

SILVERDALE WEST STAGE 1 PRIVATE PLAN

CHANGE, AUCKLAND

Ecological Values Assessment

Report prepared for

Fletcher Development Limited

Prepared by

RMA Ecology Limited

Report number and date

Report number 2115

August 2023

PREPARED FOR:

Fletcher Development Ltd

810 Great South Road

Penrose

Auckland 1061

PREPARED BY:

Project No. 2115

Version date: August 2023

Version status: Issued Ver 3

Citation:

RMA Ecology Ltd. August 2023. Silverdale West Stage 1 Private Plan Change, Auckland: ecological values assessment. Report prepared for Fletcher Development Ltd, Auckland. 42 pages + Appendices. Version 3

Revisions

Revision	Date	Description
----------	------	-------------



This report has been prepared for the benefit of our Client with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate, without independent verification, unless otherwise indicated. No liability or responsibility is accepted by RMA Ecology Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Executive Summary

The proposed Silverdale West Stage 1 Private Plan Change (PPC) area is located west of Silverdale township and is approximately 107.35 ha in area. Fletcher Development Ltd and Fulton Hogan Land Development Ltd collectively own approximately 76 ha of that land, with the remainder owned by multiple different entities.

Fletcher Development Ltd and Fulton Hogan Land Development Ltd seek to enable industrial land use across the PPC area while setting aside open space areas around established waterways. RMA Ecology Ltd has been engaged to undertake an assessment of the values of the development site in terms of aquatic and terrestrial ecology.

The approach included survey of terrestrial and freshwater areas. Site visits were undertaken on 14-16 June 2021, 5 October 2022, and 21 October 2022 to assess the ecological values within the PPC footprint. The site visit ecological assessments were supported by desktop assessments.

Most of the site is an active horticultural/ agricultural site, with multiple fields bordered by shelterbelts, some farm buildings and multiple dwellings. Smaller landholdings (especially along Dairy Flat Highway) have been more intensively managed as residential and lifestyle blocks. The landform is a gently sloping valley with the main watercourse, John Creek, being a permanent stream that flows south-north through the site. An extensive drainage network, including three additional permanent streams, three intermittent streams, and many ephemeral flow paths and farm drains, directs surface flow towards John Creek which flows from the site at the northern end. The farm drain network typically follows field boundary lines or internal roads and are open, unvegetated, sediment-filled drainage channels.

The western and eastern boundaries of the site are bordered by Dairy Flat Highway and State Highway 1 Northern Motorway, respectively. Horticultural land borders the south of the site.

Fifteen wetlands that meet the definition of 'natural inland wetland' in the National Policy Statement for Freshwater Management 2020 were identified on the site. Wetlands are mostly within the flood plain of John Creek, or have been induced in small catchments due to agricultural land practices. All wetlands have been highly degraded through historic agricultural activities, resulting in significant modification to the soils and plant communities. The wetlands are of low ecological value, and typically consist of common native and exotic rushes and herbs adapted to wet soils and are unlikely to offer core, important or significant habitat for indigenous fauna.

Horticultural and past farming activities have removed most existence of indigenous vegetation from the site. Vegetation communities are almost entirely dominated by pastoral grassland, with patches of low scrub (comprising mostly exotic weedy gorse, woolly nightshade and Chinese privet) within the lower gully system, mature pine trees, and exotic tree shelterbelts. One area of seral kanuka forest meets the criteria for the identification of Significant Ecological Areas in Schedule 3 of the AUP (and Policy B7.2), and is considered to be an area of significant indigenous vegetation. It also meets at least one of the qualifying criteria listed in Appendix 1 of the National Policy Statement for Indigenous Biodiversity, and therefore qualifies as a Significant Natural Area (SNA).

The area has occasional emergent native species such as totara and tanekaha, as well as a mixed native/ exotic understory. The few native trees or shrubs in the rest of the site have either been self-

sown by birds or wind, have been planted as part of amenity plantings associated with dwellings, or form shelterbelts.

Native wildlife across the site reflects the long history of modification and comprises a mix of cosmopolitan birds, mostly exotic species with few common natives. Lizards at the site include the exotic plague skink and most probably the native copper skink in places where farming debris and rank grass provides habitat (as opposed to manicured lifestyle blocks and more intensively-managed horticultural areas).

Bats were not surveyed and our desktop assessment suggests it is unlikely bats use the site due to nearby surveys failing to detect bats in recent years.

Overall, the ecology values for wetlands, watercourses and wildlife reflect a highly modified rural landform that has lost most of its original indigenous values. Although most native components are absent, and key ecological features such as streams and wetlands are highly degraded, there is substantial opportunity to improve on this and return biodiversity and ecological function to the site.

The Masterplan for the site identifies these key ecological features and builds on these to provide a more integrated, restored and functioning ecology for the site than is currently present.

The Masterplan and Silverdale West Stage 1 PPC:

1. Identifies the streams and wetlands as constraints in the analysis of the features of the PPC area;
2. Formalises the use of the intermittent stream and low-lying wetland areas to the north and central areas of the site as integral parts to the overall drainage structure for the site, and in doing so will protect and restore these features;
3. Describes vegetated linkages across the site to provide functional and visual green corridors for wildlife and future residents. Revegetated watercourse margins and green connections will provide habitat and resources for native birds and retain or improve existing wildlife communities; and
4. Water management across the site will focus on improving quality of stormwater and manage the way in which quantity is discharged, so that stream and wetland values are improved.

The Masterplan layout anticipates that many of the smaller mid and upper slope seepage wetlands on the site are removed to enable the road network and efficient lot sizes. All of these wetlands are of very low ecological value as they are exotic rush dominated and intensively grazed. Where wetlands removals may require ecological redress, there are substantial opportunities on the site where offsetting could be applied. Offsetting at off-site locations is also possible and could be undertaken in accordance with the AUP.

Overall, the Masterplan and the Precinct Provisions provide for the protection and restoration of riparian margins and the establishment of multi-purpose green corridors which will result in a far greater diversity and coverage of native treeland, linkages, and resources for wildlife than is currently present.

In respect to ecological management, the Silverdale West Stage 1 PPC includes provisions for environmental protection and enhancement. The provisions provide for stormwater management and enhancement of riparian margins. The PPC will apply these rules to the Silverdale West Stage 1 plan change area. This is supported in respect to the management of ecosystem values.

The National Environmental Standards for Freshwater (NES-F) and AUP includes a comprehensive set of rules relating to identified features (for example E3 for streams and E15 for vegetation). These are considered to be appropriate to address the potential for adverse effects. From an ecological perspective, these rules are appropriate to address relevant effects that may be generated at the time of resource consent.

From an ecological perspective, these PPC provisions in conjunction with other Auckland Unitary Plan provisions and the NES-F are considered to be appropriate to manage the potential effects of development within the site.

The overall outcome from the proposed PPC will be a clear, positive, net-benefit for indigenous biodiversity values and ecological services, and spans waterways, wetlands, wildlife habitat and native revegetation.

CONTENTS

1.0	Introduction	5
1.1	Background	5
1.2	Purpose and scope	7
2.0	Methods	8
2.1	Desktop assessment	8
2.2	Field assessment	8
2.3	Aquatic ecology	8
2.4	Wetlands	9
2.5	Terrestrial ecology	11
3.0	Results	12
3.1	Ecological context	12
3.2	Aquatic ecology	13
3.3	Terrestrial ecology	26
3.4	Summary of ecological values	35
4.0	Proposed Provisions and Masterplan	36
5.0	References	38

1.0 Introduction

1.1 Background

The proposed Silverdale West Stage 1 Private Plan Change (PPC) request is located west of Silverdale township and is approximately 107.35 ha.

Fletcher Development Ltd and Fulton Hogan Land Development Ltd seek to enable industrial land use across the plan change area while setting aside open space areas around established waterways.

Silverdale West Stage 1 site includes the following properties; which together comprise the investigations area ('the site'; Figure 1).

- Lot 1 DP 480626
- Lot 2 DP 480626
- Part Lot 2 DP 68886
- Part Lot 1 DP 68886
- Section 6 SO 308591
- Section 6 SO 308591
- Part Allot 210 PSH OF Okura
- Lot 1 DP 69561
- Lot 2 DP 74321
- Section 1 SO 308831
- Lot 1 DP 74321
- Part of Lot 1 DP 208687
- Part of Lot 1 DP 433431
- Part of Lot 1 DP 433431



Figure 1. The Silverdale West Stage 1 site between Dairy Flat Highway and State Highway 1 (Northern Motorway), showing the site boundary (turquoise line).

1.2 Purpose and scope

Fletcher Development Limited has engaged RMA Ecology Ltd to undertake an assessment of the ecological values of the development site in terms of aquatic and terrestrial ecology. This is to guide the development of the PPC request.

Current land use is rural and dominated by agricultural activities, with a smaller area in rural lifestyle dwellings and a minor component used for industrial purposes. The site is held within multiple titles, many of which have an occupied dwelling. Access to all parts of the site was undertaken as part of the assessment process. Our assessment included a desk-top review as well as site-based survey to obtain an accurate assessment of ecological values across the site.

The approach included survey of terrestrial and freshwater areas and provides the following:

- Identification of sites of particular ecological significance (Significant Ecological Areas; SEA);
- Review of databases to identify the likelihood of species of conservation significance being present, with an emphasis on freshwater fish, native lizards, and plants and birds;
- Walkover survey to identify or validate the presence of native vegetation, especially areas that meet criteria for assessing ecological significance under the AUP;
- Walkover and stream-specific sampling (where access was feasible and flow exists) to:
 - Determine stream values, using qualitative scoring methods along multiple reaches of all accessible, flowing streams;
 - Map the boundaries of stream types (permanent and intermittent);
 - Map wetlands, ponds, and potential barriers to stream functioning (e.g. culverts).

