Fast Track Application – 531 & 535 Mill Road - Aquatic Ecology Assessment

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EXECUTIVE SUMMARY

Carter Group Limited (CGL) are applying for a Fast-track Application (Fast Track Approvals Act 2024) of the proposed Ōhoka Residential Development, located at 531 and 535 Mill Road, Ōhoka (the Site). The Site in its current state has five main waterways, with three originating from springs/seepages within the Site and two sourced from upstream catchments. A network of internal farm drains is also located within the Site, created to drain the land for agricultural land use. Natural inland wetlands, reported to be in a degraded state because of past land use and grazing are located throughout the Site. The proposed development will result in a range of activities that have the potential to impact the aquatic ecology values within and downgradient of the Site. These include:

- Land use change from agricultural (dairy farm) to business, residential, rural-residential areas, and a potential retirement village.

Mitigation strategies have been provided to avoid and/or minimise potential effects to spring and watercourse hydrology as a result of land use change, with setbacks and engineering measures proposed to further reduce the risk of re-directing groundwater flow paths.

- Stormwater discharges and dewatering

Treated stormwater quality is expected to meet the Canterbury LWRP Receiving Water Standards for total suspended solids and metals (copper, lead and zinc) after reasonable mixing for first flush basins and wetlands. Total zinc and copper are not expected to meet the receiving standards for the more immediate discharges (swales, raingardens, proprietary devices). These exceedances have been modelled as temporary (4-hours) and compared to the Interim Tier 1 acute guideline values (up to 96-hour exposure). After mixing with the receiving environment, adverse effects of these temporary discharges are not expected, but cumulative effects to downgradient waterways are acknowledged.

- Waterway realignment and removals

As a result of the proposed development layout, loss of stream length and wetland extent will occur. The mitigation hierarchy has been followed, to demonstrate how this loss of watercourse and wetland habitat has been avoided, minimised/remedied and offset.

- Instream works

Works within watercourses will be required associated with culvert installations and removals, watercourse enhancement, watercourse realignment and removals/infilling. All instream works will be undertaken outside of sensitive fish spawning periods, with consent conditions requiring all instream works to be undertaken in isolated conditions with associated fish salvage required by a suitably qualified freshwater ecologist.

A range of recommendations are provided to manage and monitor potential effects of the proposed development. These include the requirement for an Ecological Management Plan which will detail the requirements for spring head, watercourse and wetland restoration and enhancement. Monitoring before, during and after works will also be required to document the success of the proposed offsetting.

With the recommended watercourse and wetland mitigation, offsetting and associated monitoring and maintenance, there are not considered to be effects that reach the threshold of a “sufficiently significant adverse impact” such that they need to be taken into account in terms of an assessment under s85 of the FTAA2024.

1. INTRODUCTION

Carter Group Limited (CGL) are applying for a Fast-track Application (Fast Track Approvals Act 2024) of the proposed Ōhoka Residential Development. The purpose of the act is to facilitate the delivery of infrastructure and development projects with significant regional or national benefits.

It is proposed to subdivide a 154.4 ha residential and commercial development at 531 & 535 Mill Road (the Site). Most of the Site (152.6 ha) is currently an active dairy farm, with CGL proposing the development for a minimum of 850 residential allotments, a commercial area, a retirement village, and a polo field.

CGL has commissioned Instream Consulting Limited (Instream) to prepare a report to assess the potential effects of the proposed residential development on existing aquatic ecological values. This includes assessment of the following:

- Current values of the waterways within the Site.
- Potential effects of the development on waterways within and downgradient of the Site.
- Options to avoid, minimise and offset potential adverse effects.

Appendix 1 includes a copy of the Curricula Vitae of the Instream staff that authored this report.

2. METHODS

This assessment is based on desktop review of available sources, an ecological field survey undertaken by Aquatic Ecology Limited (AEL) in 2021 and an updated field survey undertaken by Instream in March 2025. Review of publicly available information was undertaken, including Canterbury Maps (Canterbury Regional Council's geospatial database) 'Ecology & Biodiversity'[1] layers and the 'Black Maps'[2].

Based on available information, an assessment of the potential and actual effects to aquatic ecology values has been undertaken. There is the potential for direct and indirect effects to aquatic ecology values within and downgradient of the Site as a result of development. These effects are primarily associated with earthworks, change in land use, and stormwater discharges. Following the assignment of ecological values, the magnitude of these effects has been determined to understand the overall level of effect at the Site. These methods are based broadly on the Ecological Institute of Australia and New Zealand (EIANZ) guidelines (EIANZ 2018) methodology, where effects are weighted against the known ecological values of the aquatic feature. This assessment enables effects to be ranked on a gradient from negligible to very high and provide justification to avoid, remedy, mitigate, offset or compensate as appropriate. Recommendations for baseline and ongoing monitoring and management are also provided.

[1] Map | Canterbury Maps

[2] 'Black Maps' is a short-hand term for some of the mid 1800s survey plans for Canterbury. These maps give an insight into traditional areas of mahinga kai (sites of significance to Māori for food gathering) such as wetlands, lagoons, and estuaries before they were modified.

3. RESULTS

3.1. Desktop Review

The Site is located immediately southwest of the Ōhoka settlement, with several of the headwater tributaries of the Ōhoka Stream flowing through the Site. Review of the Canterbury Black Maps show that historically, the Site primarily consisted of Raupo Swamp, with a corridor of Flax and Grass associated with the Ōhoka Stream Tributary. The land has been extensively modified and drained for agricultural land use, with the Site an active dairy farm for over 30 years. It is understood that the dairying started on the land in the early 1970's.

Ten waterways are located within the Site, as shown in Figure 1. Of these waterways, three are mapped within Canterbury Maps, with the watercourse classification of 'Spring-fed Plains' and form part of the Ōhoka Stream catchment. Two mapped springs are located within the Site, forming the headwaters of the northern and central spring channels, which flow through the centre of the Site, from west to east.

The Ōhoka Stream catchment rises from springs and headwater streams west of the Site, flowing in a generally northwest to southeast direction. Immediately downstream of the Site a reach of the Ōhoka Stream Tributary flows through the Ōhoka Domain and Reserve, with a wide riparian margin, before its confluence with the Ōhoka Stream. The Ōhoka Stream joins the Kaiapoi River west of Kaiapoi, which then flows into the Waimakariri River. Mapped inanga spawning habitat is present at the confluence of the Ōhoka Stream and Kaiapoi River (as well as downstream), and the lower reaches of the Kaiapoi River is mapped as 'Land of National Significance'[3]. The Waimakariri River is mapped as 'Land of National Significance' and 'Site of Special Wildlife Significance'. The Land of National Significance is associated with the Lower Waimakariri River's braided system providing significant habitat value for endangered birds, including the wrybill, black fronted tern, and banded dotterel. A range of freshwater fauna have been recorded within the catchment, including native At-Risk fish species and the introduced trout.

3.2. Aquatic Ecology Surveys

Photographs of the key waterways within the Site are provided in Appendix 2. Aquatic Ecology Limited (AEL) assessed aquatic ecology values on site in 2021, via fishing surveys and habitat assessments. The report is provided in Appendix 3, with a summary of the key results provided below.

AEL documented five perennial, spring-fed streams within the site, three ephemeral drainage channels, two springs and one groundwater seep. Aerial imagery review and site walkovers undertaken since the AEL report (AEL 2021) was prepared have identified one additional watercourse on site, referred to as Unnamed Drain 3. Figure 1 provides an updated overview of the existing watercourse and spring features within the Site. Three ponded areas were also identified by AEL. These areas were surveyed as part of the wetland delineation undertaken by Pattle Delamore Partners (PDP 2025a: Appendix 4). Further details on wetlands within the Site are provided in section 4.7 of this report.

[3] 14 km long coastal stream. Fish and wildlife habitat. Lower reaches of the Kaiapoi River contain town known inanga spawning sites (Canterbury Maps).

Within the Site area, AEL reported that all waterways were effectively fenced from stock, which has resulted in stable bank structure and substrate. In particular, the fencing along the Ōhoka Stream Tributary, and the South Ohoka Branch has resulted in coarse substrate and hydraulic characteristics essential for trout spawning (AEL 2021). A trout spawning survey on the Ōhoka Stream was undertaken in 2018, as part of the Global Consent for the Waimakariri District Council and Environment Canterbury (Webb *et al.* 2018). Low numbers of trout redds (c. 5-25 redds/km) were identified from the Ōhoka Stream Tributary, downstream of Whites Road. Trout spawning activity was also recorded at the Site, within the Ōhoka Stream Tributary and the South Ohoka Branch during the 2021 AEL surveys.

As reported in Appendix 3, the fish fauna recorded within the Site was characteristic of steady spring-fed flows, stable banks and habitat structure, and areas of gravel substrate. Of the four fish species identified, only the longfin eel (*Anguilla dieffenbachia*) had a threat classification (At Risk – Declining: Dunn *et al.* 2017). The remaining three species are either 'Not Threatened' (upland bully: *Gobiomorphus breviceps*, shortfin eel: *A. australis*), or 'Introduced and Naturalised' (brown trout: *Salmo trutta*) (Dunn *et al.* 2017). Fish surveys also focussed on the potential presence of the critically endangered Canterbury mudfish (*Galaxias burrowsius*). This species is not considered present within the Site, based on the absence in the fish catch, but also the high predation from the introduced brown trout and native eels, which are widespread within the Site's waterways. No benthic macroinvertebrate or large invertebrate (kōura or kākahi) surveys were undertaken during the AEL investigation.

To supplement the ecological data collected by AEL and confirm current instream values, Instream undertook field surveys in March 2025. These surveys included rapid habitat assessments (RHA; Clapcott et al. 2020) and benthic macroinvertebrate sampling[4]. Site locations are provided in Figure 2, with locations selected to be used as ongoing monitoring sites. Results of the ecological surveys are summarised in section 4 and Appendix 5.

[4] Processing undertaken by Waikiwi Ecology Ltd, following Protocol P2 – 200 fixed counts, with scan for rare taxa.

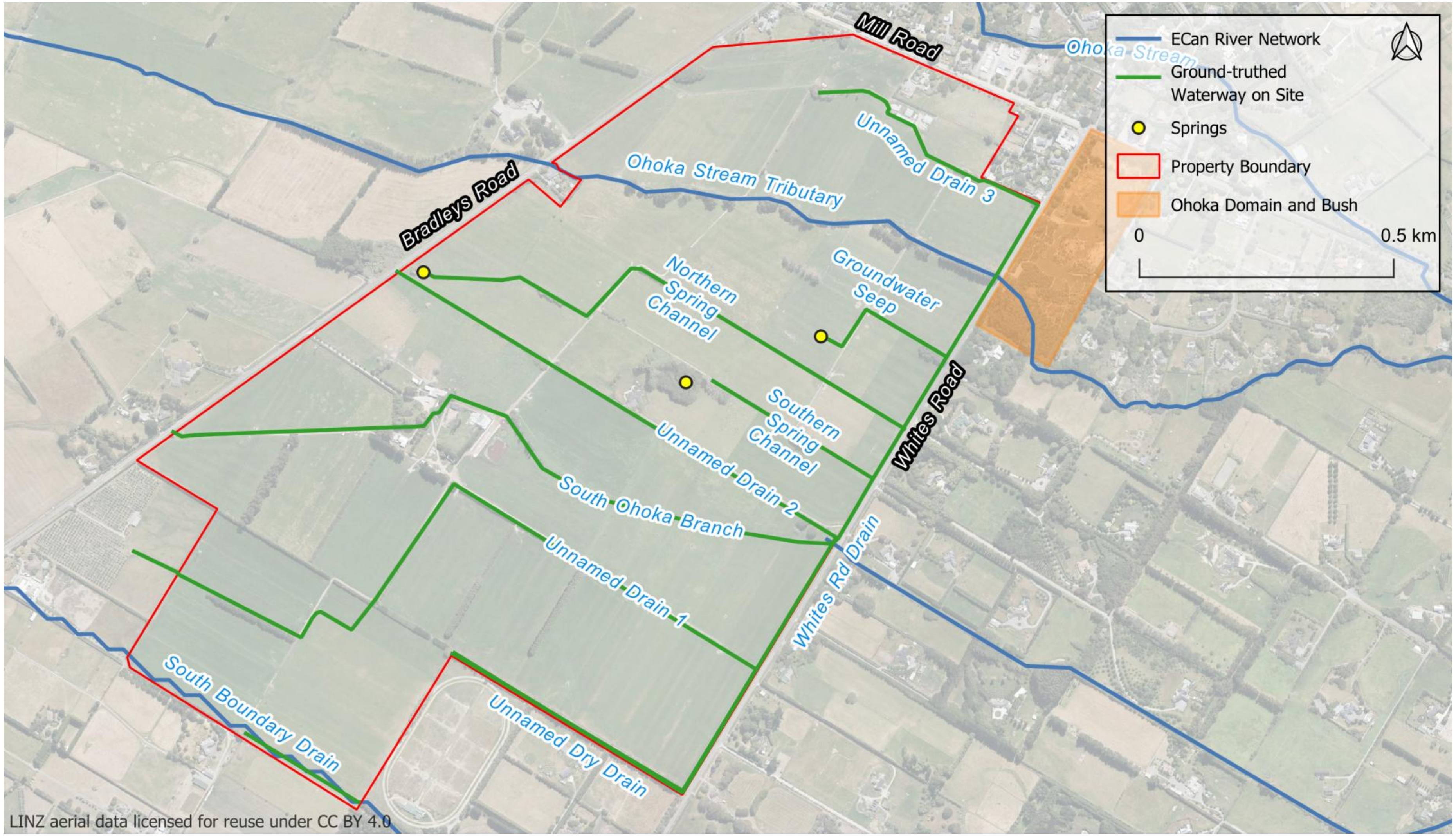

Figure 1: Overview of the Site's watercourses.

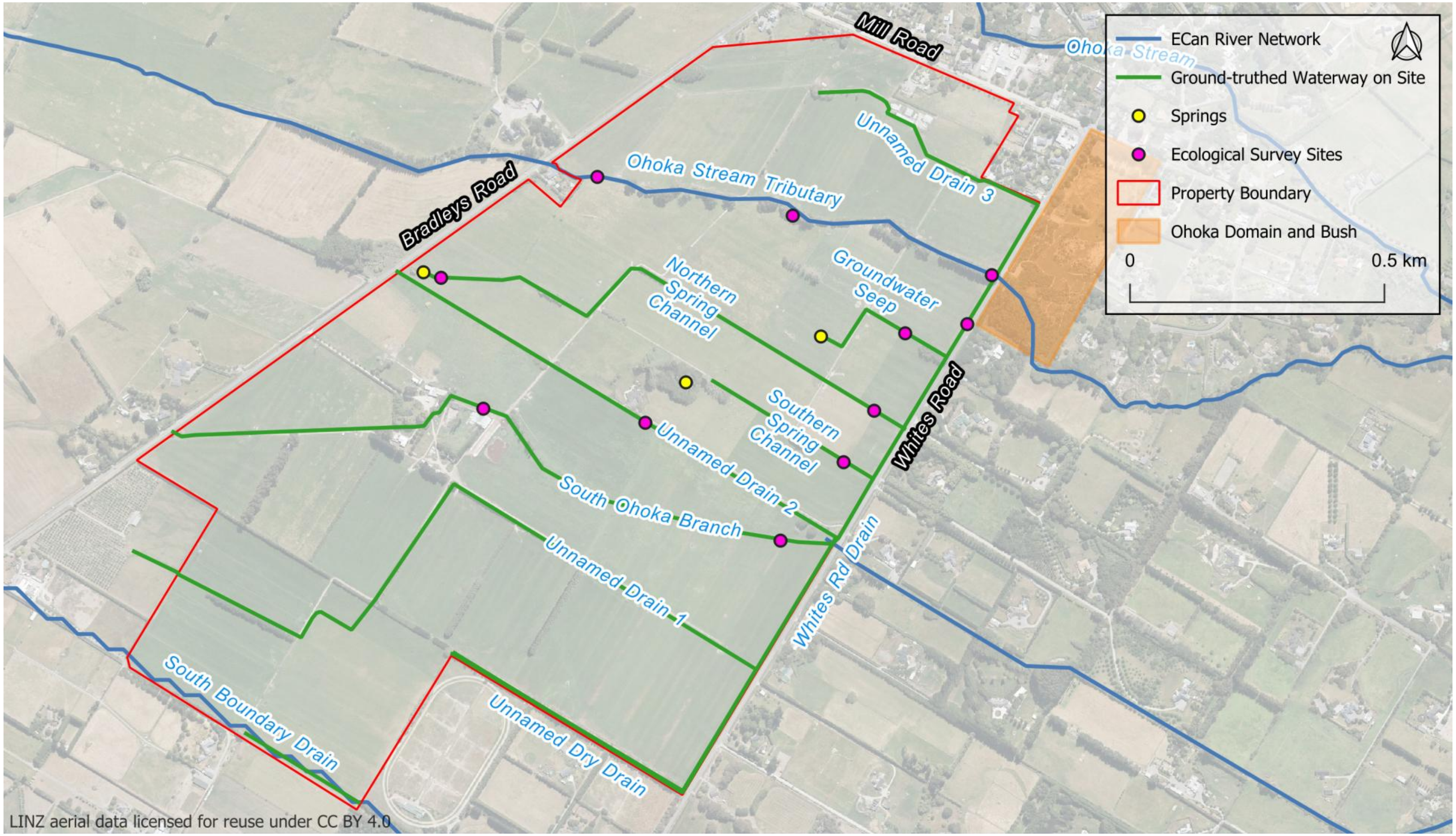

Figure 2: Instream ecological survey sites.

