table 5b), therefore immediately obtaining wetland status under the NPS-FM(2022). However, soils and hydrology tests were also undertaken to obtain further information to support the wetland status. Soils at the time of the site visit were highly wet, and although no surface water was present, water seepage into the soil pit was observed. The plot also passed the following hydrology indicators:

- 1B: groundwater < 30 cm
- 1C: soil saturation < 30 cm
- 4B: geomorphic position

Figure 5a. Location of vegetation and soil plot (blue dot) within the identify vegetation boundary extent (red line) of Wetland D.