This report contains the following:

- An overview of the methods used to assess the ecological values and the ecological significance of areas potentially affected by the development;
- A description of ecological values within the development footprint and immediate surrounds;
- An assessment of ecological significance of the development footprint and immediate surrounds, based on assessing the ecological values of the development area against:
 - significance criteria in the AUP; and
 - based on the presence of listed Significant Ecological Areas and/or Natural Stream Management Areas (NSMAs) in the AUP;

The next phase of ecology reporting (not reported here) would normally include the following, once resource consent applications are being prepared to enable subdivision and land use development:

- An assessment of the type and magnitude of potential effects associated with the development, construction, and operational activities, including potential habitat loss and degradation, and direct mortality or injury of indigenous fauna where the rules of the AUP, for example E3, E15, E16 or E38 are triggered by development; and
- Recommendations to address adverse effects.

2.0 Methods

Desktop analyses and field/site visits were used to determine the ecological values of terrestrial and freshwater areas within and surrounding the development footprint, as well as the significance of those values. This section of the report describes the methods used for desktop and field investigation locations.

2.1 Desktop assessment

A desktop assessment of the development footprint and surrounding area was undertaken to identify sites assessed as potentially having ecological values, as well as sites already listed as being ecologically significant based on a review of the AUP. Legacy District and Regional Plans were reviewed for completeness and to cross-verify against the descriptions and extents of features identified in the AUP.

These resources were also used, where available, to provide insight as to the reasons why areas were significant, and the ecological values they comprise. Areas with ecological values that were not identified or which were not listed as ecologically significant in the various reviewed documents, were assessed against the significance criteria of the AUP (Schedule 3 – Significant Ecological Areas: Terrestrial Schedule).

The Auckland Council GIS was reviewed to identify existing vegetation, streams, and overland flow paths present on the site and to establish an understanding of the ecological status of the waterways present. Maps of these existing features (streams and overland flow paths (categories 4,000 m² to 3 ha and > 3 ha)) were then ground-truthed, where access was approved to individual properties.

The following documents and databases were reviewed for the ecological assessment:

- New Zealand Freshwater Fish Database;
- NIWA Freshwater Biodiversity Database;
- National Amphibian and Reptile Database System (Herpetofauna) to gather information on lizard species that have been recorded in proximity to the project site; and
- Auckland Unitary Plan.

Any threatened species found were recorded and their threat status checked against the relevant national threatened species classification lists (Hitchmough et al. 2021, Robertson et al. 2021 and Dunn et al. 2018).

2.2 Field assessment

Site visits were undertaken on 14-16 June 2021, 5 October 2022, and 21 October 2022 to assess the ecological values present within the PPC area.

2.3 Aquatic ecology

All waterways and flow paths were mapped as being permanent or intermittent based on the definitions in the AUP. Photographs were taken and a general description of the waterway was undertaken to note characteristics including riparian species and cover, and connectivity to other waterways. A

characterisation assessment of the mapped stream reaches was also undertaken with key ecological features recorded.

Permanent river or stream

The continually flowing reaches of any river or stream.

Intermittent stream

Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least three of the following criteria:

- 1. it has natural pools;*
- 2. it has a well-defined channel, such that the bed and banks can be distinguished;*
- 3. it contains surface water more than 48 hours after a rain event which results in stream flow;*
- 4. rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel;*
- 5. organic debris resulting from flood can be seen on the floodplain; or*
- 6. there is evidence of substrate sorting process, including scour and deposition.*

All waterways within the site were walked with the first classification being whether the waterway was natural or an artificial farm drainage canal ('drain'). Waterways were classified as farm drains based on GIS and historical aerial photograph and likelihood based on topography and location. If a waterway was deemed to be natural (straightened or not) it was then assessed using the AUP criteria above.

2.4 Wetlands

The site was assessed for wetlands based on the definition in the AUP and the Resource Management Act 1991 (RMA). The site was also assessed for 'natural inland wetlands' based on the definition within the National Policy Statement for Freshwater Management 2020 (NPS-FM) (last amended January 2023).

The updated NPS-FM technical support documents regarding wetland classification and delineation require that a step-wise assessment is undertaken. That assessment includes application of the exclusion criteria based on pasture grassland, assessment of threatened species habitat use, and then application of three separate vegetation tests (Rapid Test, Dominance Test, and Prevalence Index). Wetland soils and hydrology information can be applied if the results of vegetation community and exotic pasture grass exclusion are inconclusive. Key for identification of natural inland wetlands at this site are whether any wet areas have developed in or around a deliberately constructed water body, or are dominated by pasture grasses.

We understand that the National Environmental Standards for Freshwater 2020 (NES-F) and NPS-FM require Councils to ensure that the loss of values and extent of 'natural inland wetlands' is avoided in most instances (excluding some activities, including urban development). The NPS-FM/ NES-F also restricts activities within a 10 m buffer around 'natural inland wetlands', and places controls on the level of potential adverse effects (from, for example, discharge of water or diversion of water) within 100 m from a 'natural inland wetland'.

The methodology applied for the identification of wetlands at this site was as follows (see Appendix B also):

- Visual assessment as to whether the potential wetland area could support a threatened species;

- Visual assessment as to whether the potential wetland and surrounding area is clearly dominated by pasture grass species (the Rapid Pasture Test);
- Visual assessment of areas where the vegetation composition includes species that are scored as wetland obligate, facultative wetland, or facultative (e.g., rushes, wet pasture or ‘wetland-type’ vegetation) as assessed by Clarkson et al.¹ (following the Pasture Exclusion Test, and Wetland Delineation Protocols as laid out in the Pasture Exclusion Assessment Methodology²);
- Where these compositions exist, an assessment of vegetation, soils, and hydrology is required according to the Pasture Exclusion Assessment Methodology:
 - Vegetation is assessed through plant identification and percentage cover estimates (as per the method described by Clarkson³) of 2 m x 2 m plot areas within each potential wetland area;
 - Soils are assessed by applying the criteria outlined in Fraser (2018)⁴ for identifying hydric (wetland) soils – which involves excavation and examination for gleyed, mottled, peaty, or wet soils; and
 - Hydrology is assessed by applying the criteria outlined in the Ministry for the Environment tool⁵;

An area can be classified as a wetland based on the definition within the AUP and the RMA, but not be classified as a ‘natural inland wetland’ under the NPS-FM because the definition of the latter includes some exclusions:

“Natural inland wetland means a wetland (as defined in the [Resource Management] Act) that is not:

- (a) in the coastal marine area; or
- (b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or
- (c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or
- (d) a geothermal wetland; or
- (e) a wetland that:
 - (i) is within an area of pasture used for grazing; and
 - (ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless
 - (iii) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply”

The boundaries of potential wetland areas are delineated by carrying out assessments of the various vegetation communities and through professional judgement.

¹ Clarkson B. R., Fitzgerald N. B., Champion P. D., Forester L., Rance B. D. (2021). New Zealand wetland plant indicator status ratings 2021: Data associated with Manaaki Whenua - Landcare Research contract report LC3975 for Hawke’s Bay Regional Council.

² Ministry for the Environment. 2022. Pasture exclusion assessment methodology. Wellington: Ministry for the Environment.

³ Clarkson, B. (2013). A vegetation tool for wetland delineation in New Zealand. Report prepared for Meridian Energy Limited by Landcare Research.

⁴ Fraser S., Singleton P., Clarkson B. (2018). Hydric soils – field identification guide. Envirolink Tools Contract C09X1702. Manaaki Whenua – Landcare Research Contract Report LC3233 for Tasman District Council.

⁵ Ministry for the Environment. (2021). Wetland delineation hydrology tool for Aotearoa New Zealand. Wellington: Ministry for the Environment.

2.5 Terrestrial ecology

Native and exotic vegetation types were mapped across the site with a focus on the presence of indigenous species. Birds identified visually and audibly were recorded across the site, including native and introduced species. Potential food sources and nesting habitat were noted throughout the site for the purpose of estimating the potential loss of resources for native bird species associated with the planned development.

The field survey included identification of habitats potentially occupied by native lizards, and an assessment of potential bat habitat (after Smith et al. 2017).

The ecological investigation used the AUP SEA criteria (Sawyer & Stanley, 2012) to assess the significance of ecology values recorded from the site.

We also applied the Significant Natural Area criteria listed in Appendix 1 of the recently released National Policy Statement for Indigenous Biodiversity (NPS-IB). That includes many of the same criteria as Auckland Council used when assessing sites for SEA status in the Auckland region.

3.0 Results

3.1 Ecological context

The PPC at Silverdale West Stage 1 is located within a typical Auckland rural environment. Although the original natural ecology has been heavily modified or removed through past farming and horticultural activities, the general area within the development site still contains some ecological values, albeit mostly freshwater related.

The site lies within the Rodney Ecological District (generally encompassing the former Rodney District Council spatial area).

The modification of native bush, wetlands and ecosystems, and the resultant loss of biodiversity is a characteristic of the state of biodiversity in the Rodney District. While certain areas, especially in the north of the District, still retain large areas of bush or relatively unmodified landscapes, most of the ecosystems within the District are fragmented, isolated pockets of bush, wetlands, dunes and dune lakes, estuaries, and scrubland. Less than 15 % of the original bush remains, with the majority having been cleared between 1860 and 1984 to create pasture.

Less than 1% of the wetlands remain, most having been drained between 1942 and 1977 for agriculture and urban development.

The Silverdale West Stage 1 site lies within one of the catchments that has been most heavily modified in the Rodney District through farming and conversion of indigenous wetlands and forest for farming. The hydrological catchment is the John Creek catchment.

Watercourses within the catchment are soft-bottomed streams due to the underlying sandstones and mudstones.

Original forest cover would have been puriri forest (WF7)⁶ comprising mostly puriri (*Vitex lucens*) with occasional kahikatea (*Dacrycarpus dacrydoides*), kohekohe (*Dysoxylum spectabile*) and nikau (*Rhopalostylis sapida*), with kahikatea swamp forest (WF8) on the eastern floodplains around John Creek and side tributaries. WF7 (At Risk classification) has been reduced to 20 % - 30 % of its original pre-human cover as estimated by the Threatened Environments Classification. WF8 (Acutely Threatened classification) has been reduced to less than 10 % of its original pre-human cover.