3.3. Surface Water Quality

Water quality within the catchment is representative of lowland spring-fed waterways in Canterbury, with elevated concentrations of nitrogen associated with shallow groundwater and *Escherichia coli* (*E. coli)* inputs. The closest downstream Environment Canterbury monitoring site is Ōhoka River at Island Road[5], approximately 5 km downstream of the Site. The river at this site has elevated nutrient concentrations, in particular nitrate-nitrogen, which can be toxic at high levels, and dissolved inorganic nitrogen (DIN), which is the bioavailable form of nitrogen for plant growth. The five-year median nitrate-nitrogen concentration at this site is 4 mg/L, which is above the Canterbury Land and Water Plan (LWRP) Plan Change 7 (PC7) target[6] of 3.8 mg/L and the National Policy Statement for Freshwater Management (NPSFM) annual median national bottom line of 2.6 mg/L. The faecal bacteria *E. coli* is also elevated above guideline levels, with the 5-year median count at 841 cfu/100 ml, compared to the PC7 freshwater outcome value[7] of 130 cfu/100 ml and NPS-FM national bottom line of 260 cfu/100ml.

To confirm the expected surface water quality of the waterways on site, grab samples were collected at key locations within the Site on 4 February 2025, during baseline conditions. Summary results are provided in Table 1 and discussed in the subsections below.

3.3.1. Ōhoka Stream Tributary

Samples were taken at the upstream and downstream property boundaries. *E. coli* counts were elevated at the upstream site, with a large increase from the downstream site (350 to >1,600 MPN/100 ml). Nitrate concentrations reduced slightly at the downstream site but were still elevated above the NPS-FM national bottom line of 2.4 mg/L (annual median). Ammoniacal-nitrogen increased at the downstream site, as did nitrate-nitrogen, which indicates effects from land irrigation. Total phosphorus and dissolved reactive phosphorus (DRP) concentrations increased from upstream to downstream, likely a result of stock and overland runoff of sediments; the DRP concentration of 0.02 mg/L is above the NPSFM lowest attribute state annual median[8]. All metals were below laboratory detection levels, as expected for agricultural land use.

3.3.2. Groundwater Seep

A high nitrate-nitrogen concentration (4.8 mg/L) was recorded, which is representative of shallow groundwater surfacing. This concentration is above the NPSFM national bottom line (annual median). DRP was also above the lowest attribute band level (annual median). Dissolved copper concentration was slightly above the laboratory detection limit. The cause of this is unknown but could be from vehicle track runoff adjacent to the channel. *E. coli* levels were lower at this site, compared to the neighbouring Ōkoha Stream Tributary.

[5] https://www.lawa.org.nz/explore-data/canterbury-region/river-quality/waimakariri-river-catchment/ohoka-river-at-island-road/ accessed July 2025.
[6] Table 8-5: Water Quality Limits and Targets for Waimakariri Rivers.
[7] Table 8a Freshwater Outcomes for Waimakariri Sub-region Rivers.
[8] No national bottom line available for DRP.

3.3.3. Northen Spring Channel

A reduction in total nitrogen concentration occurred between the upstream spring source and downstream channel site (from 6.2 to 3 mg/L), with corresponding reductions in nitrate-nitrogen and DIN. An increase in ammoniacal-nitrogen, nitrite-nitrogen and phosphorus (total and dissolved) concentrations occurred at the downstream site, which are indicators of irrigation effects and sediment input. Metals were below the detection limit, apart but from zinc at the downstream site, the source of which is unknown. *E. coli* was very high (5,400 MPN/100 ml) at the upstream spring site; this is not unexpected, as high level of pugging from stock was observed around the fence, which will be draining into the stream.

3.3.4. Southern Spring Channel

At the downstream extent of the central spring channel the total nitrogen, nitrate-nitrogen and DIN concentration was the lowest of the seven sampled sites (1.22 mg/L). However, this site had one of the highest concentrations of ammoniacal-nitrogen and nitrate-nitrogen recorded, which indicates effects of irrigation land use. Total phosphorus and DRP concentrations were elevated, with DRP is above the NPSFM lowest attribute state annual median. All metals were below detection limits and *E. coli* counts were low, compared to other downstream sites.

3.3.5. South Ohoka Branch

Only the downstream site was sampled, as the upstream reach is intermittent. All nitrogen parameters were elevated at this site, with nitrate-nitrogen above the NPSFM national bottom line (annual median). These elevated concentrations are considered a result of shallow groundwater inputs along its length. Total phosphorus and DRP concentrations were the second highest of all seven sites, and both copper and zinc concentrations were recorded at the laboratory detection rate. Sources of contaminated land are known to be located in the upper reaches of this watercourse, around the existing buildings.

Table 1: Summary surface water quality results.

		Ōhoka Stream Tributary		Groundwater Seep	Northern Spring Channel		Southern Spring Channel	South Branch Ohoka
Parameter	**Unit**	**Upstream**	**Downstream**	**Downstream**	**Upstream**	**Downstream**	**Downstream**	**Downstream**
Total Suspended Solids	mg/L	<3	<3	<3	23	<3	<3	<3
Total Nitrogen	mg/L	5.4	5.1	5.1	6.2	3.0	1.75	4.0
Nitrate Nitrogen	mg/L	5.2	4.8	4.8	5.1	2.4	1.22	3.4
Nitrite Nitrogen	mg/L	0.009	0.049	0.030	0.011	0.017	0.040	0.025
Total Ammoniacal Nitrogen	mg/L	<0.010	0.049	0.053	<0.010	0.034	0.040	0.018
Dissolved Inorganic Nitrogen*	mg/L	5.214	4.898	4.883	5.116	2.451	1.3	3.443
Total Phosphorus	mg/L	0.004	0.052	0.084	0.003*	0.020	0.061	0.074
Dissolved Reactive Phosphorus	mg/L	<0.004	0.041	0.063	<0.004	0.020	0.047	0.060
Dissolved Copper	mg/L	<0.0005	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	0.0005
Dissolved Lead	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Zinc	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	<0.0010	0.0010
Biochemical Oxygen Demand	mg/L	<2	<2	<2	<2	<2	<2	<2
Chemical Oxygen Demand	mg/L	<6	<6	12	30	10	8	8
Escherichia coli	MPN/ 100 ml	350	>1,600	170	5,400	130	170	350*

Notes: Underlined represents concentration above the NSPFM national bottom line or lowest Attribute Band. Shaded cells represent exceedance of LWRP Schedule 8 limits, noting these are for annual median not one-off samples. * represents laboratory error in processing time, therefore the result is inconclusive.

4. ECOLOGICAL VALUES ASSESSMENT

A summary of the ecological characteristics of the main waterways within the Site is provided below. Photos of each waterway and associated springs are provided in Appendix 2, with summary benthic macroinvertebrate data provided in **Error! Reference source not found.**, and summary habitat and basic water quality data provided in Appendix 5.

Table 2. Summary of benthic macroinvertebrate sampling results.

	Ōhoka Stream Tributary		Groundwater Seep	Northern Spring Channel		Central Spring Channel	South Branch Ohoka
	U/S	**D/S**	**D/S**	**U/S**	**D/S**	**D/S**	**D/S**
Number of taxa	31	24	21	20	23	13	17
EPT richness	7	8	0	1	0	1	3
EPT count	35	117	0	2	0	1	5
% EPT taxa	12	32	0	0.9	0	0.5	2.3
MCI	89	91	77	76	80	65	86
QMCI	3.42	4.45	3.96	4.13	3.56	4.39	4.40

Notes: Underlined values demonstrate exceedance of NPS FM (2024) national bottom-line values for MCI (<90) and QMCI (<4.5), and shaded cells demonstrate exceedance of Freshwater Outcome (QMCI minimum score ≤5) in Table 1a of the Canterbury LWRP.

All sites sampled for benthic macroinvertebrates had Quantitative Macroinvertebrate Community Index (QMCI) scores which were below the NPSFM national bottom line and LWRP Freshwater Outcome value. All sites, but the downstream Ōhoka Stream Tributary, were below the NPSFM national bottom line for the Macroinvertebrate Community Index (MCI) value. For context, total Rapid Habitat Assessment (RHA) scores of 0–25 are indicative of "poor" quality habitat, 26–50 is "fair", 51–75 is "good", and 76–100 indicates "excellent" habitat quality (Clapcott et al. 2020). Most sites scores fell within the 'fair' category, associated with deposited sediment levels, low hydraulic heterogeneity, and low-quality riparian vegetation and shading. A summary of this data is provided in Appendix 5.

4.1. Ōhoka Stream Tributary

This branch of the Ōhoka Stream is a perennial spring-fed stream that flows from west to east through the Site. Baseflow was measured on 25 February 2025[9] to be gaining in a downstream direction within the Site, from 11.4 L/s at Bradleys Road to 14.9 L/s at Whites Road. Reaches of un-silted gravel substrate are present, with trout spawning (redds) recorded (AEL 2021). The source of this stream is approximately 2 km upstream from the Site. Downstream of the Site, the tributary flows through 'Ōhoka Domain and Reserve' where a reach of stream has

[9] Flows for all streams in section 4 taken from the Hydrology Assessment (PDP 2025b).

been planted with native vegetation on the true left bank with a wide native riparian corridor associated with the reserve.

This waterway is representative of spring-fed headwater streams in the surrounding area. The presence of a clean, gravel bed substrate and perennial baseflow increases its current and potential values, with recorded trout spawning and good quality habitat. It also has recorded presence of upland and common bully (*Gobiomorphus breviceps, G. cotidianus*), longfin and shortfin eel (*Anguilla dieffenbachi, A. australis*), and brown trout (*Salmo trutta*). Currently, the stream setbacks are minimal (average of 1 m width) with no native riparian planting and the predominant riparian vegetation rank grasses. As a tributary of the Ōhoka Stream headwaters, it has a high level of potential for restoration and linkages with the downstream corridor. The RHA score for Ōhoka Stream Tributary improved moving upstream, but overall scored in the "fair" category, due to homogenous flow characteristics and lack of different types of fish habitat. Fish habitat increased in the upstream reaches as a result of undercut banks, increased overhanging vegetation, and native plantings at the upstream extent.

The MCI and QMCI values at the upstream and downstream boundary of Ōhoka Stream Tributary were similarly low due to the benthic macroinvertebrate community being dominated by pollution-tolerant taxa, including amphipods, gastropods, and/or ostracods (Table 2). However, both sites contained low counts of pollution-sensitive taxa (e.g., *Oeconesus*, *Olinga*, *Psilochorema,* and *Deleatidium* spp.). The presence of these sensitive taxa, albeit in low numbers, indicates that there is potential for ecological recovery in this waterway. With targeted restoration efforts, such as improving water quality and habitat complexity, it is likely that these sensitive taxa could effectively recolonise and establish in greater densities.

The ecological value of this watercourse has been categorised as 'high' because of the recorded trout spawning, direct connection to Ōhoka Stream, pollution-sensitive macroinvertebrate taxa, and presence of At Risk longfin eel.

4.2. Groundwater Seep

This feature is an isolated groundwater seep-fed channel that flows east to a channel parallel to Whites Road. Low flow levels have been observed discharging from gravel substrate, measured at 2.5 L/s on 25 February 2025 and reducing to 1.8 L/s by Whites Road. The downgradient channel appears to be mostly standing water, with high macrophyte levels causing water impoundment. Fencing is present around the spring head and channel, with minimal setbacks (~ 1m) and rank grass as the predominant riparian margin. The RHA score for the Groundwater seep channel was 'good', associated with gravel substrate, high invertebrate habitat, shading, and flow heterogeneity. Due to the value of groundwater seep habitats and the presence of upland bully within the channel, this feature has the potential for enhancement from its current state.

The MCI and QMCI values at the groundwater seep were low, with each parameter being below their respective national bottom line and LWRP Freshwater Outcome value (Table 2). The macroinvertebrate community was dominated by pollution-tolerant taxa, including Potamopyrgus snails, followed by copepods and ostracods. No pollution-sensitive mayflies, stoneflies, or caddisflies were found in this waterway.

The ecological value of this watercourse has been categorised as 'low' because of the limited baseflow, loss of flow along its length, lack of fish habitat, and low macroinvertebrate scores.

4.3. Northern Spring and Channel

This waterway originates at a spring within the Site near Bradleys Road. This spring is mapped on Canterbury Maps (M35/7485) and is described in the ECan database as 'artesian, permanent and having a channel or linear morphology'. The channel downstream of the spring is modified for drainage, flowing west to east through the Site to Whites Road. The waterway then flows along the Whites Road Drain channel for approximately 340 m before joining the Ōhoka Stream Tributary, immediately upstream of the Whites Road culvert. This waterway is not mapped on the Canterbury Maps waterway layers.

This waterway has been highly modified and straightened along paddocks and internal farm roads. Flow is low at the spring source, measured at 1.7 L/s on 25 February 2025, with flow gaining along its extent, measured at 7.4 L/s at Whites Road. The spring source has high potential ecological values but is currently impacted by land use and small setbacks, with pugging of the wet land surrounding the spring observed despite the spring head being protected from stock access. Only shortfin eel and upland bully have been recorded in this waterway, which are common in the area. The RHA score for the downstream site was "good" and "fair" at the upstream site. Differences were driven by riparian vegetation being denser at the downstream reaches, providing more shading to the waterway. Deposited sediment and invertebrate habitat diversity also scored poorer at the upstream site, associated with closer proximity to the springhead.

The MCI and QMCI values at the upstream and downstream boundary of the Northern Spring waterway were low, with each parameter being below their respective national bottom line and minimal score values (Table 2). The benthic macroinvertebrate community was dominated by pollution-tolerant taxa, including Potamopyrgus snails and ostracods, whereas no pollution-sensitive mayflies (Ephemeroptera), stoneflies (Plecoptera), or caddisflies (Trichoptera) were found.

The ecological value of this watercourse has been categorised as 'moderate' because of the springhead source of the stream. However, it was not categorised as high due to the highly modified nature of the channel, and the lack of riparian habitat, pollution sensitive macroinvertebrate taxa, and At Risk fish species.

4.4. Southern Spring and Channel

Two ponds are located near the main homestead, one of which is modified into a landscaped pond, with an earthen dam acting as a weir. The eastern pond is identified as a spring on Canterbury Maps (M35/7487) and the downstream channel is a mapped watercourse, although the alignment is not accurate. The landscaped pond has limited riparian planting, with lawn to the edges and some areas of ornamental planting. The eastern pond is in a more natural state, with mature exotic trees providing canopy cover and shading. Neither of the ponds were determined to be natural inland wetlands during the wetland delineation (PDP 2024a).

The channelised waterway flows through a culvert at the downstream extent of the eastern pond, flowing southeast towards Whites Road. The downstream channel substrate is predominantly fine sediment, with a high level of introduced macrophyte growth. Flow was measured at 4.6 L/s downstream of the pond on 25 February 2025, reducing to 3 L/s by Whites Road. The RHA score for the Southern Spring Channel was "fair", lacking riparian vegetation and shade. The homogenous flow also reduces the abundance of fish and invertebrate habitat available.

The fish survey recorded longfin eel, shortfin eel, and upland bully within the downstream channel. The MCI and QMCI values at the Southern Spring Channel were low, with each parameter being below their respective national bottom line and minimal score values (Table 2). The macroinvertebrate community was dominated by Potamopyrgus snails and ostracods, with no pollution-sensitive mayflies, stoneflies, or caddisflies found.

The ecological value of this watercourse has been categorised as 'moderate' because of the connection to the springhead source of the stream and associated pond. The channel downstream, however, has limited baseflow, lacks pollution sensitive macroinvertebrates, and has limited habitat diversity for fish.

4.5. South Ohoka Branch

Another branch of the Ōhoka Stream, referred to as the South Ohoka Branch, flows through the Site. The upper section west of the farm buildings does not have permanent flow, and a groundwater take is present approximately 300 m downstream from Bradleys Road. Baseflow gains from shallow groundwater inputs within the Site, with flow measured at 17.8 L/s at Whites Road on 25 February 2025. No fish were recorded between Bradleys Road and the farm buildings (the intermittent section of stream); however, gravel substrates were reported in the lower reaches, with the fish survey undertaken by AEL recording longfin eel, shortfin eel, and upland bully within the perennial reach. The lower reaches recorded gravel substrate suitable for trout spawning.

The RHA score for the South Ohoka Branch was 'fair', due to lack of riparian shade, vegetation, and homogeneous flow characteristics. The MCI and QMCI values at the South Ohoka Branch were low, with each parameter being below their respective national bottom line and minimal score values (Table 2). The macroinvertebrate community was dominated by pollution-tolerant *Paracalliope* amphipods, with only one pollution-sensitive taxa, a *Psilochorema* free-living caddisfly, recorded. The ecological value of this watercourse has been categorised as 'high' because of the presence of pollution sensitive macroinvertebrate taxa, gravel substrates in the lower reaches, and the presence of At Risk longfin eel.

4.6. Unnamed Waterways

In addition to the five main watercourses described above, drains within the Site and along the downgradient property boundary (Whites Road) will be impacted by the proposed development. These waterways are described briefly below. No fish were recorded in the internal drains during the fish survey, and they have been observed to be either dry, have standing water, or low flow levels. The ecological values of these waterways are therefore considered low.

- Whites Road Drain[10] is a watercourse channel located along Whites Road. It collects flow from the smaller watercourses draining the Site, such as the Groundwater Seep, that do not have a direct culvert connection at Whites Road, as well as runoff from Whites Road. As the drain directs flows to the Whites Road culverts, there are reaches

[10] Also referred to as Johnsons Creek in some reports.

of the drain that do not have permanent flow. The RHA score for the Whites Road Drain site between the Groundwater Seep and the Ōhoka Stream Tributary was "fair", with variable flow levels along its length and limited habitat for fish and invertebrates.

- Southern Boundary Drain (Unnamed Stream (dry) in AEL report) is located along the south-western Site boundary. It is a shallow drainage channel, which lacked surface water in the winter of 2021 field survey, apart from two shallow ponded areas.
- Unnamed Dry Drain is a dry/artificial channel along the lower southern boundary. This section of channel has been noted as dry during all site visits, with a soil base and terrestrial vegetation growth.
- Unnamed Drain 1 (Ponded Drain 2 in AEL report) is similar to Unnamed Drain 2, with very low standing water levels (3 cm) in winter conditions.
- Unnamed Drain 2 (Ponded Drain in AEL report) was considered ephemeral during the AEL site surveys. This channel was considered to drain runoff during rainfall, with ponded water, but no base flow in winter conditions.
- Unnamed Drain 3 (not in the AEL report) is a shallow drainage channel along the eastern boundary of the Site. It had standing water during the site visit, but no flow.