Over much of the low-lying areas of Rodney District the original vegetation cover has been removed, and this is the case for the Silverdale West Stage 1 site and surrounding areas. The catchment has been largely converted to pasture grazing with some plantation forest and amenity plantings surrounding dwellings.

The loss of habitats for indigenous forest wildlife would have occurred at a similar level to the loss of botanical diversity once the original forest cover was removed. Most native animals – apart from a few birds and typically one native lizard – rarely survive the transition from indigenous habitats to exotic dominated landscapes in intensive agricultural use. Intensification of landscape use for agriculture and removal of riparian vegetation cover is often also accompanied by an associated reduction in habitat for native freshwater invertebrates and fishes and a reduction in water quality within watercourses.

⁶ Singers *et al.* 2017.

At the Silverdale West Stage 1 site, the level of development into rural use for farming has seen the wholesale replacement of native woody vegetation with exotic grasslands and the establishment of exotic woody vegetation – typically in the form of shelterbelts and solitary shade trees for stock.

Even from an overview site assessment it is apparent that the network of watercourses has been heavily modified compared to its likely original state.

Key influences in the state of watercourse health at Silverdale West Stage 1 site include:

- Removal of riparian vegetation cover;
- Access by stock, especially cattle, to most watercourses;
- Unnaturally high levels of nutrient and fine sediment runoff, and resultant accumulation in watercourses;
- Damming of streams to create reservoirs that have flooded underlying stream habitats; and
- Drainage and diversion of headwater flows to improve land quality for farming.

The Silverdale West Stage 1 site has been subject to all of the above effects on the landscape and watercourses over time. While some watercourses have now been fenced to exclude stock, most of the agents of ecological decline are still present and are most probably contributing to an ongoing decline in overall environmental health, including progressive ongoing loss of indigenous biodiversity.

3.2 Aquatic ecology

3.2.1 Catchment context

The Silverdale West Stage 1 site catchment is John Creek, which flows through the centre of the site from south to north. Watercourses in the catchment have been modified through farming activities with numerous farm ponds in the headwaters of the catchment.

Approximately 90 % of the site area is used for pasture grazing of stock. The balance comprises a mix of old plantation forestry, and dwellings and associated amenity areas, and existing commercial businesses.

A history of farm works has created a network of artificial drains across parts of the farms which have modified watercourses in many places through straightening and channelization. In many places this is obvious as natural headwater streams feed into channelised streams. However, in other places identifying original watercourses from farm drains installed where there were once no watercourses, can be difficult.

As a first step in classifying the watercourses at this site, historic and recent aerial photography was reviewed in conjunction with contour maps in order to assist with separating out artificial farm canals (drains) from natural watercourses that have been severely modified.

3.2.2 Ponds

The site has an extensive history of farming and as such has a number of water storage or stock ponds.

There are ten (10) constructed ornamental and stock ponds at the site, located mainly on upper slopes where ephemeral or overland flow can be captured and stored (Figure 2). Although some of the ponds are fed by overland flow, they are not typically linked directly to downstream watercourses. Discharge from the ponds is via pond overflow valves or spillway. Pond sizes range between approximately 23 m² and 1,656 m². Total pond area across the 10 ponds is approximately 3,980 m² (0.4 ha).

Although generally not connected to formal watercourses, the ponds are likely to support native shortfin eels (*Anguilla australis*).

3.2.3 Streams

The catchment on site includes a network of small headwater streams and four permanent watercourses. Permanent streams are:

- John Creek which flows south-north through the centre of the site
- Streams P1 and P2 on the eastern side of the site, and
- Stream P3 which flows from the southern boundary and joins John Creek at the southern end of the site

Together, the network of watercourses within the Silverdale West Stage 1 site extends some 6,600 m, with an indicative breakdown by type provide in Table 1.

A network of seven (7) streams and twenty-three (23) drains or flow paths within the John Creek catchment extend ca. 5,670 m (5.7 km) across the site (Table 1). These consist of 4 permanent streams (2,654 m), 3 intermittent streams (486 m), 15 ephemeral flow paths (1,793 m) and 8 drains (738 m).

Table 1. Summary of watercourses within the site.

Ecological feature	Total number	Length
Ephemeral flow path	15	1,793 m
Intermittent stream	3	486 m
Permanent stream	4	2,654 m
Drain (not a stream)	8	738 m
Total Streams (permanent/ intermittent)	7	3,140 m
Other (ephemeral/ drains)	23	2,531 m

The most substantial watercourse at the site is John Creek (Figures 2 to 5). Where John Creek bisects the it is between 2 – 5 m wide between banks during a normal flow event (more at times of high flows), and has a permanent flow. Large woody debris, shallow and deep pools, and habitat complexity generated by the natural meandering nature of John Creek all add to the diversity and high abundance of habitats for freshwater fish and other instream life.

The stream is not fenced, and shows considerable damage to banks and margins caused by stock. In places there are abundant signs of mass wasting of the creek banks (brought about by riparian vegetation removal, stock trails and flood flows eroding vulnerable soils), and obvious high levels of fine sediment deposition generated from up-catchment and within site activities. Most of the length of John Creek within the site supports a complete canopy of introduced crack willow (*Salix fragilis*) provided by mature trees along both margins. The shade provided by the willows to the watercourse would be extensive during summer, however it is much less during winter when the trees are bare of leaves. Representative photos of John Creek and its margins are provided in Plates 1-4.

Fish are recorded from the John Creek catchment (within the site and further downstream towards Weiti Stream) are listed in Table 2. One species, longfin eel, is listed as At Risk⁷. None of the fish species are protected under the Wildlife Act 1953.

Smaller intermittent streams and ephemeral tributaries are in pasture areas, and consequently are highly degraded due to a lack of riparian cover and severe stock damage to stream beds.

Stream/ watercourse locations are provided in Figures 2 to 5, and assessment data across the AUP criteria is provided in Appendix A. Only permanent and intermittent streams are recognised by the Unitary Plan; ephemeral flow paths are not defined as streams by the AUP.

Table 2. Freshwater fish recorded from John Creek and associated tributaries (source NIWA New Zealand Freshwater Fish Database).

Common name	Scientific name	Native/ exotic	Protected wildlife? (Wildlife Act)	Threat status
Shortfin eel	<i>Anguilla australis</i>	Native	No	Not Threatened
Longfin eel	<i>Anguilla dieffenbachii</i>	Native	No	At Risk: Declining
Banded kokopu	<i>Galaxias fasciatus</i>	Native	No	Not Threatened
Redfin bully	<i>Gobiomorphus huttoni</i>	Native	No	Not Threatened
Mosquitofish	<i>Gambusia affinis</i>	Exotic	No	Introduced Pest

⁷ Goodman JM, Dunn NR, Ravenscroft PJ, Allibone R, Boubee JAT, David BO, Griffiths M, Ling N, Hitchmough RA, and Rolfe JR. 2014. New Zealand Threat Classification Series 7: Conservation status of New Zealand freshwater fish, 2013. Department of Conservation, Wellington



Figure 2. Watercourses and ponds at the site. Permanent stream (solid blue line), intermittent stream (dashed blue line), ephemeral flow path (dotted blue line), drain (solid purple line), pond (blue polygon with orange outline), and site boundary (turquoise line).



Figure 3. Watercourses and ponds at the northern and central portion of the site. Permanent stream (solid blue line), intermittent stream (dashed blue line), ephemeral flow path (dotted blue line), drain (solid purple line), pond (blue polygon with orange outline), and site boundary (turquoise line). Ponds visible on the aerial but not listed are no longer ponds on the ground.



Figure 4. Watercourses in the central portion of the site. Permanent stream (solid blue line), intermittent stream (dashed blue line), ephemeral flow path (dotted blue line), drain (solid purple line), pond (blue polygon with orange

outline), and site boundary (turquoise line). Ponds visible on the aerial but not listed are no longer ponds on the ground.



Figure 5. Watercourses across south portion of the site. Permanent stream (solid blue line), intermittent stream (dashed blue line), ephemeral flow path (dotted blue line), drain (solid purple line), pond (blue polygon with orange outline), and site boundary (turquoise line).



Plates 1-3. Views of John Creek, a permanent stream that flows south to north and drains the site. The streambed comprises soft sediments largely devoid of macrophytes. Shade is provided in parts by deciduous exotic trees, and some evergreen native and exotic trees.

3.2.4 Wetlands

There are fifteen (15) wetlands on site which cover a total area of ca. 13,850 m² (1.4 ha). All wetlands meet the definition of a natural inland wetland under the NPS-FM (Appendix B).

These areas have underlying characteristics, including permanently or intermittently wet soils, that support a natural ecosystem of plants that are adapted to wet conditions (i.e. they are wetlands) and are not dominated (> 50 %) by pasture grasses. These areas also meet the RMA definition of a 'natural wetland'.

None of the wetland areas, or other areas on the site had the potential to support species classified as 'Threatened'. While some wet areas met the >50 % pasture exclusion test, these were all at the periphery of wetter core areas that passed the NPS-FM natural inland wetland test.

Wetlands are mostly within the flood plain of John Creek, or have been induced in small catchments due to agricultural land practices. All wetlands have been highly degraded through historic agricultural activities, resulting in significant modification to the soils and plant communities. The wetlands on site are of relatively low ecological value, and typically consist of common native and exotic rushes and herbs adapted to wet soils (e.g. *Juncus edgarie*, *J. effusus*, *Ranunculus repens*) and are unlikely to offer core, important or significant habitat for indigenous fauna.

Despite the degraded state of these wetlands, and the predominance of exotic species, each area still clearly meets the definition of an 'inland natural wetland' as defined in the NPS-FW and 'natural wetland' in the RMA.

All wetlands are depicted on Figures 6 to 9.

Wetland classification data is provided in Appendix B.

Representative photos of the wetland areas are provided in Plates 4 to 8.



Figure 6. Wetlands (turquoise/ orange polygons) at the site, and site boundary (turquoise line).



Figure 7. Wetlands (orange polygon) at northern portion of the site, and site boundary (turquoise line).



Figure 8. Wetlands (orange polygon) at central portion of the site, and site boundary (turquoise line).



Figure 9. Wetlands (orange polygon) at southern portion of the site, and site boundary (turquoise line).



Plate 4. Wetland W14 within the low-lying paddocks adjacent to John Creek. Vegetation communities have been highly modified, with remnant wetland characteristics including hydric soils and opportunistic plant species adapted to wet soils.



Plate 5. Wetland W20 within saturated paddocks at the headwaters of intermittent stream I3. Vegetation communities have been highly modified, with remnant wetland characteristics including hydric soils and opportunistic plant species adapted to wet soils.



Plate 6. Wetland W9 within the low-lying paddocks adjacent to Stream P2. Vegetation communities have been highly modified, with remnant wetland characteristics including hydric soils and opportunistic plant species adapted to wet soils.



Plate 7. Wetland W7 within scrubland to the side of John Creek. Native wetland swedges and exotic wetland weeds comprise the vegetation community.



Plate 8. Wetland W9 within the low-lying paddocks adjacent to permanent Stream P2. Vegetation communities have been highly modified, with remnant wetland characteristics including hydric soils and opportunistic plant species adapted to wet soils.

3.3 Terrestrial ecology

3.3.1 Vegetation

The site has been cleared of native forest and has been farmed for many decades. Vegetation communities are almost entirely dominated by pastoral grassland, with patches of low scrub (comprising mostly exotic weedy gorse, woolly nightshade, and Chinese privet) within the lower gully system, mature pine trees, and exotic tree shelterbelts (Plate 9).

A review of the relevant regional planning map and Landcare Research land cover database revealed that there are no areas of vegetation listed as a Significant Ecological Area (SEA) in the AUP (OP), and the vegetation within the site is not legally protected by the Department of Conservation, QEII National Trust, Nature Heritage Fund Covenants, Regional Councils or Nga Whenua Rahu.

Nine areas of indigenous vegetation are shown on Figure 10 as light green shaded polygons.

Most of these nine areas are young planted native shelterbelts or patches of vegetation. Several appear to be scattered regenerating kanuka or other early successional native plants. There is one very small patch of mature native trees (IV6) which has also probably been planted some time ago. There is only one substantial patch of indigenous vegetation which appears to have regenerated naturally (IV1).

Elsewhere on the site indigenous plant species are few, and where present are either planted as part of garden amenity plantings, have been planted to form hedgerows, or are common coloniser plants that are self-introduced within established exotic vegetation (Plate 13).

Details of areas of indigenous vegetation communities are provided in Table 3.

Table 3. Indigenous vegetation communities identified on the Silverdale West Stage 1 site.

Site ID	Area on site (m ²)	Policy B7.2 assessment criteria And NPS-IB	Description
IV1	4,831	Policy B7.2: 1, Representativeness NPS-IB: Criteria A and C	Kanuka canopy, with ponga in understory. Impacts from stock access, and environmental weeds including Chinese privet, blackberry, and gorse. Significant Indigenous Vegetation - SNA
IV2	781	Nil	Scattered kanuka trees, with no intact canopy, understory, or groundcover.
IV4	169	Nil	Planted common native trees and shrubs including manuka, karamū, harakeke, cabbage tree, ponga, māhoe, karaka, and kanuka. Weeds include tobacco weed, tree privet, Chinese privet, and pampas grass.
IV5	930	Nil	Planted common native trees and shrubs including manuka, karamū, harakeke, cabbage tree, ponga, māhoe, karaka, and kanuka. Weeds include tobacco weed, tree privet, Chinese privet, and pampas grass.
IV6	278	Unlikely due to very small size and surrounding hardstand industrial area	Kauri tree (<i>Agathis australis</i>), kahikatea (<i>Dacrycarpus dacrydioides</i>), cabbage tree, totara, manuka, karo (<i>Pittosporum crassifolium</i>), titoki (<i>Alectryon excelsus</i> subsp. <i>excelsus</i>), karamū, māhoe, lemonwood, nikau (<i>Rhopalostylis sapida</i>), red mapou (<i>Myrsine australis</i>), karaka and pūriri (<i>Vitex lucens</i>). Weed species include Chinese privet and tree privet
IV7	171	Nil	Single mature totara

IV8	2,598	Nil	Planted common native trees and shrubs including manuka, karamū, harakeke, cabbage tree, ponga, māhoe, karaka, and kanuka. Weeds include tobacco weed, tree privet, Chinese privet, and pampas grass.
IV9	485	Nil	Native amenity planting including totara, harakeke, puriri, karaka, karamū, and cabbage tree.
IV10	599	Nil	Planted common native trees and shrubs including manuka, karamū, harakeke, cabbage tree, ponga, māhoe, karaka, and kanuka. Weeds include tobacco weed, tree privet, Chinese privet, and pampas grass.

There are two areas (IV1 and IV2) on site where seral kanuka forest (*Kunzea robusta*) has established along the margins of John Creek.

The seral kanuka forest in IV1 has occasional emergent native species such as totara (*Podocarpus totara*) and tanekaha (*Phyllocladus trichomanoides*), as well as a mixed native/ exotic understory and groundcover, with native species such as the native ponga (*Cyathea dealbata*) common throughout the area (Plate 10). This area meets the criteria for the identification of Significant Ecological Areas (SEAs) in Schedule 3 of the AUP (OP) (and Policy B7.2), and is considered to be an area of significant indigenous vegetation.

IV2 includes small patches of kanuka trees, with Chinese privet and exotic pasture grasses dominating the understory and ground cover, respectively. IV2 does not meet the Policy B7.2 assessment criteria for assessing SEAs and are therefore we do not consider this to be significant indigenous vegetation.

IV4, IV5, IV8, and IV10 are areas of amenity and shelterbelt planting. These areas comprise a diversity of native plant species that include manuka (*Leptospermum scoparium*), karamū (*Coprosma robusta*), harakeke (*Phormium tenax*), cabbage tree (*Cordyline australis*), ponga, māhoe (*Melicytus ramiflorus*), karaka (*Corynocarpus laevigatus*), and kanuka. Weed species in these areas include tobacco weed, tree privet, Chinese privet, and pampas grass. We estimate that these areas were planted less than 20 years ago and consider that they do not meet the AUP SEA criteria (Plate 11).

IV6 is a 278 m² area of native vegetation surrounded by an industrial yard (Plate 12). The area contains semi-mature native podocarps including one kauri tree (*Agathis australis*), kahikatea (*Dacrycarpus dacrydioides*), cabbage tree, totara, manuka, karo (*Pittosporum crassifolium*), titoki (*Alectryon excelsus* subsp. *excelsus*), karamū, māhoe, lemonwood, nikau (*Rhopalostylis sapida*), red mapou (*Myrsine australis*), karaka and pūriri (*Vitex lucens*). Weed species include Chinese privet and tree privet. Several of these tree species, kauri and manuka are classified as Threatened – Nationally Vulnerable, and the kauri is approximately 6 m tall.

IV7 is a single mature totara tree.

IV9 is an area of native amenity planting including totara, harakeke, puriri, karaka, karamū, and cabbage tree. The area does not meet AUP SEA criteria.

Regarding the NPS-IB, only IV1 meets the criteria in the NPS-IB as Significant Indigenous Vegetation; it does so based on it supporting diverse native plant communities that are representative of indigenous vegetation that would have once been present, and by virtue of the extreme rarity of kahikatea swamp forest (WF8) nationally and within the Rodney Ecological District.



Plate 9. An overview of the typical low ecological value vegetation communities on the Silverdale West Stage 1 site, including pasture grassland, exotic tree shelterbelts, and invasive crack willow trees along John Creek.



Plate 10. Native ponga ferns dominate the understory in IV1 (a remnant/ regenerating forest patch).



Plate 11. Common native trees and shrubs form a shelterbelt at IV5 (most likely planted).



Plate 11. Semi-mature kahikatea and kauri in IV6 surrounded by an industrial yard.



Plate 13. Scattered native trees (manuka pictured) are found in isolated areas around the site. This photo, taken at the north-western part of the site, shows vegetation typical of the area and includes rank grass and exotic trees and shrubs.



Figure 10. Areas where indigenous vegetation is present on the Silverdale West Stage 1 site (shaded in light green; site boundary is turquoise line). Only IV1 meets the criteria as a site of significant indigenous vegetation/ SNA.

3.3.2 Birdlife

Eighteen (18) species of birds were recorded during the site visit, including eleven (11) native species, all of which are classified as 'Not Threatened'.

The mature native trees on site provide suitable roosting and nesting habitat for a range of small native passerines such as grey warbler (*Gerygone igata*), and fantail (*Rhipidura fuliginosa*). It is expected that a wider range of local native birds that occur in the surrounding rural area, which were not recorded during the site visit, would also frequent the site (e.g. morepork - *Ninox novaeseelandiae*).

Species of birds listed as 'Threatened' or 'At Risk' that may utilise this site, even just to transit through, include the New Zealand pipit (*Anthus novaeseelandiae*). It is unlikely that NZ pipit would utilise the site for breeding, as the site is devoid of suitable nesting habitat (i.e. fernland in rough pasture clumps and partly or fully covered with vegetation).

A list of bird species observed during the site survey is provided in Table 4.

Table 4: Birds recorded at the Silverdale West Stage 1 site during the site survey.