4.7. Wetlands

A wetland delineation has been undertaken by Pattle Delamore Partners (PDP) following the Ministry for the Environment (MfE) wetland delineation protocols (MfE, 2020a). This assessment is provided in Appendix 4, with the delineated wetland shown in Figure 3.

The wetland delineation identified fifteen wetlands within the Site that met the definition of 'natural inland wetland'; however, all wetlands were reported to be in a degraded state. Total area of natural inland wetlands within the Site has been calculated at 4.29 Ha. Wetlands were typically associated with overland flow paths, land depressions, and the margins of springheads and waterways, with vegetation dominated by wetland grasses (marsh foxtail, creeping bent, blue sweetgrass). The delineation report states that past land use and grazing has resulted in these wetlands being in a degraded state, with more diverse wetland vegetation limited to spring head locations where stock has been excluded.

The delineation report notes that further ephemeral wetlands may be located within the Site (as indicted by LiDAR imagery). However, these areas did not meet the criteria for wetlands (either natural inland or the RMA definition) during the delineation surveys. It is noted in the delineation report that if present seasonally, the ephemeral wetland values are likely to be very low. The ponds at the Southern Spring were also surveyed and were determined not to meet the definition of natural inland wetlands. The delineation report notes that the upstream pond appears to have been created artificially, approximately 20 years ago, and currently has low wetland vegetation values.

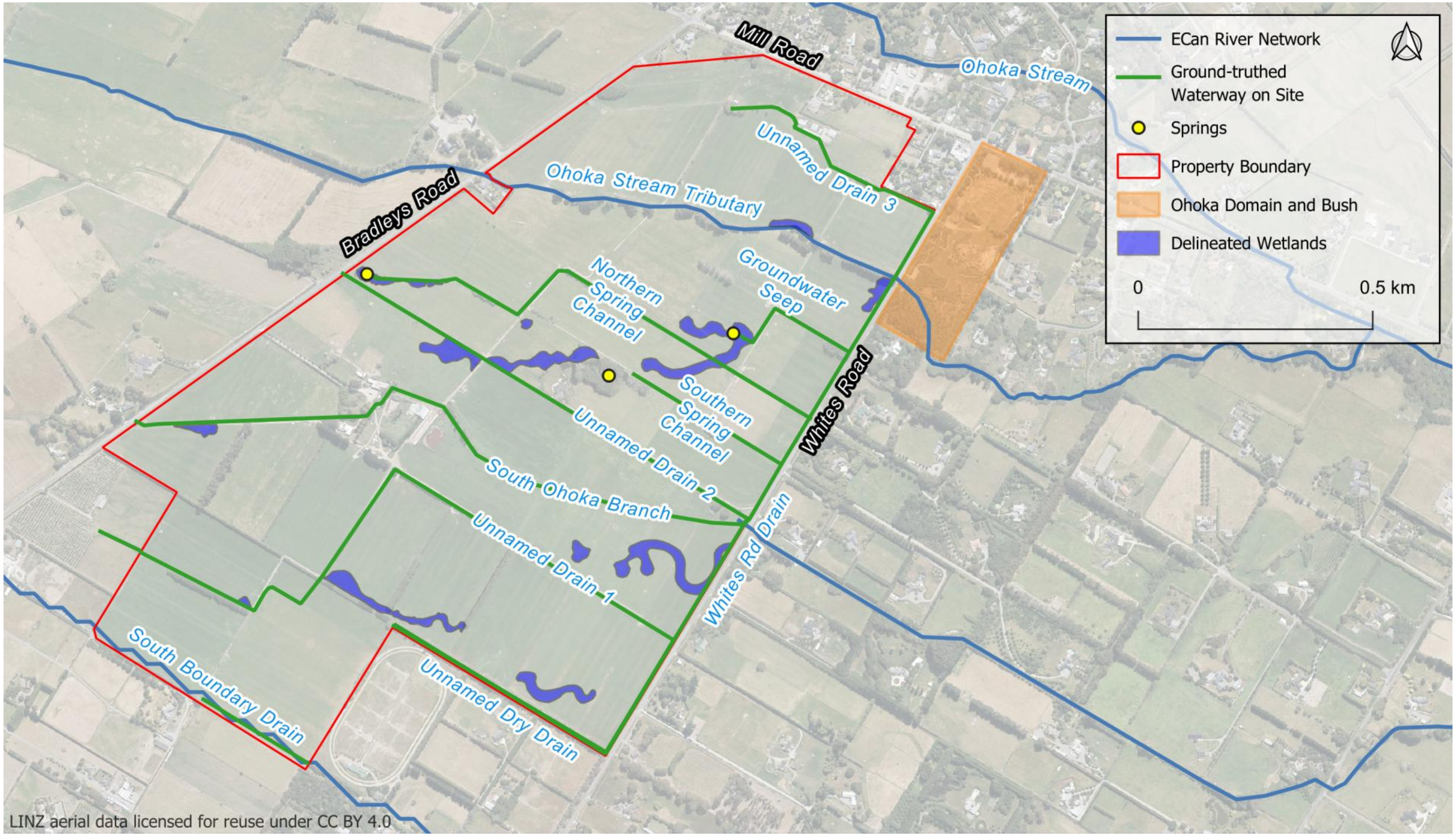

Figure 3: Overview of natural inland wetlands within the Site.

5. ECOLOGICAL EFFECTS

The section below outlines the expected magnitude of effect (low – very high) for identified development activities. The actual and potential effects associated with the proposed development are provided below and summarised in Table 6. The magnitude and level of effects terminology has been based off the Ecological Institute of Australia and New Zealand (EIANZ) guidelines (EIANZ 2018) methodology, where effects are weighted against the known ecological values of the aquatic feature. The effects management hierarchy has been followed to avoid, minimise/remedy, mitigate, offset and compensate as appropriate. All effects cannot be avoided, as a result of the overall subdivision layout requirements. However, with the proposed mitigation and offsetting, a net positive in ecological value for waterways within the Site can be achieved, compared to the current Site conditions.

A summary of residual effects and how the proposed plan meets regulatory requirements, including how the mitigation hierarchy has been followed, is provided in section 6.

5.1. Land Use Change

The proposed development has the potential to improve the ecological condition of spring-fed waterways and spring heads within the Site. The Site is currently a dairy farm, and historical land use has resulted in highly modified conditions for drainage purposes. Streams and spring heads have been fenced to exclude stock (approximately 1 m setbacks), but there is little shading or bank protection present, no observed remaining native riparian vegetation, and little flow heterogeneity. With careful landscape design, there is potential for the Site to contain highly naturalised and enhanced watercourse corridors. In particular, there is an opportunity to link Ōhoka Stream Tributary to the Ōhoka Domain and Reserve, downstream of Whites Road. This would increase the length of the stream's ecological corridor and improve not only instream conditions, but overall biodiversity values in the area.

The removal of dairy farming activities from the Site will also result in a reduction in agricultural contaminants (nitrogen, phosphorus, sediment, and *Escherichia coli* (*E. coli*)) in the waterways within and downgradient of the Site, as is consistent with the outcomes anticipated under the LWRP (which now includes PC7). However, it will result in an increase in urban contaminants (discussed further in section 5.1.1).

One of the key risks associated with the land use change is the potential for service trenches (for stormwater, sewer, water supply, telecommunication, and electrical networks) and hardfill areas to intercept shallow groundwater and re-direct groundwater flow away from springs. This has the potential to reduce spring flow and impact ecological values. As detailed in the hydrology report, this will be avoided through the buffer distance of 20 - 30 meters between the developed areas and the spring heads and groundwater seep, which reduces the risk of any potential adverse hydrological effects on spring flows. In addition, engineering measures are proposed which will further reduce the risk of re-directing groundwater flow paths (Inovo, 2025). To help inform the mitigation measures that may be required, groundwater level and spring flow monitoring prior to, during, and following construction will be undertaken to provide more certainty on the potential lowering of groundwater levels and subsequent potential adverse effects on spring flow. As discussed in the hydrology assessment (PDP 2025b), the land use change will result in an increase in impervious surfaces which has the potential to change groundwater recharge at the Site. This has the potential to impact spring recharge, which would be an adverse effect to freshwater values of the springs and waterways within the Site. The hydrology assessment, however, has concluded that the changes in groundwater recharge that contributes to the spring flows because of the proposed development is relatively small and unlikely to be an issue.

If the recommendations and engineering mitigations to reduce the risk of re-directing groundwater flow paths provided within the hydrology and infrastructure reports are followed, adverse effects are likely to be avoided and/or minimised.

5.1.1. Stormwater

The change in land use from rural to urban development will result in a change to the contaminant composition of stormwater discharged into streams within the Site. If stormwater is treated to a high standard, with sufficient attenuation to avoid flooding and scour, effects of stormwater discharge are expected to be minimised. This is in comparison to the existing effects, which include agricultural runoff of sediment, nutrients, and *E. coli*. Monitoring of water quality, deposited sediment quality, and aquatic ecology values in receiving waterways will be needed to confirm the level of effect and trigger additional mitigation if required.

Construction Phase

Stormwater during the construction phase of development will be managed through stage specific erosion and sediment control plans. The Stage 1 ESCP has been developed by Inovo (Inovo 2025). For Stage 1, diversion channels will direct stormwater along the Mill Road property boundary into a construction sediment retention pond. This pond will be designed in accordance with ECan Erosion Sediment Control Toolbox. An outfall will be located at the Whites Road boundary with stormwater discharged to the Whites Road Drain. This drain will connect to the Ōhoka Stream Tributary approximately 80 m southwest of the pond.

The primary contaminant of concern associated with the construction phase stormwater is the release of sediment laden stormwater, which could smother the gravel substrate present in the stream. As the Ōhoka Stream Tributary is a spring-fed stream, stormwater must meet the spring-fed waterway discharge requirements of the LWRP (Policy 5.95 5a), which is a maximum TSS concentration of 50 mg/L at the discharge point. To meet this concentration, the use of flocculants to bind the sediment particles may be required.

Water quality monitoring will be undertaken as part of the construction phase works, with details provided in the conditions of consent. Monitoring should include, at minimum, the following:

- Daily check of erosion and sediment controls.
- Daily checks of water clarity entering Whites Road Drain and Ōhoka Stream Tributary or checks of water clarity prior to release of water if held in the sediment retention pond, using a clarity meter.
- Weekly total suspended solids (TSS) samples to confirm compliance with 50 mg/L maximum levels.
- Scour protection at the outlet to Whites Road Drain and Ōhoka Stream Tributary.

Operational Phase

Adverse effects associated with the development of the Site include urban contaminants entering the waterways through stormwater runoff and discharges. This includes suspended sediment, heavy metals such as zinc, copper, and lead, and hydrocarbons. Sediment within streams can degrade ecosystems by reducing the visibility in water and smothering the interstitial spaces between gravels in the streambed. Heavy metals, in particular, copper, lead and zinc, can be toxic to aquatic organisms at high concentrations and prolonged exposure can result in reduced fecundity, maturation, respiration, and behaviour (Harding 2005). The toxicity of metals in freshwater is affected by several abiotic factors, including organic carbon, hardness, pH, temperature, and alkalinity (Warne et al, 2018).

The proposed stormwater treatment systems (PDP 2025c) have been designed to meet the Christchurch City Council Waterways Wetlands and Drainage Guide (WWDG) and are located at least 5 m outside the stream buffers discussed in section 6.1.1. Some main roads and large-scale lots will have vegetated swales instead of kerb and channel. The reasoning for this is to minimise the level of contaminants entering the stormwater treatment systems and ultimately the waterways. Vegetated swales are effective at removing metals and some sediment, as discussed further in the stormwater assessment report (PDP 2025c). Commercial areas and the carpark associated with the polo area will have proprietary stormwater devices.

The stormwater assessment (PDP 2025c) details the expected contaminants in the stormwater runoff from the development and the expected removal of contaminants through the proposed stormwater management and treatment system. When comparing to Environment Canterbury's LWRP receiving water standards, as per Table S5A of the LWRP, the streams within the Site are all spring-fed, therefore 95% species protection for toxicants is required, as per Table S5B. A 95% level of protection is intended to limit adverse effects on aquatic organisms to being less than minor.

An assessment on water quality post treatment was undertaken (PDP 2025d). In this assessment, total metals leaving the treatment areas were compared to the LWRP receiving water standards. It is noted that the concentrations used in this assessment were for total metals, not dissolved metals, which the standards are based on. Therefore, while total copper and zinc have been compared to the LWRP receiving water standards and the recently developed acute guideline values (GVs), this provides a conservative indication of the risk, and likely over-estimates the risk[11]. As per Table 3 (sourced from PDP 2025e), the stormwater discharge quality from the Site is expected to meet the LWRP TSS limit of 50 mg/L (for spring-fed waterways) and the 95% species protection limit for total lead of 0.0034 mg/L. The stormwater discharge quality is not expected to meet the 95% species protection limits at the point of discharge for zinc or copper. Total zinc is above the LWRP receiving water standard for all treatment systems, while total copper is expected to be above the LWRP receiving water standard for all systems but the first flush basin and wetland. It is noted that the expected total copper concentration is very close to meeting the LWRP receiving water standards at the point of discharge (0.0003-0.0004 mg/L over the standard). When considering the mixing zones[12] post-discharge, it is expected that total copper will meet the LWRP receiving water standards.

[11] https://environment.govt.nz/assets/publications/Freshwater/accute-copper-and-zinc-water-quality-guideline-values-user-guide.pdf

[12] The mixing zone is approximately 20-30 m in length, based on 10 x the wetted width of the stream.

Table 3: Expected Discharge Quality from Proposed Treatment Systems (sourced from Table 5 in PDP 2025e).

Treatment System	TSS mg/L	TN mg/L	TP mg/L	Total Zinc mg/L	Total Copper mg/L	Total Lead mg/L
Swales & detention basin	12.6	0.35	0.07	**0.0192**	**<u>0.0017</u>**	0.0010
First flush basin & wetland	6.3	0.30	0.04	**0.0128**	0.0011	0.0006
Proprietary device & detention basin	2.1	0.31	0.05	**0.0203**	**<u>0.0018</u>**	0.0010
Rain gardens	7.0	0.53	0.05	**0.0209**	**<u>0.0018</u>**	0.0010
LWRP receiving water standards[1]	50	-	-	0.0080	0.0014	0.0034
Acute GVs (95% species protection)[2]				0.024	0.0013	

Notes: [1] LWRP Schedule 5 95% species protection level for 'Spring-Fed – Plains'. TSS limit as per Rule 5.95 Condition 5(a) of the LWRP which applies to the proposed stormwater discharge activity. **Bold** values indicate an exceedance in LWRP limits, <u>Underlined</u> values indicate exceedance of acute GV (prior to mixing). [2] Gadd et al (2024) Interim Tier 1 acute GVs.

A water quality assessment was undertaken by PDP to understand the extent and duration of total zinc and copper concentration exceedances prior to considering mixing with background water quality. In this assessment, the Ōhoka Stream Tributary catchment was used, as it receives stormwater from the largest area of the subdivision and includes all types of proposed treatment presented (PDP 2025d). For this reason, the PDP determined that the Ōhoka Stream Tributary catchment was representative of expected discharges (i.e., stormwater quality) from the overall Site.

The design of the stormwater management areas is to attenuate storm flows and mimic current flow volumes leaving the Site. In this case, dilution of zinc and copper will be available for wetland discharges, as discharge volumes can be engineered to limit discharge, which will occur over four days. However, the water quality assessment (PDP 2025d) shows that for swales, raingardens, and proprietary treatment devices, residence times will be low and discharge to the streams will occur before the background stream levels rise, providing limited dilution for a short time. To determine the expected mixing from these treatment devices, a model was run for the "worse-case" storm scenario. In this scenario, an approximately 4-hour period was determined where there will not be adequate mixing within the Ōhoka Stream Tributary, as the discharge volume will be higher than baseflows. This is shown in Figure 1 of water quality assessment (PDP 2025d). After 4 hours, flow from the upstream contributing catchments would provide sufficient mixing to dilute the contaminant load from the proposed development to within LWRP receiving water standards.

As the LWRP receiving water standards are based on chronic toxicity effects, this temporary exceedance is not expected to cause significant adverse effects, and adequate mixing is expected once the initial flush of stormwater from the swales and proprietary treatment devices has passed. The short duration (approximately 4 hour) exceedances have also been compared to the Interim Tier 1 acute GVs developed for New Zealand (Gadd et al 2024). These were developed for short term exposure (up to 96 hours). As per Gadd et al (2024), if the metal concentrations do not exceed the acute GVs, there is high confidence the ecosystem is protected from acute effects. When comparing to these GVs, zinc falls within the 95 % level of species protection, prior to any mixing, for all treatment types. Copper is below the acute GV for first flush basins and wetlands, but slightly above the GV for the more immediate discharges. It is noted that this is prior to any mixing and is a comparison to total concentration, not dissolved. When considering mixing with the receiving environment, no adverse effects are expected.

It is recognised that these discharges will result in cumulative effects of urban contaminants in the downstream catchment, which includes the Ōhoka Stream, Kaiapoi River, and lower reaches of the Waimakariri River. The proposed level of stormwater treatment and the temporary nature of the stormwater discharges are expected to minimise adverse effects to receiving waters.

As part of the Stormwater Management Plan for each stage of the development, quarterly surface water quality monitoring will be required. For Stage 1, this should occur upstream and downstream of the discharge points to Ōhoka Stream for the first three years, to confirm compliance with the LWRP and future consent conditions. The following parameters are recommended for operational stormwater monitoring.