Scientific name	Common name	Threat Status (Robertson et al., 2016)
<i>Circus approximans</i>	Swamp harrier	Native – Not threatened
<i>Egretta novaehollandiae</i>	White-faced heron	Native – Not threatened
<i>Gerygone igata</i>	Grey warbler	Native – Not threatened
<i>Hirundo neoxena</i>	Welcome swallow	Native – Not threatened
<i>Porphyrio melanotus</i>	Pukeko	Native – Not threatened
<i>Prothemadera novaeseelandiae</i>	Tui	Native – Not threatened
<i>Rhipidura fuliginosa</i>	Fantail	Native – Not threatened
<i>Tadorna variegata</i>	Paradise shelduck	Native – Not threatened
<i>Todiramphus sanctus</i>	Sacred kingfisher	Native – Not threatened
<i>Vanellus miles</i>	Spur-winged plover	Native – Not threatened
<i>Zosterops lateralis</i>	Silvereye	Native – Not threatened
<i>Anas platyrhynchos</i>	Mallard	Exotic – Introduced and naturalised
<i>Branta canadensis</i>	Canada goose	Exotic – Introduced and naturalised
<i>Carduelis carduelis</i>	European goldfinch	Exotic – Introduced and naturalised
<i>Passer domesticus</i>	House sparrow	Exotic – Introduced and naturalised
<i>Platycercus eximius</i>	Eastern Rosella	Exotic – Introduced and naturalised
<i>Turdus merula</i>	Blackbird	Exotic - Introduced and naturalised
<i>Turdus philomelos</i>	Song thrush	Exotic - Introduced and naturalised

3.3.3 Lizards

All native lizards are absolutely protected under the Wildlife Act 1953. A Wildlife Act Authority from the Department of Conservation is required to undertake activities within habitat that may support native lizards and where those activities may result in a significant impact on the species or its habitat. Searches and handling of native lizards at this site were undertaken under Wildlife Act Authority 78350-FAU issued to RMA Ecology Ltd for the Auckland Region.

During the site survey, one exotic lizard species was recorded, the pest species plague skink (*Lampropholis delicata*). The site survey involved general visual observations of potential lizard habitats, and inspecting

beneath debris (e.g. logs) within the site, however it did not constitute a comprehensive survey using a range of methods (e.g. the use of artificial cover objects, pitfall traps etc.).

The national lizard, frog and tuatara database managed by the Department of Conservation (Herpetofauna) confirms records of native lizards within 1 km of the site, including the 'At Risk' ornate skink (*Oligosoma ornatum*) and 'Not Threatened' copper skink (*Oligosoma aeneum*).

The history of vegetation clearance, and low quality of humid, forest interior and thick rank grassland sites strongly suggests that ornate skinks are unlikely to be present, as is the case for arboreal geckos.

Overall, it is likely that rainbow skinks are well distributed across the site, particularly within paddocks, shelterbelts, riparian margins, and house and garden amenity areas. Copper skinks are most likely present in lower numbers and in a narrower subset of habitats including areas of rank grass, and thick weedy vegetation surrounding the edges of the wetlands, as well as thick riparian vegetation.

Lizards that have been recorded within the area and DOC Bioweb database that may occupy the site are provided in Table 5. Applicable habitat has been sourced from van Winkel et al., 2018.

Table 5. Lizard species recorded in the national Herpetofauna database from nearby the site.

Scientific name	Common name	Threat Status (Hitchmough et al., 2015)	Likelihood of occupying the site	Applicable habitat
<i>Naultinus elegans</i>	Elegant gecko	At risk - declining	Extremely low	Indigenous forest (IV1) and associated seral scrub
<i>Mokopirirakau granulatus</i>	Forest gecko	At risk - declining	Extremely low	Indigenous forest (IV1) and associated seral scrub
<i>Oligosoma ornatum</i>	Ornate skink	At risk - declining	Extremely low	Indigenous forest (IV1) riparian margins.
<i>Oligosoma aeneum</i>	Copper skink	Not threatened	Moderate	Seral scrub. Wood stacks and rank grass. Riparian margins
<i>Lampropholis delicata</i>	Plague skink	Introduced and naturalised	Confirmed	Seral scrub. Wood stacks and rank grass.

3.3.1 Bats

Long-tailed bats / pekapeka (*Chalinolobus tuberculatus*, currently classified 'nationally vulnerable' - O'Donnell et al. 2017), require large trees (including standing dead trees) with cavities (e.g. deep knot holes), epiphytes or loose bark for roosting; and typically use linear landscape features such as bush edges, gullies, water courses and roadways to transit between roosting and feeding sites (Borkin and Parsons 2009).

The closest confirmed record of long-tailed bats is within 7 km of the site, in the Wainui area (Figure 11).

The site supports some characteristics preferred by bats, (e.g. mature trees along watercourses, old pine trees) and it is possible that a resident long-tailed bat population could utilise parts of the site (e.g. with mature trees), if only to transit through the site.

The likelihood of bats being present at the site can be informed by a recent bat survey undertaken at the nearby Milldale site, which supports similar farmland, shelterbelt, and riparian tree lands, as well as small plantation woodlots. That survey (undertaken in 2020) deployed twelve (12) Automatic Bat Monitors (ABMs) throughout the wider Milldale site. ABM sites targeted areas where bats are most likely to be

detected, focusing on habitat features such as old trees, shelterbelts and other features bats may utilise for commuting, foraging or roosting. ABMs were left on site to record data for 21 nights of favourable weather conditions. No bat activity was detected from any of the 12 ABMs over this period.

The Plan Change applicant's intention is to follow the NZTA/ DOC protocols for managing potential adverse effects on bats (Protocol B: Pre-felling procedure 1.4.1 and Protocol C (if bats are confirmed to be present)). These includes undertaking a survey for bats immediately prior to felling of trees in the north-western part of the site and within the woodlot areas in the central part of the site - i.e. those areas which support the best opportunities for bats at the site.

Overall, the history of the site with past forest clearance, the low quality of potential habitat currently present, and the results from recent nearby surveys suggests that bats are unlikely to be present at, or use, the site.



Figure 11. Map of bat records in proximity to the site, showing Silverdale West Stage 1 site boundary (red line), bat surveys where no bats were detected (crimson dots), and bat surveys where long-tailed bats were detected (aqua dots).

3.4 Summary of ecological values

Overall, the ecology values for wetlands, watercourses and wildlife reflect a highly modified landform that has lost most of its original indigenous values. Although most native components are absent, and key ecological features such as streams and wetlands are highly degraded, there is substantial opportunity to improve on this and return biodiversity and ecological function to the site.

There is one area, IV1, that meets the criteria as SEA in the Auckland Unitary Plan and as SNA in the NPS-IB. There is no remnant native forest on this site, no significant ecological areas are listed at the site in the AUP.

Habitat for wildlife is poor throughout due to many decades of horticultural and pastoral grazing. At most, the site may offer habitat in parts of copper skink and bats; however, it is very unlikely to constitute core or important habitat for these species.

Key ecological features present on the site are listed below. Streams and wetland should form part of the protection layer to inform planning for the site masterplan; values such as lizards and bats require confirmation regarding distribution, abundance, and habitat associations on the site as part of habitat restoration/ planting planned for the site, and for informing wildlife management during development of the site where habitat and populations will be removed and relocated. In our view, the key ecological features at the site are:

- The main stem of John Creek and its tributaries;
- The riparian margins surrounding the John Creek catchment;
- Possible copper skinks in some parts of the site;
- The mosaic of wetlands within low lying areas; and
- The existing indigenous forest site IV1.

Enhancements to the ecology for the site should focus on:

1. Improving connectivity between ecological systems - especially by using the existing stream and wetland areas to manage, treat and control stormwater on the site. The general overall improvement in water quality that is likely to arise from ceasing agricultural/ horticultural activities on the site also offers opportunities to plan for the restoration of the stream and wetland areas to support an improved, native biodiversity and to provide habitats for aquatic fauna (such as waterfowl, fish, eels, and macroinvertebrate communities).
2. Enhancing food and habitat resources for native wildlife – by planning streetscapes and open areas to support native nectar and fruit-producing plant species as part of a site-wide strategy to create green corridors, provide improved food and roosting/ nesting habitat resources for native birds, and to restore ecological areas (stream margins, wetlands, multi-use amenity/water management areas with wildlife and wildlife habitat in mind).

4.0 Proposed Provisions and Masterplan

The Masterplan incorporates ecological considerations through several key design drivers, including:

- Strengthening water management systems;
- Bridging connections to outside the site;
- Connectivity within the site; and
- Restoring and improving ecological functions and energy flows.

These are expressed in the Structure Plan/ Masterplan as:

1. A central south-north, green corridor centred on John Creek which will provide a central focal point, connectivity, and integration of ecological services through stormwater management, conveyance, and treatment, as well as opportunities for ecological restoration, and connectivity to indigenous vegetation patches across the site;
2. Improve aquatic habitat, function, and biodiversity values of John Creek as a natural outcome of the revegetation and enhancement of the margins of the Creek and the restoration of the main wetland clusters at either end of the site. This will improve in-stream habitat, riparian margin revegetation and improvements to water quality, both within the site, and, therefore, improvements to the northern receiving area of John Creek and Weiti Stream and the nearby estuary.
3. Where riparian enhancement is included, this provides opportunities for not only revegetation planting, but also including created habitat for lizards, bats, and invertebrates (for example, by including logs, refuge stacks, and including specific forest trees within riparian margin management).

The above ecological protection and restoration initiatives are reflected in the draft Precinct Provisions, which include specific objectives to protect, restore and enhance ecological features on the site, and polices that require the planting of stream margins, the use of native plants in restoration areas, and the consideration of improvements to water quality.

The Masterplan layout anticipates that many of the smaller mid and upper slope seepage wetlands may be removed to enable the road network and efficient lot sizes. All of these wetlands are of very low ecological value as they are exotic rush dominated and intensively grazed. Where wetland removals may require ecological redress, there are substantial opportunities on the site where offsetting could be applied. Offsetting at off-site locations is also possible and can be undertaken in accordance with the AUP.

There are no ecological values on the site that are so significant or so rare or threatened that avoidance is likely to be the only option that could be considered in relation to the development of the site. However, there are values at the site that would be beneficial to protect and enhance from an ecological perspective, both to retain ecological links on the landscape and to maintain or improve functionality of ecological systems already in place (even if these are currently in a degraded state).

In the context of the development of the site in an efficient and economically viable manner, there are a range of measures that can be adopted to reduce the extent and severity of potential effects on the existing ecological values.

Examples include:

- Avoidance of effects on John Creek, indigenous vegetation, and some wetlands. Overall, the avoidance of effects on intermittent streams and wetlands will be undertaken to the extent practicably feasible in accordance with Chapter E3 of the AUP.
- Mitigation to lessen the severity of effects through salvage and relocation of fish and eels from streams that will be bridged with roading culverts or otherwise adversely affected, the principles of effective erosion and sediment control, maintaining base flows into headwater streams and wetlands, and removal of online ponds and dams to restore stream flow and habitat (where deemed appropriate) will be applied.
- An emphasis on the use of locally-sourced, ecologically-appropriate native plants in the design of amenity areas and restoration plantings of riparian margins so that habitat and food resources are provided as far as possible for native wildlife including birds, lizards, and invertebrates.

Based on our knowledge of the effects arising from developments such as this Plan Change area, it is unlikely that any future resource consent applications for works within the PPC site and their adverse effects could be entirely addressed by enhancement works within the Plan Change area. Where residual ecological effects after avoidance, mitigation and on-site enhancement works are insufficient to address such effects, off-site protection and enhancement opportunities will be investigated.

Overall, the Structure Plan/ Masterplan and the Precinct Provisions provide for the protection and restoration of riparian margins and the establishment of multi-purpose green corridors which will result in a far greater diversity and coverage of native treeland, linkages, and resources for wildlife than is currently present.

The identification of the features identified in this report will assist in their recognition at the time of future resource consent applications. The NES-F and the AUP include a comprehensive set of rules relating to identified features (for example E3 for streams and E15 for vegetation). These are appropriate to address the potential for adverse effects in the same way they already apply to the local area's more intensive use Zones. From an ecological perspective, these rules are appropriate to address relevant effects that may be generated at the time of resource consent.

Considering the absence or low ecological values within Plan Change site, it is my opinion that the precinct provisions will adequately protect all the important ecological values of the site. Where there may be unavoidable adverse effects on ecology values, these can be effectively remedied, mitigated, offset, or compensated such that the overall net ecological effect of the Plan Change will be no more than minor.

The overall outcome from the proposed Private Plan Change will be a clear, positive, net-benefit for indigenous biodiversity values and ecological services, and spans waterways, wetlands, wildlife habitat and native revegetation.

5.0 References

- Clarkson BR, Champion PD, Johnson PN, Bodmin KA, Forester I, Gerbeaux P, Reeves PN 2013. Wetland indicator status ratings for New Zealand species. Landcare Research, Hamilton.
- Clarkson BR, Fitzgerald NB, Champion PD, Forester L, Rance BD. 2021. New Zealand wetland plant indicator status ratings 2021: Data associated with Manaaki Whenua - Landcare Research contract report LC3975 for Hawke's Bay Regional Council
- Dunn NR, Richard M. Allibone, Gerard P. Closs, Shannan K. Crow, Bruno O. David, Jane M. Goodman, Marc Griffiths, Daniel C. Jack, Nicholas Ling, Jonathan M. Waters and Jeremy R. Rolfe. 2017. Conservation status of New Zealand freshwater fishes. New Zealand Threat Classification Series 24. Department of Conservation, Wellington.
- Goodman JM, Dunn NR, Ravenscroft PJ, Allibone R, Boubee JAT, David BO, Griffiths M, Ling N, Hitchmough RA, and Rolfe JR. 2014. New Zealand Threat Classification Series 7: Conservation status of New Zealand freshwater fish, 2013. Department of Conservation, Wellington.
- Hitchmough R, Barr B, Knox C, Lettink M, Monks J, Patterson GB, Reardon J, van Winkel D, and Rolfe J, and Michel P. 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35. Department of Conservation, Wellington.
- O'Donnell CFJ, Borkin KM, Christie JE, Lloyd B, Parsons S and Hitchmough RA. Conservation status of New Zealand bats, 2017. New Zealand Threat Classification Series 21. 4 p.
- Robertson HA, Karen A. Baird, Graeme P. Elliott, Rodney A. Hitchmough, Nikki J. McArthur, Troy D. Makan, Colin M. Miskelly, Colin F. J. O'Donnell, Paul M. Sagar, R. Paul Scofield, Graeme A. Taylor and Pascale Michel. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. Department of Conservation: New Zealand Threat Classification Series 36. Department of Conservation, Wellington.
- Sawyer J. and Stanley R. 2012. Criteria for the identification of significant ecological areas in Auckland. Auckland Council.

Report prepared by:



.....
Graham Ussher

Principal Ecologist

GTU

g:\shared drives\рма ecology main drive\рма ecology ltd\active projects\2115 dairy flat plan change\working\plan change ecology report\sw ppc ecology assessment 20aug23 issued.docx

Appendix A – Stream classification and condition

Table A1. Assessment of watercourses against the AUP criteria for classifying permanent and intermittent streams (and by omission, ephemeral streams) for the Silverdale West Stage 1 site. Permanent streams meet the single permanent criterion and are based on expert judgement. Intermittent streams are not permanent and meet ('yes' response) at least three of the intermittent stream criteria. Ephemeral streams do not meet at least three of the stream criteria. The 'Surface flow 48 hours after rain' and 'continuously flowing' criteria were not strictly assessable (N/A) due to recent rain, and judgement was used as part of this assessment to differentiate stream classifications.

Stream	Length (m)	Permanent	Intermittent criteria						Classification
		Continually flowing?	Has natural pools?	Has a well-defined channel?	Surface flow 48 hrs after rain?	No rooted terrestrial vegetation across channel?	Organic debris on floodplain?	Evidence of substrate sorting?	
John Creek	1,716	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Permanent
P1	394	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Permanent
P2	245	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Permanent
P3	282	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Permanent
I1	86	No	Yes	Yes	N/A	Yes	No	Yes	Intermittent
I2	214	No	Yes	Yes	Yes	Yes	No	Yes	Intermittent
I3	185	No	Yes	Yes	Yes	Yes	No	Yes	Intermittent
E1	111	No	No	Yes	N/A	No	No	No	Ephemeral
E2	28	No	No	No	N/A	No	No	No	Ephemeral
E3	81	No	No	No	N/A	No	No	No	Ephemeral
E4	96	No	No	No	N/A	No	No	No	Ephemeral
E5	40	No	No	No	N/A	No	No	No	Ephemeral
E6	91	No	No	Yes	N/A	No	No	No	Ephemeral
E7	29	No	No	No	N/A	No	No	No	Ephemeral
E8	117	No	No	Yes	N/A	No	No	Yes	Ephemeral
E9	186	No	No	Yes	N/A	No	No	No	Ephemeral

Stream	Length (m)	Permanent	Intermittent criteria						Classification
		Continually flowing?	Has natural pools?	Has a well-defined channel?	Surface flow 48 hrs after rain?	No rooted terrestrial vegetation across channel?	Organic debris on floodplain?	Evidence of substrate sorting?	
E10	87	No	No	No	N/A	No	No	No	Ephemeral
E11	119	No	No	Yes	N/A	No	No	No	Ephemeral
E12	60	No	No	No	N/A	No	No	No	Ephemeral
E13	114	No	No	Yes	N/A	No	No	No	Ephemeral
E14	66	No	No	Yes	N/A	No	No	No	Ephemeral
E15	107	No	No	Yes	N/A	No	No	No	Ephemeral

Table B2. Summary of characteristics and overall condition for permanent and intermittent streams for the Silverdale West Stage 1 site. See footnotes for explanation of qualitative assessments.

Stream	Type	Riparian diversity ¹	Channel shade ²	In stream habitat ³	Bed characteristics ⁴	Overall condition ⁵
John Creek	Permanent	Moderate	Good	Moderate	Moderate	Moderate
p1	Permanent	Poor	Poor	Moderate	Poor	Poor
p2	Permanent	Very poor	Very poor	Poor	Very poor	Very poor
p3	Permanent	Moderate	Good	Moderate	Moderate	Moderate
i1	Intermittent	Moderate	Good	Poor	Moderate	Moderate
i2	Intermittent	Very poor	Very poor	Very poor	Poor	Very poor
i3	Intermittent	Very poor	Very poor	Very poor	Poor	Very poor

1 Riparian diversity assessed as: no vegetation (very poor), pasture or grass or monoculture of low weeds (poor), several woody plant species either native or exotic (moderate), many woody plant species; mixed exotic/ native/ successional species (good); highly diverse range of native plant species forming a mature or maturing canopy with understorey and ground tiers (very good).

- 2 Channel shade assessed as: fully open; lack of canopy cover (very poor); <20 % water surface shaded (poor); 20 – 60 % water surface shaded; mostly open with shaded patches (moderate); 60 – 80 % water surface shaded; mostly shaded with some open patches (good); > 80 % water surface shaded; full canopy (very good).
- 3 In stream habitat assessed as: favourable habitats (woody debris, rooted aquatic vegetation, leaf packs, undercut banks, root mats, stable habitat) limited and coverage <10 % channel (very poor); favourable habitat diversity limited to 1-2 types; woody debris rare, coverage 10 – 30 % of channel (poor); moderate variety of habitat types (3-4 types) covering 30 – 50 % channel (moderate); most habitat types present, covering 50 – 75 % channel (good); all habitat types present covering >75 % of channel (very good).
- 4 Bed characteristics assessed as: Very high loading of un-natural silt and uniform hydrologic conditions (very poor); un-natural siltation with limited variety of hydrological conditions (poor); mostly natural bed substrates with moderate variety of hydrologic conditions (moderate); natural bed substrates with a good variety of pools, runs, riffles (good); natural bed substrates with the full range of hydrologic conditions present (deep and shallow pools, chutes, runs, riffles) (very good).
- 5 Overall condition assessed as a combination of the four key characteristics with scores all or predominately of 'poor' returning an overall poor condition or very poor, scores predominantly or mostly of 'moderate' returning an overall moderate condition, and scores all or predominately of 'good' returning an overall good condition

Appendix B – Wetland data and analysis

As part of the survey of the entire site, the Pasture Exclusion Assessment Methodology (incorporating the Clarkson 2013 wetland assessment tests) was applied to identify areas of possible wetland vegetation. Locations of particular interest were gully heads, stream margins, and slope seeps.