- Dissolved Copper
- Dissolved Zinc
- Dissolved Lead
- Total Petroleum Hydrocarbons (TPH)
- Total Suspended Solids (TSS)

The removal of dairy farming activities from this Site will result in a reduction in agricultural contaminants in the waterways (nitrogen, phosphorus, sediment and *E. coli*), which is required under PC7 of the LWRP. The closest downstream Environment Canterbury monitoring site is Ōhoka River at Island Road[13]. This site has elevated nutrient levels associated with historical land use impacting the groundwater that feeds the stream. This includes nitrate-nitrogen, which can be toxic at high levels, and DIN, which is the bioavailable form of nitrogen for instream plant growth. Five-year median nitrate-nitrogen concentration is 4.02 mg/L, which is above the LWRP PC7 target[14] of 3.8 mg/L and the NPSFM national bottom line of 2.6 mg/L. The faecal bacteria *E. coli* is also elevated above guideline levels, with the 5-year median count at 893.5 cfu/100 ml, compared to the PC7 freshwater outcome value[15] of 130 cfu/100 ml and NPSFM national bottom line of 260 cfu/100m. The expected stormwater discharge quality calculated for the development (Table 5 in PDP 2025c) has total nitrogen and total phosphorus concentrations lower than those measured within the Site (Table 1) and the 5-year median concentrations at Ōhoka Stream at Island Road (section 3.3).

5.1.2. Wastewater

Wastewater will be pumped to Rangiora Wastewater Treatment Plant. Further details are provided in the wastewater assessment report (PDP 2025e). As no adverse effects to Site

[13] https://www.lawa.org.nz/explore-data/canterbury-region/river-quality/waimakariri-river-catchment/ohoka-river-at-island-road/
[14] Table 8-5: Water Quality Limits and Targets for Waimakariri Rivers.
[15] Table 8a Freshwater Outcomes for Waimakariri Sub-region Rivers.

waterways are expected associated with wastewater, this activity is not assessed further in this report.

5.1.3. Dewatering

Local dewatering will occur associated with the construction of the Stormwater Management Areas, stormwater and wastewater pipework infrastructure, installation of subsoil drainage and potentially with some sections of waterway realignment or closure. These works will be temporary in nature and as discussed in the Dewatering and Dust Suppression Assessment (PDP 2025f) the discharge of dewatering flows will be managed to avoid adverse stream depletion and water quality effects. Shallow groundwater onsite has been shown to contain some dissolved metals at concentrations that are likely to exceed the Canterbury LWRP Schedule 5 receiving water standards after reasonable mixing. Therefore, to mitigate potential water quality impacts, flow will be returned to ground approximately equidistant from streams as the point(s) of take. Alternatively, there may be some areas of the site where the shallow groundwater quality is suitable for discharge to surface water (into the stream(s) closest to the dewatering activity). This will require confirmation via laboratory testing that dissolved metal concentrations will meet Schedule 5 receiving water standards prior to discharge.

5.2. Waterway Realignments and Removals

To enable development of the land, a subdivision plan has been prepared by Inovo[16]. This plan has resulted in some of the waterways on Site being realigned or removed, in line with advice provided by AEL (2021) and Instream. This advice included the maintenance of bank stability, spring base flows, and springhead depth, maintenance of suitable stream hydraulics, and un-silted trout spawning gravels in the Ōhoka Stream Tributary and the South Ohoka Branch, and the maintenance of fish passage for trout for the Ōhoka Stream tributary and the South Ohoka Branch.

The four main waterways on Site will be protected and enhanced compared to current state through native riparian planting and instream habitat enhancement. This will be managed through the development of an Ecological Management Plan for the Site, to be prepared by a suitably qualified freshwater ecologist with input from Regional and District Council. A breakdown of the proposed changes is provided below.

- The Ōhoka Stream tributary will be retained in its current alignment, with the high-quality gravel substrate known to provide trout spawning habitat to be a priority for protection.
- The Groundwater Seep channel will be redirected slightly to border the retirement village and roads. It will continue to flow into the Whites Road Drain.
- The Northern Spring channel is proposed to be realigned to join the Central Spring channel downstream of the pond. This is to increase the baseflow within the stream. Currently, baseflow in these two spring fed watercourses is low, with high macrophyte growth and low habitat scores. Increasing baseflow will enable improved hydraulics through instream habitat additions, and meander creation, which will lead to improved

[16] Inovo Watercourse and Wetland Change Plan.

ecological values and linkages between the northern spring head pond and southern spring head.

- The Ohoka South Branch will retain is current alignment, apart from an approximately 400 m intermittent stream section in the upper reaches. This reach will be realigned around the current farm housing. This portion of the channel can be designed to incorporate high-quality features such as pools and meanders to improve ecological values of the stream.
- Three unnamed drains are proposed to be filled in. These waterways had either no flow, standing water, or very low flows during multiple site visits. These channels have been artificially created to drain the land. However, they are classified as modified natural watercourses, as they are connected to shallow groundwater and drain what would have historically been wet land.

These changes are shown in the Watercourse and Wetland Change Plan, provided as Figure 4. In summary, while there will be changes to the layout of watercourses within the Site, an objective in designing the subdivision layout was to provide improved values for the four main waterway corridors. This includes concentration of flows to increase hydraulic heterogeneity, substantial buffers from development and indigenous, ecologically appropriate riparian planting.

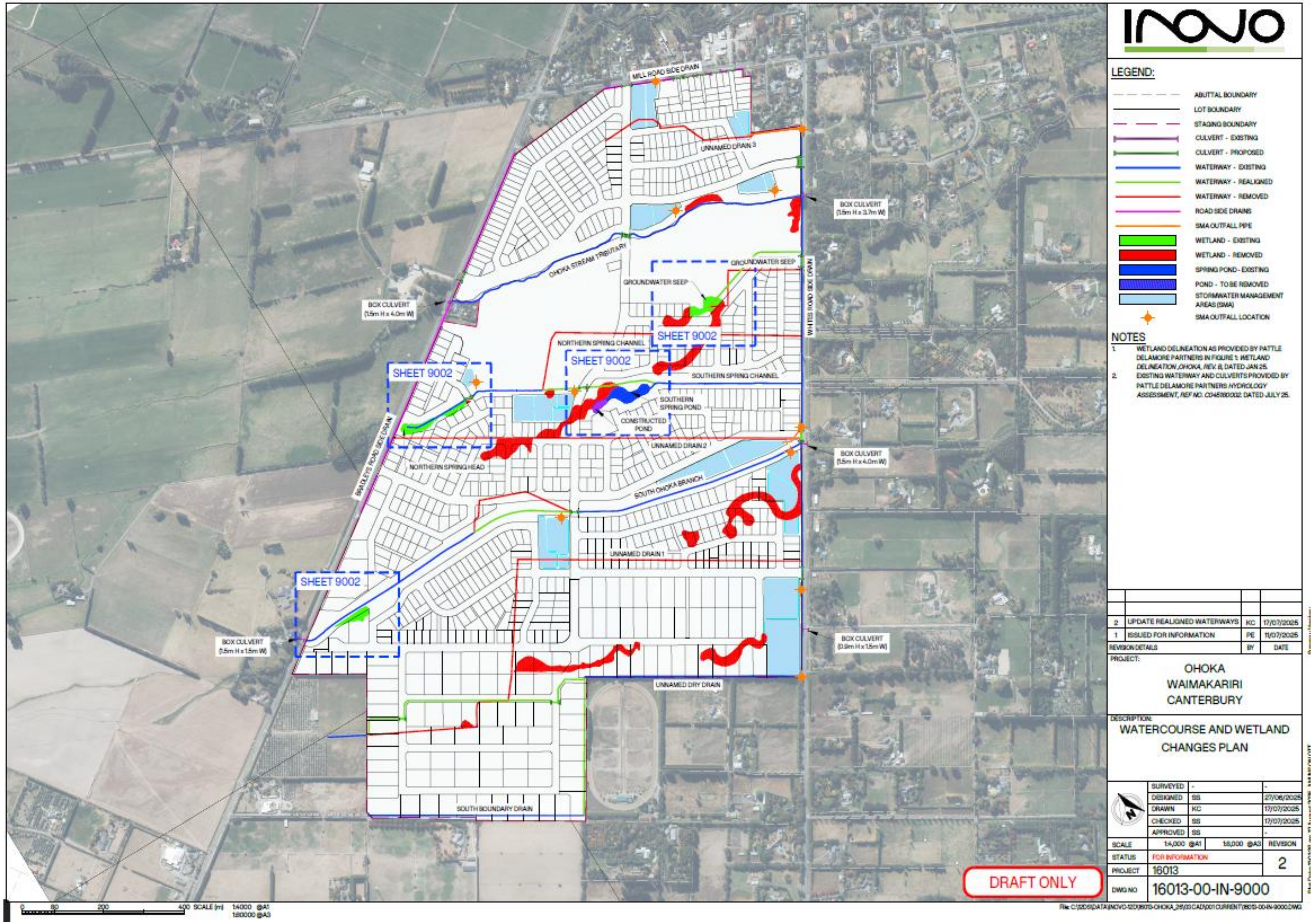

Figure 4: Watercourse and Wetland Changes Plan (Draft, provided by Inovo 11/08/2025).

5.3. Instream Works

The development of land as discussed in the above sections will require construction works within and adjacent to springs and streams. This includes instream works associated with SMA connections, road crossings, removal of current culverted crossings, channel realignment, bank benching and planting, and instream restoration/enhancement works.

To minimise impacts during these required construction works, a range of mitigation controls should be put in place. Two examples are provided below:

- Any instream works within the Ōhoka Stream Tributary or South Ohoka Branch should be undertaken outside of the trout spawning season (1 May – 31 October), and the works should be isolated (i.e. pump and bypass of works area) with an associated fish salvage.
- Stream realignment of the upper South Ohoka Branch should be undertaken over the summer months, when the stream is dry to avoid adverse effects. Where this is not possible, such as the Northern Spring channel and the Groundwater Seep channel, flow should be retained in the new channel until the replacement channel has been completed, including all enhancement works.

An Ecological Management Plan is proposed as a condition of consent to provide a detailed breakdown of mitigation measures to avoid adverse impacts to instream values from construction works. These conditions will be similar to those detailed in the Site Management Plan (Inovo 2025b). If these works are undertaken under the guidance of a suitably qualified freshwater ecologist, effects are expected to be low.

There are also risks of development away from the bed and banks of waterways, associated with works around springs and spring-fed streams that may intercept groundwater. Examples of this include piping and trenching of services, which can result in redirection of spring flows and cause adverse impacts to flow volumes and instream ecological values. While setbacks from springs and streams have been proposed (Table 4, section 6.1.1) additional mitigation measures to avoid redirection of spring flows is required. As per the hydrology assessment (PDP 2025b), the highest risk of reduced spring flow and spring water levels is from shallow groundwater being intercepted by the construction of service trenches and hardfill areas (such as roads), which could reduce groundwater flow to the springs. To mitigate for this, controls to avoid short circuiting groundwater are required. As the instream ecological effects are directly associated with changes in hydrology, ecological effects are also expected to be low if spring flows are maintained.

The effect of instream works within the Site will be temporary in nature. While short term adverse effects may occur associated with disturbance, if appropriate controls are in place, such as works area isolation, fish salvage, erosion and sediment control, and environmental monitoring, effects are expected to be low.

5.3.1. Watercourse Crossings

Internal road crossings of watercourses are required to enable the subdivision design; however, the number of road crossings at the four main watercourses has been minimised as much as practical to four. One central road will pass through the Site, crossing the Ōhoka Stream Tributary, Southern Spring Channel, and the South Branch Ōhoka Stream. A secondary road crossing of the Northern Spring Channel will also be required. These crossing locations are shown in the subdivision plan, provided within the Site Infrastructure Report (Inovo 2025a). Pedestrian and bike path crossings are also proposed, with all pedestrian watercourse crossings to be single-span bridges, to avoid instream structures and works within the waterway. These crossing locations are shown in the landscape plans (DCM 2025).

In addition to the four main road crossings, there will one internal road crossing in Stage 11 at Unnamed Drain 1, and thirteen new crossings will be needed along roadside drainages to access the Site. Of these, two are along Bradleys Road, six along Mill Road, and four along Whites Road. Culverts are proposed to be used for all road crossings, designed to meet the National Environmental Standards for Freshwater (NESF) Clause 70 and in accordance with the New Zealand Fish Passage Guidelines (NIWA 2025). It is understood that circular culverts will be used in most places along Bradleys, Mill, and Whites Roads, and box culverts will be used for the larger internal road crossings. Designs should be reviewed and approved by a suitably qualified freshwater ecologist to ensure consistency with these guidelines. As works will be required within the bed and banks of the streams for installation of the culverts, mitigation will be required to avoid adverse effects. Key mitigation controls will be defined in the Ecological Management Plan, including timing of works to avoid fish spawning periods, and requirements for the reach to be isolated, and a fish salvage undertaken by a suitably qualified freshwater ecologist. If mitigation controls provided in the proposed Ecological Management Plan are implemented, effects are expected to be low.

As the Site is currently an active farm, there are many culverted farm track crossings present within the waterways. The following crossings are recommended to be removed to improve the natural condition of the waterways that are to be retained and enhanced.

- Ōhoka Stream Tributary – 2 culvert crossings
- Groundwater seep channel – 1 culvert crossing
- Northern and Southern Spring Streams – 4 culvert crossings
- South Ohoka Branch – 10 culvert crossings

6. ASSESSMENT OF THE EFFECTS MANAGEMENT HIERARCHY

6.1. Watercourses

The NPS-FM, as amended October 2024 includes policy 3.24 to avoid the loss of river extent and values. Regional Council must be satisfied that any consent granted is subject to conditions that apply the effects management hierarchy, and conditions that specify how the requirements in (i) – (iii) will be achieved:

(i) the applicant has demonstrated how each step in the effects management hierarchy will be applied to any loss of extent or values of the river (including cumulative effects and loss of potential value), particularly (without limitation) in relation to the values of: ecosystem health, indigenous biodiversity, hydrological functioning, Māori freshwater values, and amenity; and

(ii) if aquatic offsetting or aquatic compensation is applied, the applicant has complied with principles 1 to 6 in Appendix 6 and 7, and has had regard to the remaining principles in Appendix 6 and 7, as appropriate; and

(iii) there are methods or measures that will ensure that the offsetting or compensation will be maintained and managed over time to achieve the conservation outcomes.

A breakdown of the mitigation hierarchy, to avoid, minimise or remedy, mitigate, offset or compensate the loss of watercourse extent and value is provided below.

In summary, hydrological and ecological impacts to the two mapped springheads and the four main spring-fed watercourses have been avoided to the extent practicable through setbacks. This has avoided loss of extent of the main waterways on site. Where the loss of watercourse extent cannot be avoided, effects are proposed to be minimised and remedied through minimising changes to the alignments of the main streams, with habitat enhancement of realigned sections and mitigation of groundwater flow paths.

Residual effects of the proposed development have been determined for the loss of watercourse extent and cumulative effects of urban contaminants within waterways downgradient of the Site. As the overall level of effects following avoidance and minimisation is higher than low, ecological offsetting is required. Practical steps have been proposed to offset the loss of watercourse values, including increased setbacks and native riparian margins along the four main waterways, cessation of groundwater takes within the Site, instream enhancement to improve ecological values, and the creation of high-quality stream reaches where realignment is required (groundwater seep channel, Northern Spring Channel). These steps will improve the ecosystem health of the streams within the site, which will lead to an increase of indigenous biodiversity values within the stream corridors and improved amenity values within the local area through connections to Ohoka Bush and Reserve. To ensure that the offsetting will be maintained and managed over time, consent conditions are required for ongoing monitoring for comparison with baseline data and maintenance of the riparian planting. It is understood the stream reserves will be maintained by the developer, before the land is vested to Waimakariri District Council.

Following offsetting, it is considered that a net improvement in aquatic ecology values can be achieved, and the loss of stream length can be effectively offset. This is because the increase in baseflow volume, riparian, and instream enhancement will provide an improvement in ecological values within these streams.

6.1.1. Avoid

The proposed development will result in changes to the Site's waterways to enable the subdivision plan layout. However, to avoid loss of extent and value of watercourses, no changes to the two springheads, the groundwater seep, and the Ōhoka Stream Tributary alignment will occur.

Minimum setback distances to avoid adverse effects of land use change at each of the waterways to be retained are provided below in Table 4. The potential for re-directing groundwater flow paths is a key risk of the proposed land use change. Pre-mitigation, potential effects associated with changes to hydrology are considered high, as they could result in the loss of existing hydrological conditions, which would substantially impact the streams ecological values. If the recommendations provided in the hydrology and infrastructure reports are followed to reduce the risk of re-directing groundwater flow paths, the magnitude of effect has been reduced to low. Monitoring of water quantity, quality, and aquatic ecology values before, during, and post-development in receiving waterways will be needed to confirm the level of effect and trigger additional mitigation if required.

The proposed minimum buffer distances to waterbodies are considered suitable to protect, and lead to the enhancement of, the ecological values of the waterbodies on site. These setbacks are large and have been separated into riparian enhancement setbacks and stream/spring buffer setbacks. Riparian enhancement setbacks relate to the minimum distance from the stream edge that riparian planting will occur. The stream/spring buffer setback relates to an extended distance in which deep trenching for services and impervious surfaces, such as buildings and roads, will not occur. This is provided to retain an open stream corridor and avoid adverse effects to the spring head groundwater flow paths, as discussed in the hydrology report (PDP 2025b) and the overland flow paths to the waterways, including discrete groundwater seeps along the stream lengths.

Table 4: Proposed Spring and Stream Setbacks.

Feature	Stream/Spring Buffer Setback (m)	Riparian Enhancement Setback (m)
Northern and Central Springs	30	20
Groundwater Seep	20	15
Ōhoka Stream Tributary	20	10
Ōhoka Branch South, Northern and Southern Spring Channels	15	10
Groundwater Seep Channel	10	10
South Boundary Drain	5	5

The 20 m riparian enhancement setback for the Northern and Southern Springs provides the opportunity for the restoration of wetland habitat associated with the low-lying springs and will provide connection to the proposed riparian buffers of the waterways. A smaller riparian enhancement setback of 15 m is proposed for the Groundwater Seep, with a 10 m riparian enhancement setback for the downstream channel. This is a result of the lower level of flow and enhancement potential at this spring-fed waterway.

A 10 m riparian enhancement setback is proposed for the length of the Ōhoka Stream Tributary, which has been assessed as having the highest ecological values and restoration potential. This wide buffer will provide the ability to introduce a high-quality riparian zone, with a broad band of native plantings, as well as walking tracks along the stream corridor from Bradleys Road, connecting the Site through to the Ōhoka Domain and Reserve. A further 10 m is provided as open space however, to keep the stream corridor open and enable recreation and amenity values. Pathways and gathering areas can be located within this setback to enable connections with people and nature. The landscape design and planting plans will be developed with input from a freshwater ecologist to ensure a workable outcome that provides a high level of riparian planting.

A 10 m riparian enhancement setback has also been recommended for Ohoka Branch South, and the realigned Northern and Southern Spring Channel, with a further 5 m setback for open space. 10 m is considered suitable riparian buffer to provide shade, filter overland runoff, and increase biodiversity values of these stream reaches. A 5 m minimum buffer has been recommended for the Southern Boundary Drain as it is intermittent and has lower potential for enhancement.

These stream setbacks are in alignment with recommendations provided by MKT in 2022 during consultation on a previous plan change process, which incorporated the Site. These recommendations included, "*where practicable, there should be a 20 m setback between the proposed subdivision development and waterways that flow through the site. Additionally, there should be a 10 m buffer within the setback which should be planted with locally sourced indigenous plants to assist with nutrient uptake and to enhance biodiversity values*".

Riparian wetlands will be created through planting the benched channels that are a requirement for site hydrology. This is further discussed in section 6.2.4. Taller trees and shrubs planted further back from the water's edge will provide bank stability, waterway shade, and riparian habitat. High levels of waterway shade help prevent the growth of nuisance aquatic weeds and algae. As spring fed streams have a relatively stable base flow, overhanging vegetation and a range of native plant species should be used. A planting plan will be developed to demonstrate the species, density of planting, maintenance and monitoring to be undertaken for the future stages and will be a requirement of an Ecological Management Plan.

To ensure the setback provides for the enhancement of ecological values and not just landscape amenity values, detailed landscape design will need to be undertaken with input from a freshwater ecologist. Ecological values of the riparian zone should include shade, overhanging vegetation, terrestrial biodiversity through ecological corridors, and amenity values through greenway path linkages.

6.1.2. Minimise or Remedy

Only minor changes to the alignments of the main streams are proposed, as shown in the subdivision plan:

- South Ohoka Branch - realignment of approximately 400 m in the upper intermittent reaches where existing buildings are located.
- Northern Spring downstream channel will be realigned to join the Southern Spring Channel downstream of the Central Spring Pond.
- Groundwater Seep downstream channel will be realigned slightly to enable the retirement village.

The potential to improve the ecological value of the waterways on site is reliant on maintaining hydrological connections. Mitigation of groundwater flow paths and minimum buffer distances from springs are therefore required, in order to minimise uncertainty in effects. This is discussed further in the hydrology assessment (PDP 2025b).

With the proposed riparian buffers and restoration, a net gain in watercourse value is expected, and the loss of stream length is considered to be effectively mitigated against. This is because the increase in baseflow volume and riparian enhancement will provide large improvement in ecological values within these streams.

While the proposed subdivision plan will result in minor changes to the larger streams, several small internal farm drains, which can be classified as modified natural watercourses, but have low ecological values in their current form, will be infilled. These changes are summarised in Table 5. When comparing the current and proposed site layout, the following approximate changes to waterway length will occur.

- Main perennial streams: approximately 4,000 m to 3,540 m. This reduction of 460 m of watercourse length is associated with the realignment of the Northern Spring Channel to join the Central Spring Channel and a short (10 m) reduction of the Groundwater Seep channel. It is noted that while a reduction in length of the Northern Spring Channel will occur, the merging of spring flows in the lower Southern Spring Channel will increase the baseflows in this reach and provide a connection for aquatic life between these spring head ponds.

  While a reduction in stream length will occur, a substantial increase in riparian extent and stream corridor will occur for the four main watercourses. When comparing the proposed riparian setback, an approximate increase from 8,040 to 70,800 m^2 will occur, and when comparing the proposed riparian and stream buffer, an approximate increase from 8,040 to 107,075 m^2 will occur. An increase in stream value is expected, resulting from the improved baseflow and stream enhancement.

- Internal farm drains/ Whites Road Drain: A reduction in the length and riparian margin area of internal farm drains and the Whites Road Drain will occur with the proposed subdivision layout, from 4,744 to 2,145 m and 9,488 to 7,200 m^2, respectively.

As summarised in Table 5, when comparing all watercourses on site, a reduction of approximately 3,059 m in length will occur, this is primarily due to the loss of small internal farm drains with low ecological value in their current form. However, when comparing the increase in riparian planting and stream setbacks, an increase of approximately 60,472 and 96,747 m^2 is proposed, respectively. This is expected to result in a net improvement of aquatic ecology values across the entirety of the Site.

*Table 5: Summary of proposed changes to stream length and area (extent). Measures are approximate, sourced from flow models and aerial imagery and are not based on survey data. * Minimum setback, additional area possible in detailed design.*

Watercourse Name	Length (m)		Area (m^2)		
	Current	Proposed	Current	Proposed Riparian Setback	Proposed Stream/Spring Buffer Setback
Ōhoka Stream Tributary	935	935	1,870	18,700*	37,400
Groundwater Seep channel	280	270	560	5,400	5,400
Northern Spring Channel	1,050	600	2,140	12,000	18,000
Central Spring Channel	385	385	770	7,700	5,775
South Ohoka Branch	1,350	1,350	2,700	27,000*	40,500
Total – main waterways	**4,000**	**3,540**	**8,040**	**70,800***	**107,075**
Whites Road Drain	1,350	1,175	2,700	2,350	2,350
Southern Boundary Drain	270	270	540	1,350	1,350

Watercourse Name	Length (m)		Area (m²)		
	Current	Proposed	Current	Proposed Riparian Setback	Proposed Stream/Spring Buffer Setback
Unnamed Drain 1	1,444	0	2,888	0	0
Unnamed Drain 2	460	0	920	0	0
Unnamed Drain 3	520	0	1,040	0	0
Unnamed Dry Drain	700	700	1,400	3,500	3,500
Total – internal drainages	**4,744**	**2,145**	**9,488**	**7,200**	**7,200**
Total – all waterways	**8,744**	**5,685**	**17,528**	**78,000**	**114,275**
Change	**-3,059**			**+60,472**	**+96,747**

6.1.3. Watercourse Effects Summary

Table 6 summarises the ecological values of the watercourses on site, and the expected magnitude of effect of the main development activities. This is the magnitude of effect after the avoidance and minimisation discussed in section 6.1. The overall level of effect considers both the ecological value and the magnitude of effect.

Residual effects of the proposed development have been determined as follows:

- Loss of watercourse extent.
- Cumulative effects of urban contaminants (total zinc) within waterways downgradient of the Site.

For these activities, where effects are higher than low, which can be considered as more than minor, ecological offsetting is required, as discussed in section 6.1.4.

Table 6: Waterway Effects Summary

Ecological Feature	Ecological Value	Activity	Magnitude of Effect	Level of Effect
Ōhoka Stream Tributary	High	Land use change	Low	Low
		Instream works	Low	Low
		Dewatering	Low	Low
		Stormwater discharges	Moderate	Moderate
Groundwater Seep and channel	Low	Land use change	Low	Very low
		Stream realignment/instream works	Moderate	Low
		Dewatering	Low	Low
	Moderate	Land use change	Low	Low

Ecological Feature	Ecological Value	Activity	Magnitude of Effect	Level of Effect
Northern Spring and channel		Stream realignment/instream works	Low	Low
		Dewatering	Low	Low
		Stormwater discharges	Moderate	Moderate
Southern Spring and channel	Moderate	Land use change	Low	Low
		Instream works	Low	Low
South Ohoka Branch	High	Land use change	Low	Low
		Stream realignment	Low	Low
		Dewatering	Low	Low
		Stormwater discharges	Moderate	Moderate
Unnamed Drains	Low	Infilling	Very high	Moderate

6.1.4. Offset

Despite the opportunities to avoid and/or minimise the loss of extent and value, the proposed design will result in the loss of watercourse length within the Site. The loss of stream length has been mitigated against the increase in stream corridor width. However, there will still be a loss of stream length associated with the realignment of the downstream extent of the Northern Spring Channel and the infilling of internal farm drains. The following enhancement is therefore proposed, in line with principals 1-6 in Appendix 6 and 7 of the NPSFM and will be managed through the development of the Site's Ecological Management Plan. This enhancement will also benefit stormwater runoff from overland flows, through additional filtration.

- Spring head enhancement through wetland and riparian planting, and increased setbacks.
- Increased setbacks and native riparian margins along the Ōhoka Stream Tributary, Northern and Southern Spring Branch, South Ohoka Branch and the Groundwater Seep Channel.
- Removal of 17 existing watercourse crossings (culverts).
- Cessation of four groundwater takes within the Site.
- Instream enhancement to improve ecological values.
- Creation of high-quality stream reaches where realignment is required (Groundwater Seep Channel, Northern Spring Channel and South Ohoka Branch channel).

6.2. Wetlands

The NPS-FM as amended October 2024 includes policy 3.22 to avoid the loss of extent of natural inland wetlands, protect their values, and promote their restoration. There are exceptions to this, including (as relevant to this application) if Regional Council is satisfied that:

(i) the activity is necessary for the purpose of urban development that contributes to a well-functioning urban environment (as defined in the National Policy Statement on Urban Development); and

(ii) the urban development will provide significant national, regional, or district benefits; and the activity occurs on land identified for urban development in operative provisions of a regional or district plan; and

(iii) the activity does not occur on land that is zoned in a district plan as general rural, rural production, or rural lifestyle; and

(iv) there is either no practicable alternative location for the activity within the area of the development, or every other practicable location in the area of the development would have equal or greater adverse effects on a natural inland wetland; and

(v) the effects of the activity will be managed through applying the effects management hierarchy.

A breakdown of the mitigation hierarchy, to avoid, minimise or remedy, mitigate, offset or compensate the loss of wetland extent, as it relates to the proposal, is provided below.

In summary, retaining all delineated wetlands within the Site is impractical from an urban development perspective, as Site hydrology will be altered. Impacts to existing wetlands at spring heads have been avoided through setbacks of 30 m from the Northern and Southern Springs and 20 m from the Groundwater Seep. The intention of this is to maintain hydrological and ecological functioning of the wetland areas. Where the loss of wetland effects cannot be avoided, effects will be minimised and remedied through enhancement as part of the riparian setback enhancement process. As the overall level of effects following avoidance and minimisation is higher than low, ecological offsetting is required. Practical steps have been proposed to offset the loss of wetland values through the creation of new wetland areas, including fresh plains wetlands within the stream corridors, and the creation of large stormwater wetlands with indigenous wetland vegetation is also proposed. In addition, there is potential to convert the artificial pond within the central pond system into a planted wetland area, to further remedy effects (discussed further in 6.2.2); however, this has not been included in offsetting calculations.

These steps will improve the ecosystem health of the wetlands to be retained within the Site, which will lead to an increase of indigenous biodiversity values and improved amenity values. To ensure that the offsetting will be maintained and managed over time, consent conditions are required for ongoing monitoring for comparison with the wetland delineation (PDP 2025a; Appendix 4). It is understood the stream reserves will be maintained by the developer, before the land is vested to Waimakariri District Council. Maintenance of restored areas is crucial to achieve improved values within the Site.

6.2.1. Avoid

Subdivision design will result in the loss of some natural inland wetlands within the Site (Figure 3). These wetlands have been classified as being in a degraded state, because of past land use and stock grazing. The loss of these wetlands cannot be fully avoided in the subdivision plan. However, approximately 0.84 Ha of mapped wetlands are located within the stream setback areas. These riparian wetlands, in particular around the spring heads and Groundwater Seep, will be retained.

6.2.2. Minimise or Remedy

Loss of wetland extent has been minimised where practicable through the spring and waterway setbacks, as shown in Figure 4. However, due to the topography of the land and subdivision layout requirements, it is not possible to maintain the overland hydrological connections to all wetlands. Without these hydrological connections, the wetlands are not expected to persist.

To remedy this loss, the highest value wetland area is proposed for restoration, with an increase in current area proposed. The highest value wetland was reported at the Northern Springhead, a 30 m setback is proposed here, with indigenous wetland vegetation and grading of the surrounding area to increase extent. Observations made on site show pugging surrounding the fenced off springhead, which indicates wet ground conditions which could support a larger extent of wetland area. The 30 m setbacks proposed around the Northern and Southern Springs, and 20 m setback around the Groundwater Seep will enable the regeneration of indigenous wetland values where the natural hydrology is present to support them.

It is noted that for the Central Spring Pond system, the northern most section is artificial, and may be infilled or modified as part of the development (assuming it is supported by overland flows). The artificial pond area is separated from the main spring-fed pond by an earthen weir. The reasoning for this is that this pond is maintained by overland runoff and drainage of an upstream wetland area. This land upgradient of the pond will be altered as part of the subdivision design to directed overland flow to stormwater treatment areas. This would mean less recharge of the pond, which could lead to the pond becoming stagnant or drying out. Retaining overland runoff to this pond is not a preferred option, as urban contaminants would then travel downstream into the spring-fed Central Spring Pond and stream channel, which is proposed for enhancement. It is therefore recommended that the artificial pond area is planted with indigenous vegetation to create a new wetland area. Further hydrological assessment will be required at the detailed design stage to guide the development of a wetland in this location; therefore, it has not been included in offsetting calculation but should be retained as an option for future stages of development. It is recommended that this option is retained as part of adaptive management within the Site's development.

6.2.3. Wetland Effects Summary

Table 7 summarises the expected effects of the land use change at the site, in particular the proposed subdivision layout which will result in the infilling/loss of natural inland wetland area. The magnitude of effect after avoidance and minimisation discussed in section 6.2 is applied is considered high, as there will be complete loss of wetlands in some areas, however the higher value wetlands will be retained. The overall level of effect considers both the ecological value of the wetlands and the magnitude of effect. Where the overall level of effect is higher than low, ecological offsetting is required, as discussed in section 6.2.4.

Table 7: Wetland effects summary

Ecological Feature	Ecological Value	Activity	Magnitude of Effect	Level of Effect
Wetlands	Low	Land use change (infilling of wetlands)	Very high	Moderate

6.2.4. Offset

While approximately 0.84 Ha of natural inland wetland extent within the Site will be avoided, approximately 3.5 Ha will be lost as a result of infilling and direct changes to hydrological flow paths. Where this loss of extent cannot be avoided, practical steps to offset the loss of wetland values through restoration and creation of new wetland areas are proposed. It is noted that no 'like for like' offsetting can be achieved as the Site; however, the proposed wetland offsetting will provide for a range of wetland ecosystem types within the Site.

To offset the loss of approximately 3.5 Ha of natural inland wetland area within the Site, the restoration of existing wetland areas around springheads and stream edges, as well as the creation of new indigenous wetland areas is proposed. Table 8 provides a breakdown of the wetland area lost compared to the area to be offset through the subdivision design. The proposed options for offsetting include:

- Restoration and enhancement, which will lead to an increase in extent and value of wetlands at the current spring heads and associated ponded habitats. These areas are currently impacted by land use, with small setbacks to stock access. The proposed setbacks (30 m for the Northern and Central Springs, 20 m for the Groundwater Seep) will include restoration planting of indigenous wetland species to increase the extent of wetland area and improve the current values. Observations made on site show deep pugging surrounding the fenced-off springheads, which indicates wet ground conditions that could support a larger extent of wetland area if not disturbed.
- Creation of riparian wetlands within the fresh plains on benched banks of the Ōhoka Stream Tributary, Southern Spring Channel, and the South Ohoka Branch. A cross-section of the proposed riparian wetland design is provided in Figure 5.
- Wetland habitat within the Stormwater Management Area (SMA). It is recognised that these are artificial wetlands and will receive contaminants associated with stormwater. However, extensive wetland habitat will be provided for wetland flora and fauna within the proposed Site, which will increase the biodiversity values in the local area.
    - Stormwater wetlands - this area has been calculated from the wetland area within Table H1 of the stormwater assessment (PDP 2025c). This area only includes the wetland areas within the SMAs. The wetland area will include both open water (approximately 40%) and shallow wetland planting (approximately 60%) and will be spread across the Site, near the waterway corridors. As per the stormwater assessment (PDP 2025c) and the landscape designs (DCM 2025), the wetland areas will be planted with indigenous wetland species to provide a naturalised wetland environment and increase the extent of wetlands within the Site.
    - Stormwater wet ponds/basins have been included as they will be intermittently wet and will have approximately 20% of their area planted with indigenous wetland planting.

Table 8: Wetland offsetting summary

Feature	Area (Ha)	
	Current	Proposed
Natural inland wetland area within proposed setbacks	4.3	0.84
Additional wetland area to be restored around spring heads	-	0.25
Fresh plains wetlands	-	0.63
Stormwater wetlands[1]	-	2.36
Stormwater wet ponds/basins[2]	-	0.47
Total wetland area within the proposed Site	**4.3**	**4.55**

Notes: Stormwater areas calculated from Table H1 in the Stormwater assessment (PDP 2025c). 1 – wetland area includes both open water pond (40%) and shallow wetland planting (60%) areas, 2 – calculated as 20% of wet basin area (wetland planting) - Pers comm. P. Claassens, PDP.