A total of 27 vegetation plots and 13 soil samples were taken in representative locations across the subject areas. All 27 vegetation plots had an associated soil core sample taken, and additional soil samples were taken in either nearby upland grass communities to demonstrate where wetlands terminated, or in low-lying areas to determine whether wetland soils were present.

The methodology applied for the identification of wetlands at this site was as follows:

- Visual assessment as to whether the potential wetland area could support a threatened species;
- Visual assessment as to whether the potential wetland and surrounding area is clearly dominated by pasture grass species (the Rapid Pasture Test);
- Visual assessment of areas where the vegetation composition includes species that are scored as wetland obligate, facultative wetland, or facultative (e.g., rushes, wet pasture or 'wetland-type' vegetation) as assessed by Clarkson et al.⁸ (following the Pasture Exclusion Test, and Wetland Delineation Protocols as laid out in the Pasture Exclusion Assessment Methodology⁹);
- Where these compositions exist, an assessment of vegetation, soils, and hydrology is required according to the Pasture Exclusion Assessment Methodology:
 - Vegetation is assessed through plant identification and percentage cover estimates (as per the method described by Clarkson¹⁰) of 2 m x 2 m plot areas within each potential wetland area;
 - Soils are assessed by applying the criteria outlined in Fraser (2018)¹¹ for identifying hydric (wetland) soils – which involves excavation and examination for gleyed, mottled, peaty, or wet soils; and
 - Hydrology is assessed by applying the criteria outlined in the Ministry for the Environment tool¹²;

⁸ Clarkson B. R., Fitzgerald N. B., Champion P. D., Forester L., Rance B. D. (2021). New Zealand wetland plant indicator status ratings 2021: Data associated with Manaaki Whenua - Landcare Research contract report LC3975 for Hawke's Bay Regional Council.

⁹ Ministry for the Environment. 2022. Pasture exclusion assessment methodology. Wellington: Ministry for the Environment.

¹⁰ Clarkson, B. (2013). A vegetation tool for wetland delineation in New Zealand. Report prepared for Meridian Energy Limited by Landcare Research.

¹¹ Fraser S., Singleton P., Clarkson B. (2018). Hydric soils – field identification guide. EnviroLink Tools Contract C09X1702. Manaaki Whenua – Landcare Research Contract Report LC3233 for Tasman District Council.

¹² Ministry for the Environment. (2021). Wetland delineation hydrology tool for Aotearoa New Zealand. Wellington: Ministry for the Environment.

An area can be classified as a wetland based on the definition within the AUP and the RMA, but not be classified as a 'natural inland wetland' under the NPS-FM because the definition of the latter includes some exclusions:

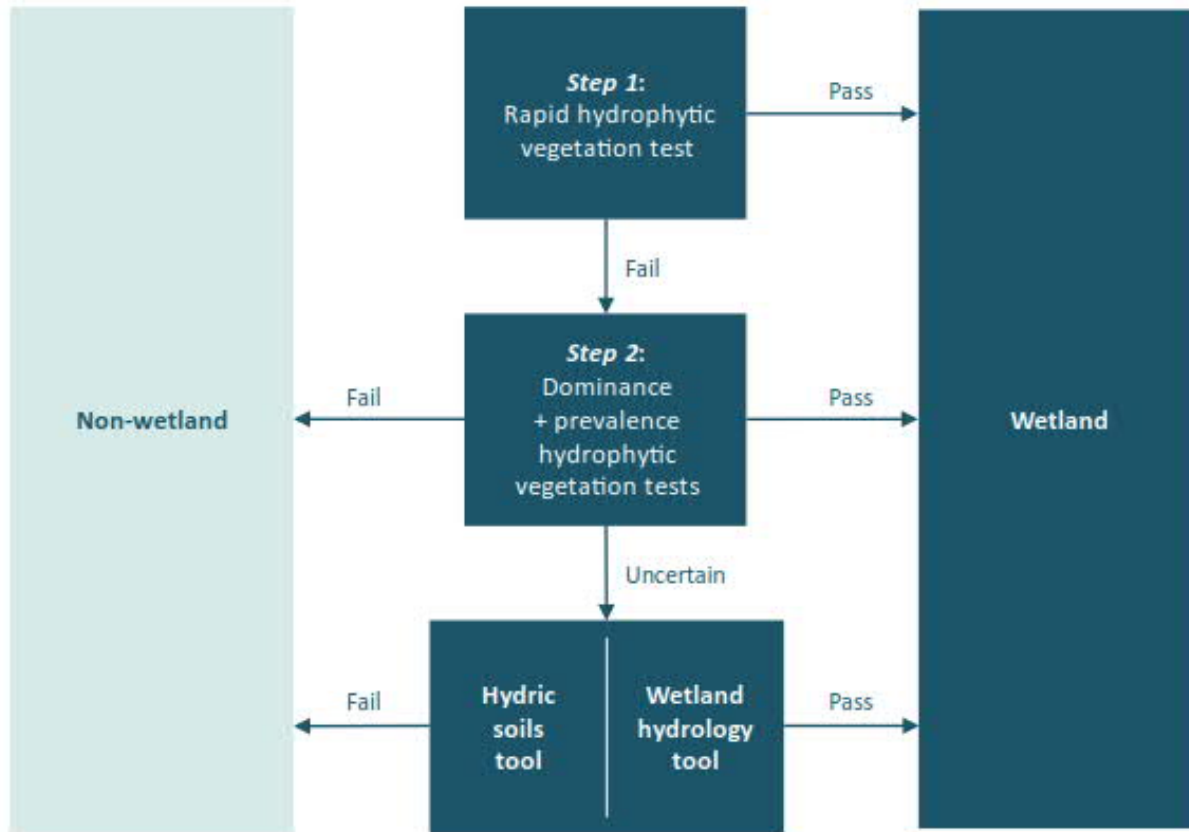
"Natural inland wetland means a wetland (as defined in the [Resource Management] Act) that is not:

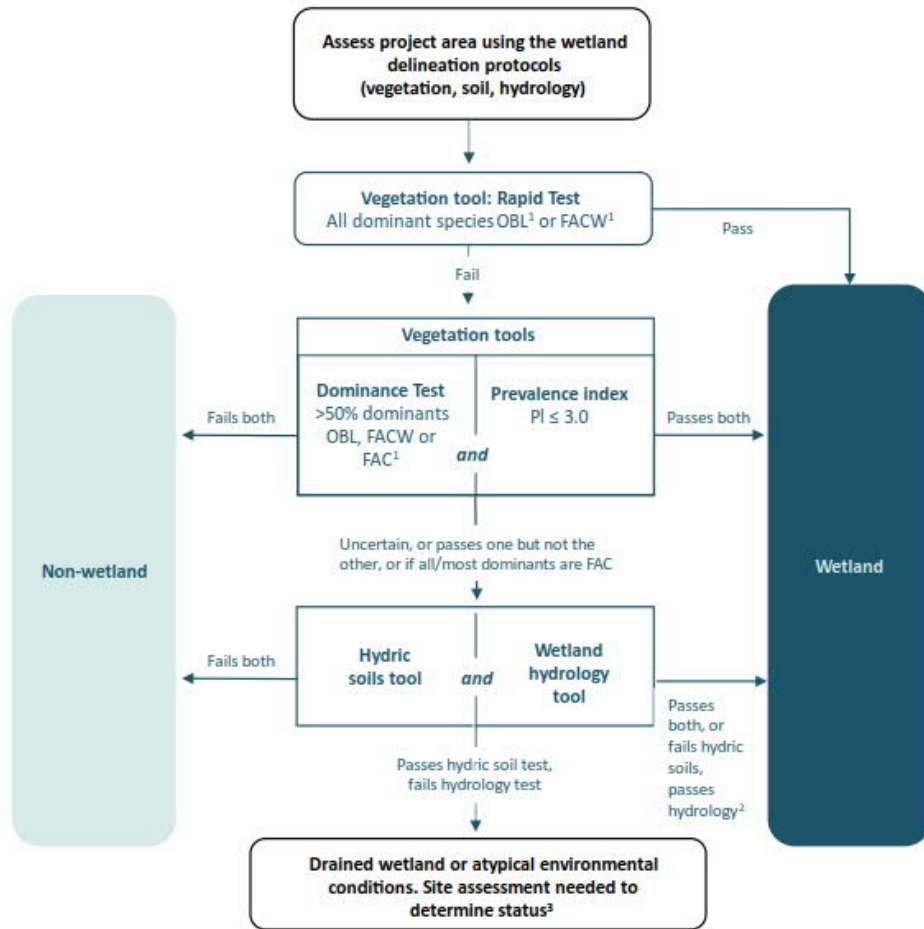
- (f) in the coastal marine area; or
- (g) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or
- (h) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or
- (i) a geothermal wetland; or
- (j) a wetland that:
 - (iv) is within an area of pasture used for grazing; and
 - (v) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless
 - (vi) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply"

The boundaries of potential wetland areas are delineated by carrying out assessments of the various vegetation communities and through professional judgement.