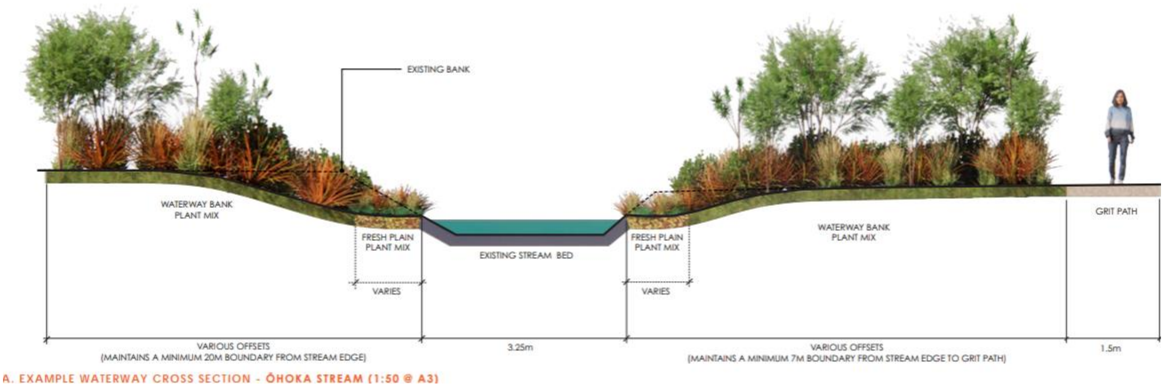

Figure 5: Preliminary cross section of benched banks (sourced from DCM Urban landscape designs).

7. DISCUSSION

When comparing past and current agricultural land use at the Site, the proposed urban development has the potential to result in a net ecological benefit to aquatic ecological values. Currently, the spring heads, stream channels, and wetlands within the Site have been highly modified for drainage and land use purposes, with limited riparian buffers, low shading present, and little habitat or flow heterogeneity. The loss of waterway and wetland extent within the Site has been avoided and/or minimised to the extent practicable in the proposed subdivision plan. The loss of waterway and wetland extent that cannot be avoided has been minimised where possible and will be offset through the proposed ecological improvements to the four main waterways, the two springhead ponds, and the Groundwater Seep. Additional wetland areas will also be created through fresh plains benched stream banks and stormwater wetlands.

With careful landscape design, there is potential for the Site to contain highly naturalised and enhanced watercourse corridors and a range of wetland types. In particular, there is an opportunity to link Ōhoka Stream Tributary to the Ōhoka Domain and Reserve, downstream of Whites Road. This would provide an increase to the amenity values and length of the publicly accessible walking trails along the Ōhoka Stream Tributary corridor and improve not only instream conditions, but overall biodiversity values in the area. The potential to improve the ecological value of the waterways on site is highly reliant on maintaining hydrological connections. To avoid and/or minimise the interception of flow paths to springheads and stream channels during both the construction and operational phases of development, the following is proposed; minimum buffer distances from springs and streams, engineering controls for inground trenches required for services, and managing potential stream depletion effects for dewatering.

The removal of dairy farming activities from this Site will result in a reduction in agricultural contaminant inputs to the waterways (nutrients, sediment, and *E. coli*), which is required for the catchment under PC7 of the LWRP. However, it is recognised that urban development will result in a change in the contaminants discharged to streams during storm events. Stormwater will be treated, with stormwater treatment areas designed to buffer high flows. This will result in most of the site's stormwater flows being attenuated to be released slowly over four days (PDP 2025d). The intention being to mimic predevelopment flows and reduce the potential for scouring of the bed and banks of receiving streams. This is of particular importance on the Ōkoha Stream Tributary and lower South Ohoka Branch, where trout spawning has been recorded in clean gravels. The expected discharge quality has been reported to exceed the LWRP receiving water standards at the point of discharge for total zinc and copper. While copper concentrations are close to the standards and no adverse effects are expected, zinc has been assessed to not meet the standards for the faster released stormwater (from swale and proprietary devices), with a modelled time of up to 4 hours in a conservative assessment before adequate dilution will occur. To determine if adverse effects were expected from this temporary discharge of stormwater, concentrations at the point of discharge were compared to the Interim Tier 1 acute GVs (Gadd et al 2024). These GVs are for short term effects (up to 96-hour exposure). When compared to these, total zinc falls within the 95% level of species protection for all treatment types prior to any mixing, therefore no adverse effects are expected to occur. Total copper concentration is below the acute GV for first flush basins and wetlands, but above the acute GV for the more immediate discharges. It is noted that this is prior to any mixing with the receiving environment and is a comparison to total concentration, not dissolved. When considering mixing with the receiving environment, and the conservative nature of the assessment, adverse effects are not expected.

Monitoring and maintenance will be required to confirm the proposed mitigation and offsetting measures are effective. Monitoring of flows, water quality and ecological values will be required to inform the development of stream and wetland enhancement plans, as well as to confirm the appropriateness and success of the proposed offsetting measures.

8. RECOMMENDATIONS

To result in a net improvement to aquatic ecology values within the Site, the following recommendations are provided. These recommendations should be incorporated into consent conditions, where relevant.

- An Ecological Management Plan is proposed as a condition of consent, which would require, at minimum, the following:

- Springhead Restoration.
  - Stream Restoration and Enhancement.
  - Wetland Restoration and Enhancement.
  - Waterways and Wetland Monitoring and Maintenance.
  - Construction mitigation and controls for instream works, construction phase stormwater and construction phase dewatering.
  - Pest and Predator Management.
- Ecological monitoring is required to confirm current and post development values and is proposed as a condition of consent, which would require, at minimum, the following:
  - Topographical surveys undertaken at springheads and streams prior to development. This information will also be used to inform final stream and wetland enhancement plans.
  - Follow up surveys (water quality, habitat, benthic macroinvertebrates and fish) 1 and 3 years after development (as the development is staged, this requirement shall be per stage, at the completion of each stage).
  - Reporting to the Regional Council no later than 9 months following surveys.
- Enhancement in the form of naturalisation of the springhead ponds and seep, stream channels, and wetland areas to be retained, including native planting instream habitat features. This is shown at a high level in landscape designs and will be developed further as a condition of consent. Enhancement plans will be guided by a suitably qualified freshwater ecologist.
- Surface water quality and quantity monitoring of the three waterways entering and leaving the Site to confirm the assessed levels of effect of stormwater treatment and land use change.
- Robust erosion and sediment controls will be required for all works within or near waterways and should include input from a suitably qualified freshwater ecologist. At minimum, they must be installed and maintained in accordance with ECan's Erosion and Sediment Control guidelines and require isolation and fish salvage where water is present.
- Isolation of works area and associated fish salvage for all instream works where water is present.

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APPENDIX 1: CURRICULA VITAE – LAURA DRUMMOND

Laura Drummond – Skills & Experience

Laura Drummond is an aquatic ecologist with 18 years of professional experience in working in consultancy and research. Laura specialises in the effects of development and land use on receiving environment and has experience in a wide range of water quality and ecological assessments of freshwater and brackish environments including river, wetland, lake and estuarine habitats. Laura has a strong understanding of environmental principles, regulatory requirements, and providing solutions for environmental issues.

Based in Christchurch, Laura is experienced in the ecological values of Canterbury rivers and the current pressures of land use. Laura has been involved with a range of reconsenting projects in Canterbury, including irrigation schemes and land developments, and is familiar with the current drivers of change, such as improving water quality conditions, cumulative effects, fish screens and fish passage. Laura enjoys working with multidisciplinary teams, including engaging with other technical experts and stakeholders to provide the best outcome for the project.

Laura has provided expert evidence at hearings for district and regional councils, and developers, including appearances at resource consent applications, plan changes and Environment Court. Laura has published scientific papers in peer-reviewed journals on stream ecology and is a member of the New Zealand Freshwater Sciences Society.

Employment History

Period	Company	Position
2023 – Present	Instream Consulting Ltd (Christchurch)	Principal Scientist
2018 – 2023	Pattle Delamore Partners (Christchurch)	Technical Director – Ecology Service Leader – Ecology Senior Ecologist
2012-2018	SNC Lavalin (Canada)	Environmental and Regulatory Specialist Fisheries Specialist
2012-2014	Applied Aquatic Research (Canada)	Freshwater Ecologist
2007-2012	NIWA (Christchurch)	Freshwater Ecology Technician
2006-2007	Environment Canterbury	Ecosystem Health Monitoring Officer

Qualifications

- Master of Science (Ecology), University of Canterbury, 2012
- Postgraduate Diploma (Environmental Science), University of Canterbury, 2007
- Bachelor of Science (Biology), University of Canterbury, 2006

Affiliations

- New Zealand Freshwater Sciences Society
- Christchurch Ecology Group (co-facilitator)

Selected Project Experience

Rolleston Industrial Developments Ltd. Aquatic ecology evidence for Lincoln South Private Plan Change

Laura was an expert witness for Aquatic Ecology for proposed Private Plan Change 69 (Lincoln South) to the Operative Selwyn District Plan and for an associated submission to the proposed Selwyn District Plan.

The aquatic ecology evidence covered an assessment of the current values within and downgradient of the site, potential effects to the springs, streams and potential wetlands of the proposed plan change as a result of the proposed rezoning of the land. The evidence covered the following matters: potential effects and mitigation options, the requirement to have substantial setbacks to avoid adverse effects to spring recharge and subsequent change to ecological values, and the requirement for an Ecological Management Plan.

Laura prepared and presented evidence at the private plan change and proposed district plan hearings.

Rolleston Industrial Developments Ltd, aquatic ecology evidence for Ohoka Private Plan Change and proposed Waimakariri District Plan

Laura was an expert witness for Aquatic Ecology for the Private Plan Change RCP31 (Ohoka) to the Operative Waimakariri District Plan and for an associated submission to the proposed Waimakariri District Plan.

The aquatic ecology evidence covered an assessment of previous ecological surveys, the potential effects to the springs, streams and potential wetlands of the proposed plan change as a result of the proposed rezoning of the land and potential mitigation options. The evidence covered the potential effects of the land use change, mitigation strategies to avoid adverse effects to spring and waterway recharge and the requirement for an Ecological Management Plan to guide the development and proposed restoration plans.

Laura prepared and presented evidence at the private plan change and proposed district plan hearings.

Hawkes Bay Regional Council, Ruataniwha Tranche 2 Groundwater Take

Laura acted as the technical expert (freshwater ecology and water quality) on behalf of Hawkes Bay Regional Council for the consent review for the proposed Tranche 2 groundwater take from the Ruataniwha basin aquifer.

Laura provided technical advice and reviewed section 92 information, prepared evidence and attended the hearing and including attendance at an appeal at the Environment Court.

Rotorua Lakes Council, Community Water Take Assessments

Laura was the lead ecologist for the technical assessments of two Rotorua municipal water supplies (Wāipa/Hemo and Karamu Tākina).

Iwi engagement was a large focus of this project, with a co-management approach to the consent applications. Ecological assessments included determining baseline ecological values, instream minimum flow analysis and ecological impact assessments to determine potential impacts of the continued takes and recommend appropriate mitigation.

Fonterra, Surface Water Quality Assessments

Laura was the lead author for technical reports prepared in support of consent applications for treated wastewater irrigation on multiple Fonterra irrigation farms and direct discharges to surface water. Reporting included statistical data analysis the current state of surface water quality in receiving water bodies, long-term trends, and comparisons to national and regional surface water quality objectives. Stakeholder engagement included community consultation and hui events, to communicate results to stakeholders. Fonterra sites Laura has worked with include Hautapu, Edgecumbe, Edendale and Kauri.

Timaru District Council, Global Stormwater Discharge Consents – Timaru Area

Laura was the lead ecologist for the design and reporting of receiving environment environmental assessments, completed as part of the development of the global Stormwater Management Plan (SMP) for the Timaru area. This assessment included review/ gap analysis of existing information and conditions, baseline field assessments, identification of potential toxicity implications to instream biota and monitoring recommendations. Stormwater Monitoring Plans and Trigger and Action Response Pans (TARPS) were also been developed for five Timaru areas.

APPENDIX 2: SITE PHOTOGRAPHS

Figure 1: Ōhoka Stream Tributary, view upstream from farm track crossing.

Figure 2: Ōhoka Stream Tributary, view downstream from farm track crossing.

Figure 3: Gravel substrate in Ōhoka Stream Tributary.

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Figure 19: Whites Road drainage at Southern Spring channel

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Figure 21: Unnamed Drain 2 at Whites Road

Figure 22: South Ohoka Branch at Whites Road

Figure 23: South Ohoka Branch downstream of Whites Road

Figure 24: Unnamed Drain 1 at Whites Road

Figure 25: Unnamed Dry Drain at Whites Road

APPENDIX 3: AQUATIC ECOLOGY LIMITED REPORT (AEL 2021)

Land Use Change, 535 Mill Road, Ohoka; Aquatic Ecology Report

Prepared for:
Rolleston Industrial Developments Ltd

AEL Report No. 192

Mark Taylor
Riley Payne

Final

November 2021

A juvenile brown trout from the Ohoka Tributary

Aquatic Ecology Ltd.
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Contents

1 Executive Summary

A rural land parcel (approximately 156 ha) is proposed for a District Plan change to mixed-density residential and commercial. Aquatic Ecology Limited was commissioned to evaluate the aquatic ecology of the waterways and water bodies in the land parcel and recommend realignments and waterway setbacks on the basis of maintaining, and possibly enhancing ecological values.

Four fish species were identified, the native longfin eel, shortfin eel, upland bully, and the introduced brown trout. Of these, the longfin eel has a conservation status of declining. The other species do not have a conservation status. Notably, we did not identify the Canterbury mudfish, and we are confident that this endangered species does not reside in the land parcel, partly due to the widespread distribution of other predatory and competitive fish species.

Waterways were in good order due to extensive fencing, and we expect stream health measures to be in the order of 'fair' to 'good' based on national protocols.

We would recommend a minimum of 10 m buffer strip setbacks (from the water's edge) on principal waterways (Ohoka Stream tributary, South Ohoka Branch, Northern and Southern spring fed channels, and the groundwater seep). A 5 m service strip on the Un-named Stream, with a re-alignment of the ephemeral Ponded Drain into neighbouring perennial waterways. A minimum development offset of 20 m, but more if possible, should be applied from the point of wetland delineation (Ministry for the Environment 2020b) for the smaller of the two springheads (feeding Northern Spring Channel), but the larger spring feeding the Southern Spring Channel, requires a minimum of a 30 m setback.

The Northern Spring Channel could be diverted into, and benefit, the flow in the Southern Spring Channel. And the combined Southern and Northern Spring Channel would benefit from being combined and naturalised into a more meandering form. Likewise, the Ponded Drain could also be diverted into the lower reach of the Southern Spring Channel. Diversions and decommissioning of waterways is subject to the recent NES-F 2020 regulations.

We recommend the decommissioning of Ponded Drain (2), as it lacks aquatic values. We also identified 3 waterbodies with puddled water which we regard as not being wetlands and can be decommissioned.

2 Introduction and objectives

2.1 Proposal

A plan change is proposed for the property in the vicinity of 535 Mill Road, comprised of a large land parcel of 152.56 ha and other small parcels comprising of approximately 3.5 ha of rural zoned land. The proposed change will be from rural to the majority being residential 3 and residential 4a zones as defined in the Waimakariri District Plan. An outline development plan (ODP) was provided (Figure 1) which was overlaid with waterways mentioned later in the text. The ODP places stormwater treatment facilities across the development which will all flow toward the southeast of the plan change area, with green setback areas around waterbody areas of known environmental importance (App. I, Fig, a).

AEL was commissioned to assess the Plan Change area for ecological values in respect to waterways and waterbodies. This information will facilitate the finalisation of the Outline Development Plan in respect to the placement of setbacks and the ecological importance of aquatic habitats within the proposed plan change area (PPCA).

2.2 Methods

2.2.1 Background information

Some background information was available from previous studies, including previous trout spawning studies by AEL for the Waimakariri District Council (WDC), and AEL's district-wide studies underpinning the WDC global consent for minor works on waterways. These studies did not include the proposed plan change area, but for context, provided ecological data in the general area, but also immediately downstream and to the north of the PPCA.

A low-scale fieldwork programme was followed as tabulated in Table 1.

Table 1. Field programme for the ecology assessment.

Date	Fieldwork
14/7/21	Initial reconnaissance
20/7/21	Trout spawning survey
21/7/21	Fish survey over PPCA-electric fishing
26-27/7/21	Fish survey over PPCA-netting and trapping

2.2.2 Electric fishing

Fishing locations and photos were recorded in the field using a high accuracy GPS receiver (Garmin GPSMap 64s). To assess the fish community, electric fishing was conducted, under AEL's electric fishing permits (MPI Permit 749, DOC 70754-FAU and under authority from NCFGC). The fished reaches encompassed all hydrological habitats in the surveyed waterways, most of which were considered riffles. The total sample time (i.e. the total time that the machine was actively electrifying the water) for these reaches was 57 minutes. Captured fish were then anaesthetised, identified, measured, and upon recovery from anaesthesia, released back into their resident habitats.

All electric fishing locations (Fig. 1) were fished on 21/07/2021 using a conventional Kainga EFM300 electric fishing machine at an operating voltage of 200 V. D.C. This voltage provided a sufficient electrical field size to prevent escapement. Electric fishing serves to briefly (approx. 3 seconds) render fish unconscious to facilitate their capture in nets for identification. The machine incorporates a timer, allowing the effective fishing time to be recorded. Overall conditions for fish capture using electric fishing were adequate, with good water conductivity and excellent water clarity.

2.2.3 Netting and Trapping

Due to the depth and macrophyte growth of a number of waterways on the property, electric fishing was supplemented with set-netting and trapping. This is because netting and trapping fishing techniques are more effective where deep and slow-flowing water is present. Nets and traps were set in the Southern Spring Channel, Groundwater Seep, and Ponded Drain, and deployed overnight on the 26th of July 2021 (Table 2, Figure 1). Nets used were mini and medium-sized baited fyke nets, with a 12 mm mesh. Traps used were Gee Minnow™ (GM) lines. Each line consisted of five baited Gee Minnow™ traps.

Table 2. Net and Trap setting on 26th July 2021.

Waterway (as in Fig. 1)	GM lines	Fyke nets (and size)
Groundwater Seep	2	2 mini
Southern Spring Channel	3	3 mediums, 1 mini
Ponded Drain	1	0

All captured fish were anesthetised, identified, measured, and after recovery, released back into their resident habitat.

2.3 Analytical methods and approach

During fieldwork, the provided ODP was accessed *via* a GPS-enabled ruggedised iPad, facilitating the corelation of core habitats to features in the field. Mapping was undertaken with Google Earth Pro and QGIS (v. 3.16.4). Isolated waterbodies were identified from Google Earth imagery of the PPCA with their hydrological sources evaluated using the sliding temporal scale with that software (2005-Dec 2020).

2.4 Description of waterways, fish fauna

Notably, all waterways and springheads we observed were effectively fenced from stock, either with a single electric hotwire, or multiple strands of barbed wire. We observed no apparent examples of stock intrusion into riparian zones. Fished habitats had a substrate composed of gravel with some silt, except for the Ohoka Stream tributary which had a gravel bed (Table 3).

Table 3. Substrate and depths of electric-fished sites in the PPCA.

Electric-fish location	Lower South Ohoka Branch	Lower South Ohoka Branch #2	Lower South Ohoka Branch #3	Upper South Ohoka Branch	Ohoka Tributary	Northern spring Channel
Substrate	gravel bed, ~30% embedded	90% fine + coarse sediment, 10% gravel (embedded)	gravel, 10% embedded	Soft sediment, wetland/macrophyte growth in waterway	Loose gravel bed, riffle, high flow	Soft sediment, macrophytic growth present (e.g. milfoil)
Reach length (m)	25	23	30	25	35	40
Maximum depth (cm)	25	27	17	24	37	26
Average depth (cm)	17	25	14	18	29	20

Based on our fieldwork, the physical habitats of surveyed waterways are described here, in north to south order, along with the fish catch results (Table 3). Photographs of the waterways are provided in App. II (Figs. a-e).

2.5 Fish results synopsis

Following significant fishing effort using electric fishing, netting and trapping techniques, a total of four species were identified on the 535 Mill Road property (Table 4). These were, in order of catch abundance, the upland bully (*Gobiomorphus breviceps*), shortfin eel (*Anguilla australis*), longfin eel (*Anguilla deiffenbachii*) and brown trout (*Salmo trutta*).

The brown trout was only identified in the Ohoka tributary. Suitable habitat for this species was identified in the lower reaches of the South Ohoka Branch, however after a significant electric fishing effort no brown trout were identified in this reach. Upland bullies in all fished locations appeared gravid, and therefore will be breeding within the property boundaries.

Table 4. Fish catch within the 535 Mill Road PPCA.

Site	Ohoka Stream Tributary	South Ohoka Branch	Northern spring	Southern spring incl. channel	Groundwater seep	Ponded drain
Method	**Electric fishing**	**Electric fishing**	**Electric fishing**	**Netting + Trapping**	**Netting + Trapping**	**Netting + Trapping**
Fishing Pressure	**14 minutes**	**33 minutes**	**10 minutes**	**4 GM lines, 4 Fyke nets**	**2 GM lines, 2 Fyke nets**	**1 GM line**
Upland bully	20	23	6	7	10	0
Shortfin eel	1	22	2	7	0	0
Longfin eel	0	1	0	1	0	0
Brown trout (juvenile)	1	0	0	0	0	0
Unidentified bully	2	3	0	0	0	0
Total row	**24**	**49**	**8**	**15**	**10**	**0**

2.5.1 Ohoka Stream tributary

To the north, and the waterway with the most apparent flow volume, was a tributary of the Ohoka Stream (Fig. 1). This waterway had a significant baseflow during our winter survey, and possessed a gravel substrate. It was considered perennial and flow-stable, based on the growth of luxuriant marginal aquatic flora and fauna (App. II, Figs. a, b). For the electric-fished reach near the proposed stormwater treatment reserve, the average surface water depth of this channel (along its thalweg or mid-line), at time of survey, was c. 29 cm.

A fresh (i.e., recent) trout redd was identified in the middle of PPCA (Fig. 1), but older redds were found north and south of this location (Fig. 1). So trout spawning habitat suitability may be widespread. Two native fish species were identified, neither of which have conservation status: the upland bully, and the shortfin eel. A number of juvenile bullies could not be identified to species level, but these are likely to be upland bully as well.

The ODP indicates this waterway is expected to have a minimum 10m esplanade setback each side which is likely to protect instream values, including those of trout spawning and maintenance of native fish populations. To maintain trout spawning habitat, the waterway would require low TSS and flow stability during the winter months. Upland bully requires clean gravel for spawning, and associated with high bully abundance. The tributary provides rearing for small brown trout, and both habitat and flow stability is important for this species. The channel should remain free of instream structures to facilitate the movement of large spawning trout between the PPCA and the lower reaches downstream of Whites Road. Any stormwater treatment outlets in this channel should be situated away from suitable trout spawning locations. These can be mapped when a more detailed plan is required.

2.5.2 Groundwater Seep

A short (c. 170 m) distance to the south, an isolated groundwater-fed channel flows towards Whites Road, appeared during the site investigation to be fed by a groundwater seep (Fig. 1), especially so when the water table is high during winter months, and reaches of the Groundwater Seep contain an abundance of macrophytes particularly watercress (App. II, Fig. c, d). During winter there was a perceptible flow, over a fine-substrate base. During summer, we consider that the channel would lose a significant proportion of base flow. However, based on the aquatic fauna present, some water is always present in the channel.

Only upland bullies were identified from the Groundwater Seep, despite significant fishing effort.

2.5.3 Northern Spring Channel

The northern spring channel is a linear waterway traversing the PPCA, and originating from a spring near Bradleys Road (Fig. 1). Substrate in this channel consists of a mixture of fine sediment and embedded gravel. Flow is slow but perceptible, at least during the winter months. The average surface water depth of this channel, taken across the electric fishing reach (Fig. 1), was c. 20 cm. Plant zonation suggests that the flow is perennial.

A reach in the northern third of the channel was electric fished (App. II, Figs. e, f) with the shortfin eel and upland bullies identified. The flow may be too low, and the substrate too fine, to provide trout spawning habitat.

2.5.4 Southern Spring Channel

The Southern Spring Channel originates in two large deep ponds near the main homestead, one of which (more northern) appears recently man-made. The ponds are identified as a spring on Canterbury Maps. The southern pond has a small discharge channel which flows south towards Whites Road(App. II, Figs. g, h). The ponds are surrounded by mature oak trees, and contain large amounts of woody debris and leaf litter from the surrounding deciduous trees. The channel contains a fine sediment substrate and a significant abundance of introduced macrophytes, especially watercress. Both springs and their respective channels are considered perennial.

The headwater ponds and channel were subject to significant fishing pressure during this survey. Three fish species were identified: the upland bully, shortfin eel, and the longfin eel. The longfin eel is the only species in the PPCA with a conservation status of "declining" (Dunn *et al.* 2017). It has a higher dependence of bank cover and water depth than the non-endangered shortfin eel. The specimen in the spring head was large (c. 1100 T.L.), reflecting the depth and size of its resident habitat.

Large eels need to be able to access the sea so they can migrate to their tropical spawning grounds, therefore the ecological linkage between the springhead to Whites Road (i.e., Southern Spring Channel, Fig. 1) is important in this role.

2.5.5 Ponded Drain

Ponded Drain (Fig. 1) is considered ephemeral, as indicated by tall fescue and the facultative aquatic buttercup growing on the channel base. This channel is likely used to drain runoff during rainfall, and their base flow appears to be zero. A fishing attempt in the limited amount of ponded drain water did not identify any aquatic species (App. II, Figs. i, j).

2.5.6 South Ohoka Branch

During our winter baseflow visit, this waterway conveyed a clear-water flow, over a gravel base. Similar to all other waterways in the PPCA, the fenced banks and bed were stable. The upper section west of the farm buildings is ephemeral, and while it was watered during our visit (App. II, Fig. k, mean depth c. 18 cm), it was observed to dry during a recent visit (pers. obs. Peter McAuley, Inovo). No obligate aquatic macrophytes were observed between Bradleys Road and the farm buildings, nor were any fish identified during the fishing survey.

However, the downstream section, east of the farm buildings, was considered to contain perennial flow. The average mid-channel water depth in this reach was c. 19 cm. The substrate in the downstream section consisted of loose gravel, with short sections of fine sediment. Three fish species were identified in moderate numbers, the upland bully, shortfin eel, and the longfin eel, the latter possessing conservation status. A number of small bullies could not be identified to species level, but were, very likely, juvenile upland bullies. No brown trout were identified during the fish and brown trout survey, but trout redds were identified during the spawning survey, but only east of the farm dwellings. We also note that the waterway is not fenced immediately downstream of the PPCA (south-east of Whites Road), and is currently quite degraded by stock access. This results in bank erosion, channel widening and sediment increases. Based on Google Earth Street View imagery, this appears to be an ongoing issue. Therefore, we consider that the PPCA reach of this stream would represent an important refuge of high-quality habitat for rearing and spawning for trout and native fish.

Accordingly, we would recommend the protection and naturalisation of this channel, but preserving the hydraulics and gravel substrate which are particularly important for trout spawning. In particular, the preservation of the existing wetted channel width at winter baseflow.

2.5.7 Ponded Drain 2 (dry)

This fenced waterway was chocked with buttercup and pasture grass and was too shallow to fish (c. 2 cm, App. II, Figs. m, n). The channel appeared to be ephemeral, and shallowed down-gradient and southwards. It appeared to have no ecological value, and any water in the channel is likely to originate from rainfall or irrigation runoff.

2.5.8 Unnamed Stream (dry)

This waterway ran along the south boundary of the PPCA and lacked surface water for most of its course, with surface water limited to puddles (App. II, Figs. o, p). There was no vegetation at all in the channel, and we consider it likely the channel is dry for most of the year.

2.5.9 Isolated waterbodies

A number of waterbodies were located, and were assessed in respect to their status as a natural wetland as per the MFE National Policy Statement (Ministry for the Environment 2020a), the Land and Water Regional Plan (LWRP) and the RMA.

In this regard, in Ministry for the Environment (2020a), a natural wetland means a wetland (as defined in the Act) that is not:

(a) a wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or
(b) a geothermal wetland; or
(c) any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain-derived water pooling

In the Land and Water Regional Plan (LWRP):...."

Wetland includes:
1. wetlands which are part of river, stream and lake beds;
2. natural ponds, swamps, marshes, fens, bogs, seeps, brackish areas, mountain wetlands, and other naturally wet areas that support an indigenous ecosystem of plants and animals specifically adapted to living in wet conditions, and provide a habitat for wildlife;
3. coastal wetlands above mean high water springs;

but excludes:
(a) wet pasture or where water temporarily ponds after rainfall
(b) artificial wetlands used for wastewater or stormwater treatment except where they are listed in Sections 6 to 15 of this Plan;
(c) artificial farm dams, drainage canals and detention dams; and
(d) reservoirs for firefighting, domestic or community water supply.

Under the RMA 1991 the definition of a wetland is simple:

"wetland includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions"

Waterbody 1

This shallow disconnected puddle was situated in the middle of a paddock, and appeared to be a puddle which lacked wetland vegetation, and was not fished (App. II, Fig. q). It possessed no wetland vegetation and was surrounded by pasture grass. It was not regarded as a natural wetland under the NPS 2020 definition, nor a wetland under the LWRP and RMA definitions.

Waterbody 2

This is the remnant of an old fluvial channel, now appearing as a depression vegetated in dryland plants (App. II, Fig. r). There was no surface water, aquatic plants, nor signs of aquatic habitat. However, the fluvial channel depression was quite apparent in 2012 satellite imagery. It is possible the channel has been partially filled in the meantime. It was not regarded as a natural wetland under the NPS 2020 definition, nor a wetland under the LWRP and RMA definitions.

Waterbody 3

This site may also have been a segment of a historic fluvial channel, but appears to be waste ground used for land fill, surrounded by grazed, heavily pugged pasture. It was not regarded as a natural wetland under the NPS 2020 definition, nor a wetland under the LWRP and RMA definitions.

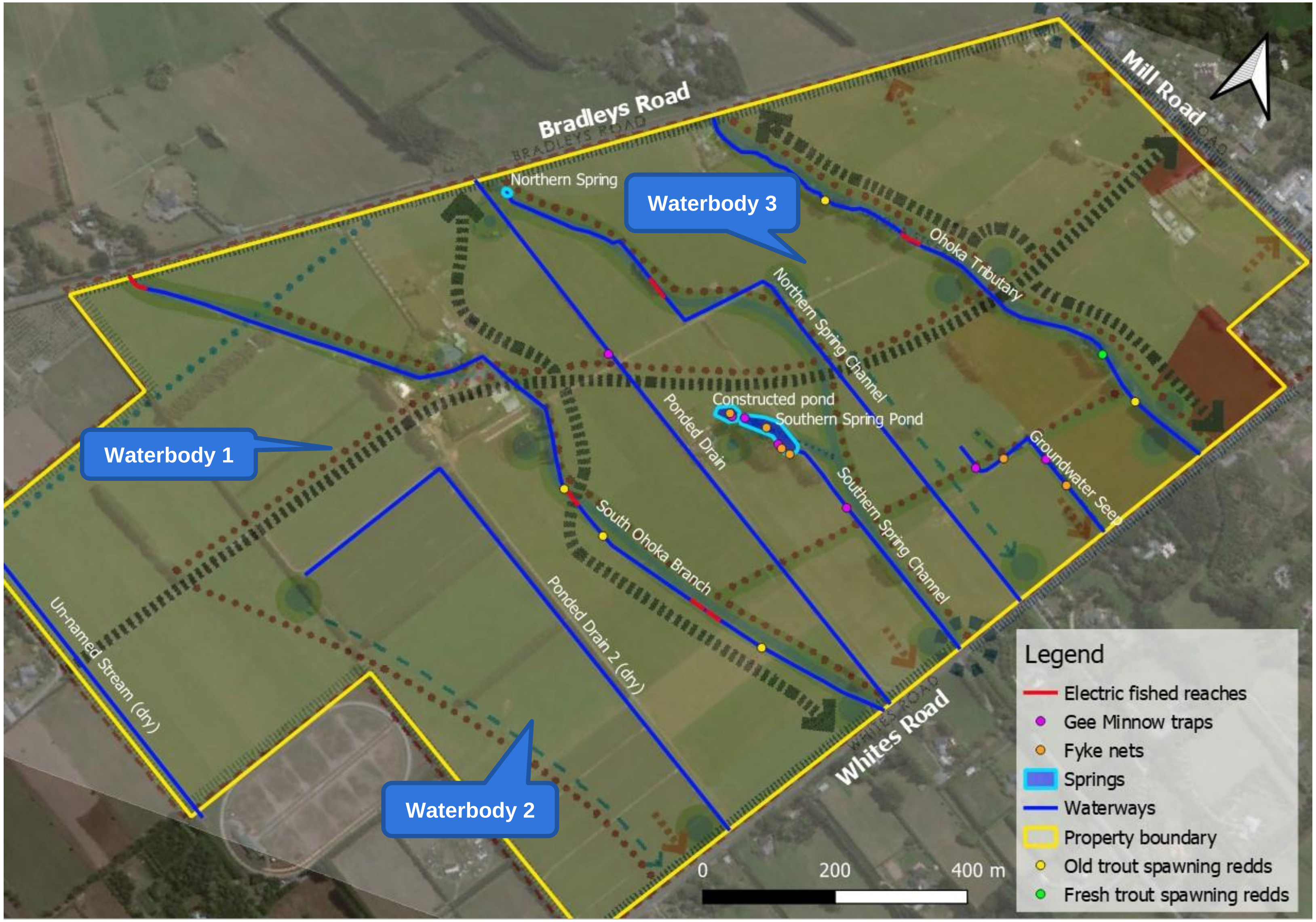

Figure 1. The outline development plan overlaid with waterways mentioned in the text.

3 Discussion

3.1 Ecology synopsis

No New Zealand Freshwater Fish Database (NZFFD) records have been recorded from the PPCA, although records exist in the surrounding area. Surveys completed by the Canterbury Regional Council (now Environment Canterbury) in 2001 record upland bullies (*Gobiomorphus breviceps*), common bullies (*Gobiomorphus cotidianus*) and shortfin eels (*Anguilla australis*) at Whites Road in the adjacent Ohoka Stream tributary, and the so-called "existing stream" at Whites Road (NZFFD cards 19680-19682, 19689-19690). A 2011 Department of Conservation (DOC) survey of the Ohoka Stream tributary downstream of Whites Road confirmed the presence of these three species. However, this survey also identified longfin eels (*Anguilla dieffenbachii*) and brown trout (*Salmo trutta*) in the waterway (NZFFD card 32080). The identified fish fauna in the Plan Change Area, in order of probable natural abundance, is the four species: upland bully, shortfin eel, longfin eel, and brown trout. It is probably that unidentified bullies are likely to be just upland bullies which are too difficult to identify in the field to species level. It is possible that some of these fish were common bullies. Of these, only the longfin eel has a significant conservation status of "declining", the remaining native species have a status of "not threatened", and the brown trout is introduced (Dunn *et al.* 2017).

In the PPCA, all of the waterways and waterbodies with ecological value were effectively fenced from stock, consequently bank structure, marginal plant growth, and substrate were stable. In particular, the fencing along the Ohoka Stream tributary, and the South Ohoka Branch maintains the coarse substrate and hydraulic characteristics essential for trout spawning.

A significant trout spawning survey was undertaken on the Ohoka Stream by AEL in 2018, as part of the Global Consent for the Waimakariri District Council & Environment Canterbury (Webb *et al.* 2018). Low numbers of trout redds (c. 5-25 redds/km) were identified from the Ohoka Stream tributary, downstream of Whites Road. The 2018 survey did not extend onto the PPCA.

The fish fauna within the PPCA was characteristic of steady flows, stable bank and habitat structure, with some gravel substrate. Of the four fish species identified, only the longfin eel had conservation status of nationally declining (Dunn *et al.* 2017). The remaining three species are listed as unthreatened (upland bully, shortfin eel), or introduced (brown trout)(Dunn *et al.* 2017).