We note that the accuracy of our GPS is +/- 5 m, and that boundaries shown in this report should be considered to be indicative. The exact extent of wetland transition points/ boundaries at this site was not accurately mapped – the polygons shown in this report are approximations. Accurate delineation would require targeted fieldwork and (most probably) several dozen wetland assessment plots or transects throughout the site to resolve the boundaries between RMA-level, NPS-FM-qualifying wetlands, and non-wetland areas. Therefore, the boundaries of the polygons provided in this report include an element of expert judgement.

The supporting calculations for determining wetlands, site photographs including soil samples can be provided, and the updated wetland extents and survey points can also be provided as a shapefile upon request.





Footnotes:

¹ Wetland indicator status abbreviations: FAC = facultative, FACW = facultative wetland, OBL = obligate wetland.

² For example, recent wetland.

³ The US procedures for atypical or problematic situations are recommended.

Figure B1. Flow chart of steps for hydrophytic (wetland) vegetation determination. Wetland indicator status abbreviations: FAC= facultative; FACW = facultative wetland; OBL = obligate wetland (sourced from NPS-FM MfE Wetland Delineation Protocols 2020 – updated in 2023).

Simple key to identify hydric soil features

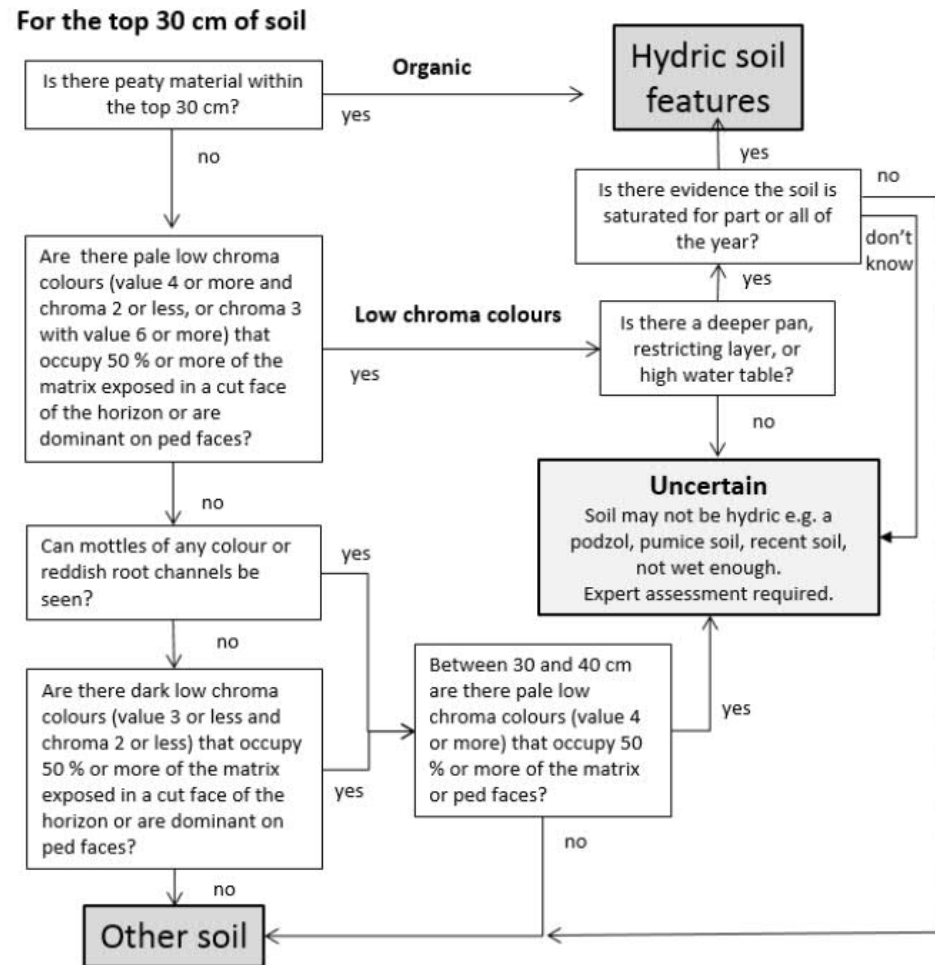


Figure B2. Key to identifying hydric soils (from Fraser et al. 2018).



Plate B1. (left) Soil Core 4, an example of a non-hydric soil taken within a paddock with terrestrial grasses, away from wetland areas, sample used as a control. (right) Soil Core 5, an example of a hydric soil with pale low-chroma clay which qualifies as a wetland soil.



Plate B2. (left) Wetland plot W21, an example of a historic wetland area that has been modified by pasture farming. Sporadic *Juncus* rushes in this location result in the wetland vegetation criteria as per Clarkson (2013) method meeting the NPS-FM criteria as a natural inland wetland. (right) Wetland plot W20, plot taken 3-5 m away from W21. The dominance of pasture grasses in this location result in the wetland vegetation criteria as per Clarkson (2013) method not meeting the NPS-FM criteria as a natural inland wetland. Due to the dominance of pasture grass in the wider area, this location was determined to not be a natural wetland.

The results from W20 and W21 illustrate the ambiguities of determining 'natural wetlands' in areas with extensive impacts from historic agricultural land uses. This area was likely to have been a wetland mosaic, and as such multiple wetland plots were required to accurately determine if the area was a natural wetland.

Table B1. Results of vegetation plot analysis against the NPS-FM Delineation Protocols. Sampling points are shown on Figure B3.

Site			pasture grasses (as per MFE 2023)															June 2022 MN + TP		
Date & Recorders																				
Common name	Species (hydtype)	group score	Wetland plot number ---->	W1	W2	W3	W4	W5	W6	W7	W8	W9	W11	W13	W14	W15	W18			
Wetland identifier (N/A = not wetland)			W1		W3	W4	W5	W6	NA	NA	NA	NA	NA	W13	NA	W14				
See GIS mapping for location of wetlands																				
Creeping bent	<i>Agrostis stolonifera</i> FACW	2		68%							2%	8%		5%			10%			
sweet vernal	<i>Anthoxanthum odoratum</i>	4																		
Tall oat grass	<i>Anthoxanthum odoratum</i>	5																		
Starwort	<i>Callitriche stagnalis</i> OBL	1																		
	<i>Carex secta</i> OBL	1							25%											
Kikuyu	<i>Cenchrus clandestinus</i>	4		5%													5%			
Chickweed	<i>Cerastium sp.</i> FACU	4																		
Scotch thistle	<i>Cirsium vulgare</i> FACU	4					1%													
Umbrella sedge	<i>Cyperus eragrostis</i> FACW	2					10%		5%					10%	2%	2%	35%			
	<i>Cyperus latifolius</i> FACW	2																		
Cockfoot	<i>Dactylis glomerata</i> FACU	4												3%						
Wild carrot	<i>Daucus carota</i> UPL	5		1%																
Japanese lady fern	<i>Deparia petersenii</i> FAC	3							5%											
Sharp spike-sedge	<i>Eleocharis acuta</i> OBL	1																		
Yorkshire fog	<i>Fibris lanatus</i> FAC	3					5%	3%	2%				2%	5%	10%	3%	2%			
Cal's ear	<i>Hypochaeris radicata</i> FACU	4											1%							
	<i>Isoplepis cernua</i> OBL	1																		
Jointed rush	<i>Juncus articulatus</i> FACW	2																		
	<i>Juncus edgariae</i> FACW	2																		
Soft rush	<i>Juncus effusus</i> FACW	2																		
	<i>Juncus sphenanthus</i> FACW	2																		
	<i>Lychnis viscaria</i> OBL	1																		
Chinese privet	<i>Liquidambar sinense</i> FACU	4							2%											
Tall fescue	<i>Lolium arundinaceum</i> FAC	3		10%																
Perennial ryegrass	<i>Lolium perenne</i> FACU	4																		
Lolus	<i>Lolus pedunculatus</i> FAC	3																		
Loosestrife	<i>Lythrum hyssagifolia</i> FACW	2																		
Water cress	<i>Nasturtium officinale</i> OBL	1																		
Paspalum	<i>Paspalum dilatatum</i> FACU	4																		
Mercer grass	<i>Paspalum distichum</i>	2																		
Narrow leaved plantain	<i>Plantago lanceolata</i> FACU	4																		
Broad-leaved plantain	<i>Plantago major</i> FACU	4							1%											
Creeping cinquefoil	<i>Potentilla reptans</i> FAC	3																		
Self-heal	<i>Prunella vulgaris</i> FACU	4																		
Spearwort	<i>Ranunculus flammula</i>	2																		
creeping buttercup	<i>Ranunculus repens</i> FAC	3																		
Broad-leaved dock	<i>Rumex obtusifolius</i> FAC	3																		
clover	<i>Trifolium repens</i> FACU	4		1%																
Arum lily	<i>Zorasterischa aestivapica</i>	3																		
Litter																				
Bare ground																				
Total cover				99%																
Threatened species habitat?				no																
% pasture grass cover?				17%																
Excluded as NPSFM wetland (>50% pasture in improved pasture?)				No																
Rapid Test - Pass?				No																
Dominance test score (>50%) for OBL, FACW, or FAC				yes																
Prevalence Index (Hydrophytic vegetation <=3)				2.2																
Prevalence Index (<= 3.0)				yes																
All or most dominant FAC?				No																
Hydric Soil Present				yes																
Wetland Hydrology Present				yes																
Passes Hydric soils & hydrology = wetland																				
Passes hydric soil; fails hydrology = atypical																				
Fails hydric & hydrology = not wetland																				
Fails soils, passes hydrology = wetland																				
NPSFM wetland (Yes or No)				Yes					No	No	No	No	No	Yes	No	Yes				



Figure B3. Locations of vegetation plots undertaken to assess wetland status. Northern part of the site.



Figure B3. Locations of vegetation plots undertaken to assess wetland status. Northern central part of the site.



Figure B3. Locations of vegetation plots undertaken to assess wetland status. Southern central part of the site.



Figure B3. Locations of vegetation plots undertaken to assess wetland status. Southern part of the site.