The two eel species (i.e., shortfin eel, longfin eel) require sea access to complete their life cycles, being adept climbers as migratory juveniles, they can negotiate some instream structures like culverts and weirs. Adult spawning brown trout require access through Whites Road culverts along the courses of the Ohoka Stream tributary, and the South Ohoka Branch. Upland bullies spawn and rear locally, and benefit from gravel and cobbles for spawning and refuge (Jowett & Boustead 2001). The longfin eel grows to a large size, and is one of the largest freshwater eels species in the world. In the PPCA, a specimen of 1100 mm in length was obtained from the springhead at the Southern Spring Channel, and large individuals require significant water depth and stable bank structure.

The PPCA falls within the natural ecological range of the critically endangered Canterbury mudfish (*Galaxias burrowsius*). Accordingly, we were careful to ensure that the area was well-surveyed for isolated waterbodies where this species can survive, and that fishing methods were appropriate to catch these rare fish if they were present. However, given the results of this study, we are confident that the Canterbury mudfish does not survive in this PPCA. This is partly due to their absence in the fish catch, but also due to inability to survive predation and competition from the introduced brown trout and native eels, which are clearly widespread in the PPCA.

We did not survey freshwater invertebrates at the Plan Change level, as these assays can be undertaken at the consenting and AEE stage. Given the stable nature of the banks and flow, and the presence of some gravel reaches, we are confident that the invertebrate fauna would reflect at least fair stream health, and we consider it likely that koura (*Paranephrops zealandica*) are present in some locations.

3.2 Habitat requirements to preserve ecological values

Below are specific and general requirements to preserve fish values in the PPCA.

- Maintaining bank stability.
- Maintenance of spring base flows, and springhead depth (esp. at the Southern Spring Channel).
- Maintenance of suitable hydraulics, and unsilted trout spawning gravels in the Ohoka Stream Tributary and the South Ohoka Branch.
- Maintenance of fish passage for trout for the Ohoka Stream tributary and the South Ohoka Branch.

3.3 Notes on waterway alignment in respect to the November ODP

Following our ecological findings, some waterways are planned to be realigned to facilitate the development of an Outline Development Plan. All realignment proposals will be subject to accordance with the NES-F (National Environmental Standards) 2020 after the Plan Change stage. Waterways are presented in north-to-south order.

- There is no proposed change, in terms of alignment, in the Ohoka Tributary to the north of the PPCA, which will be left in its natural state.

- The Groundwater Seep may have a seasonal groundwater feed, and would benefit from being meandered and naturalised in some way.

- It is considered beneficial to combine the Northern Spring Channel baseflow into the Southern Spring Channel, possibly downstream of the spring-fed ponds. Both channels are perennial and are likely to be meandered and naturalised. The old linear channel of the Northern Spring Channel will then be decommissioned.

- The course of Ponded Drain, which appears ephemeral, could be diverted into the perennial Southern Spring Channel. The preference would be to maintain the perennial course of the lower Southern Spring Channel. The old linear course of the Ponded Drain will then be decommissioned.

- The course of the South Ohoka Branch will be retained in its present form.

- The course of Ponded Drain 2, which appears highly ephemeral, could be realigned into the South Ohoka Branch, but as its dry and lacks aquatic values, it can be decommissioned

- The channel on the southern boundary of the PPCA (referred to as Un-named Stream) was largely dry, and could remain in this location and provide utilitarian function as a swale. A 5 m buffer could be used as a service lane.

- Waterbodies 1, 2, and 3 (see Fig. 1), upon inspection, were not considered to be wetlands under the Act, LWRP, or the NPS-FM. Since they lacked any ecological merit, they may be decommissioned.

3.4 Recommendations on development setbacks and buffer strips

- A minimum 10 m ecologically functional buffer strip on each side of the principal waterways as measured from the water's edge (i.e. Ohoka Stream tributary, Groundwater Seep, Northern Spring and Southern Spring Channels, and South Ohoka Branch.) A width of 10 m or more is required to provide nutrient uptake, erosion control, shading to control nuisance aquatic weed growth (if canopy height exceeds wetted width). At a minimum width of 10 m, there will be some ecological function for stream invertebrates .

- The setback on the southern Boundary (un-named stream in Fig. 1), can be reduced to a service strip of 5 m.
- A minimum of a 20 m buffer setback for the northern spring
- A minimum of a 30 m setback for the large Southern spring as indicated in the November ODP.

4 Conclusions

Our recommendations on setbacks and buffer strips, released earlier to the Applicant, have been incorporated into the November 2021 ODP (Appendix I, Figure a).

If the habitat requirements in section 3.2, the realignment notes in section 3.3 (including being subject to accordance with the NES 2020) and the recommendations on setbacks and buffer strips in section 3.4 are implemented, then the change of land use from rural to residential and commercial will maintain and/or improve the current ecological status of the land within the plan change area.

5 Acknowledgements

We thank Peter Sheriff for his assistance with land access, orientation to waterways, and discussions about the waterways in the PPCA. We are grateful to Janine McIvor and Malcolm Main for fieldwork assistance. Laura Drummond and Bas Veendrick, of Pattle Delamore Partners, made comments on an earlier draft.

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7 Appendix I. Land use change plan (November 2021)

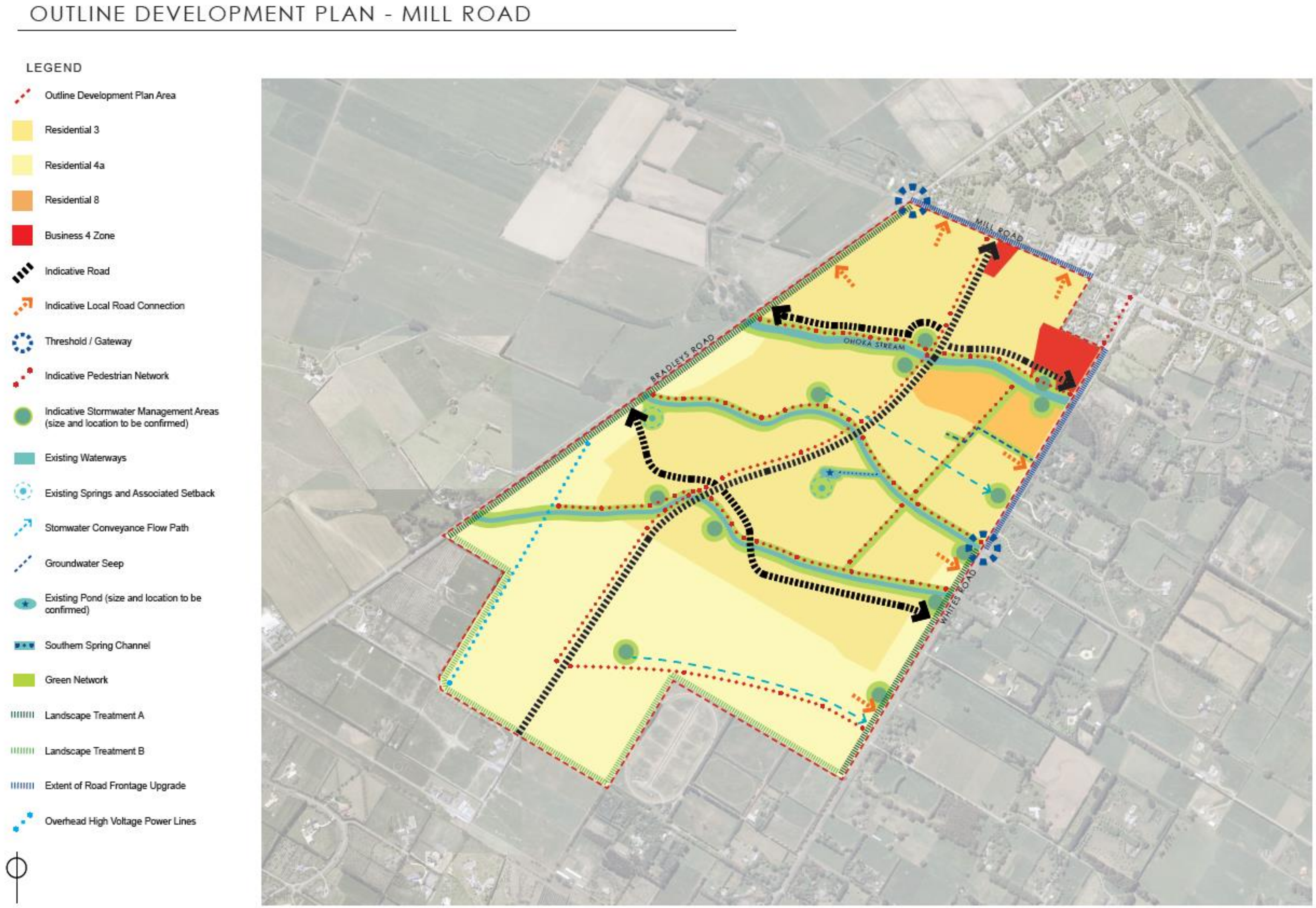

Figure a. Draft outline development plan for the land use change proposed at 535 Mill Road.

8 Appendix II. Photographs obtained during the field surveys

Figure a. Ohoka Stream tributary. Shortfin eels, upland bullies and brown trout were identified in this waterway. A fresh trout spawning redd was also located.

Figure b. Ohoka Stream tributary. Note the hotwire effectively protecting the fragile banks and marginal vegetation.

Figure c. Upstream section of the groundwater seep. Upland bullies were located in this section, caught in Gee Minnow traps (pictured).

Figure d. Downstream section of groundwater seep. Upland bullies were caught in this reach. Waterway fenced from stock by hotwire.

Figure e. The spring at the head of the Northern Spring Channel. It is protected by a hot-wire around its periphery.

Figure f. Northern spring channel. Upland bullies and shortfin eels were identified in this waterway.

Figure g. The south pond at the head of the Southern Spring Channel. Species located in these ponds were the longfin eel, shortfin eel and upland bully.

Figure h. Southern spring channel. The only species recorded in this channel was the upland bully. Turbidity in this photograph was from the setting of the GM traps line.

Figure i. GM traps set in the ponded drain. No flow is visible in this drain, and no fish species were recorded.

Figure j. Ponded drain, downstream of the GM set. Note the absence of aquatic flora.

Figure k. Upstream section of existing stream. No fish were identified at this location.

Figure l. Downstream section of existing stream. Longfin eels, shortfin eels, and upland bullies were present in this reach.

Figure m. Ponded drain 2. This waterway contained minimal (c. 3 cm) surface water, insufficient to fish.

Figure n. showing the small amount of water and terrestrial plants in ponded drain 2.

Figure o. Showing a ponded section of the Un-named south boundary waterway.

Figure p. Un-named south boundary waterway, looking upstream. At the time of survey, this was a dry channel with two shallow ponded sections located. No aquatic flora was identified, and therefore the shallow ponds were deemed low value.

Figure q. Waterbody 1. This pond filled a small depression in the middle of a paddock. No aquatic value and stock-accessible.

Figure r. Waterbody 2. The remains of an old fluvial channel present before 2012.

APPENDIX 4: WETLAND DELINEATION REPORT (PDP 2025A)

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memorandum

TO	Tim Carter	FROM	Inge Martens and Nicki Papworth
	Carter Group Limited	DATE	13 August 2025
RE	Wetland Assessment – 531 & 535 Mill Road, Ohoka		

1.0 Introduction

Pattle Delamore Partners Ltd (PDP) was engaged by Carter Group Limited (CGL) to undertake a site-wide wetland delineation at 531 & 535 Mill Road, Ohoka (Figure 1). The specific objectives of this investigation were to identify and delineate the extent of wetland habitat on the property to support CGL's Fast track application to develop the land into a residential subdivision.

This memorandum outlines the methodology and findings of the wetland delineation performed by PDP ecologists (see Appendix A).

2.0 Wetland Definitions

RMA:

As outlined in the RMA (1991), a **wetland** is an area that is intermittently or permanently saturated by water and supports natural ecosystems of plants and animals adapted to wet conditions.

NPS-FM:

The NPS-FM 2020 (amended January 2024) definition of a **'natural inland wetland'** is a wetland (as defined in the RMA) 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); 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.

3.0 Methodology

Site visits for 535 Mill Road, the majority of the project site, were undertaken on the 28th and 29th of November 2024 to assess and delineate the extent of wetland habitat (Figure 1). A later visit was conducted on 3rd of June 2025 to investigate the potential for wetland presence at 531 Mill Road. This parcel of land was purchased following the original survey dates. Representative site photographs of both addresses are provided in Appendix B.

An initial desktop assessment using aerial imagery (Google Earth) was undertaken to assess the possible presence of wetlands within the property boundaries. Indicators of wetland presence in aerial imagery included visible surface water, sparsely vegetated land depressions, seasonal inundation, vegetation colouration, and vegetation composition. Areas with these features were prioritised for field delineation and all efforts were made to access these areas by foot to confirm the vegetation types present.

Areas suspected of containing wetlands were assessed as per standard wetland delineation protocols for New Zealand based on the presence or absence of hydrophytic vegetation as outlined in the Ministry for the Environment (MfE) wetland delineation protocols (MfE, 2020b). Exotic pasture species used for assessing the pasture exclusion provisions under clause (e)(ii) of the NPS-FM are those listed in the national list of exotic pasture species (MfE, 2020a).

The MfE protocols use the Clarkson (2014) methodology, which assesses the presence of wetlands based on the presence of hydrophytic plants and species adapted to wet conditions. Under this classification all species are assigned an indicator status depending on the likelihood of them occurring within areas of wetland. These categories are:

- **OBL: Obligate**. Almost always is a hydrophyte, rarely in uplands (estimated probability >99% occurrence in wetlands).
- **FACW: Facultative Wetland**. Usually as a hydrophyte but occasionally found in uplands (estimated probability 67-99% occurrence in wetlands).
- **FAC: Facultative**. Commonly occurs as a hydrophyte but occasionally found in uplands (estimated probability 34-66% occurrence in wetlands).
- **FACU: Facultative Upland**. Occasionally is a hydrophyte but usually occurs in uplands (estimated probability 1-33% occurrence in wetlands).
- **UPL: Obligate Upland**. Rarely is a hydrophyte, almost always in uplands (estimated probability <1% occurrence in wetlands).

Areas that are dominated (>50% cover) by OBL or FACW plants satisfy the rapid hydrophytic vegetation (RHV) test for the presence of wetland vegetation. These are therefore considered to be wetlands without the need for further sampling or investigations of hydrology or soils. Areas that did not meet these requirements required a wetland survey plot (2x2 m) to assess the potential of meeting the criteria of a wetland habitat.

After wetlands were identified using the MfE protocol in the field, aerial imagery available from Google Earth, Retrolens and LiDAR was reviewed to check wetland vegetation historicity and to inform the assessment of extent. Wetlands were then geospatially digitised using ArcGIS Pro (v.3.4) and the dominant vegetation and structure recorded using the Atkinson system for describing structural classes.

4.0 Results

4.1 Site Description

The project area areas of saturation and a mosaic of hydrophytic species scattered among primarily pastoral, non-wetland vegetation. There was no need to undertake detailed ground assessments of a range of areas across the landscape where the dominant vegetation was primarily perennial ryegrass (*Lolium perenne*). This is a FACU and pasture species under the MfE (2020b) delineation protocols. It is noted that hydrophytic grass species such as marsh foxtail (*Alopecurus geniculatus*) and creeping bent (*Agrostis stolonifera*) were present in varying abundances across the whole property.

Several sites within the project site had features suggestive of wetland hydrology or vegetation visible in aerial imagery. At the time of the ground survey, these were found to be comprised of cut and carry pasture grasses. These recently mowed areas were not assessable, but we expect that they are the same composition as the surrounding areas that we assessed by foot (i.e., dominated by perennial ryegrass). The soil underneath the mowed areas were firm and there were no hydrology features indicative of wetland extent.

4.2 Vegetation

The field assessment identified 15 locations as wetland habitats (Figure 1, Table 1). Due to the dominant species and vegetation structure that was present, most wetland habitat sites met the rapid hydrophytic vegetation (RHV) test (MfE, 2020b). Hydrophytic species found within identified wetlands on the property are provided in Appendix C.

The 15 wetlands identified have been described in Table 1 based on their vegetation structure and hydrological features.

Table 1: Wetland features identified at the Ohoka project site

Wetland	Vegetation Type	Notes	Area (ha)
1	Marsh foxtail-creeping bent grassland-celery leaved buttercup grassland	This wetland was located in a depression on the south side of a stream to the west of the farm buildings. Pugging was significant as it appeared the area was also a common feed station spot for stock.	0.12
2	Marsh foxtail-creeping bent grassland	This wetland was located in a depression along the margins of a straightened watercourse and included an area of sparsely vegetated soils showing surface cracks and pugging. Soil was moist less than 10 cm below the surface. Other hydrophytic species included willowherb, and occasional blue sweetgrass.	0.03
3	Marsh foxtail-creeping bent-blue sweetgrass grassland	This wetland was located within a geomorphic depression possibly formed by either a realigned first-order watercourse or an intermittent surface water overland flow path. In some areas soil surface was wet, and significant pugging of soils by stock. Where the ground was firmer underfoot, soils were moist less than 10 cm below the surface.	0.54
4	Marsh foxtail-creeping bent-blue sweetgrass grassland	This wetland was located in another section of the same overland flow path as Wetland 3. A large sparsely vegetated concave surface was present, and bare soils had large surface cracks and moist soils underneath the dry surface.	0.39
5	Marsh foxtail-creeping bent grassland	This wetland was located in a depression to the west of another likely preferential surface water flow path. Aerial imagery showed frequent inundation and surface water at this location.	0.11
6	Marsh foxtail-creeping bent-blue sweetgrass grassland	This wetland was located in the overland flow path the east of Wetland 5. Surface water was present at the time of the survey.	0.79
7	Marsh foxtail-creeping bent grassland	This wetland was located at the head and sides of a spring to the north of the farm buildings. Significant pugging (30-40 cm deep) was present at the seep head under a large willow (*Salix babylonica*) with standing water present in deeper holes. Exposed soils were still moist and were dark brown and humic. Blue sweetgrass was common closer to the spring sides. Wetland vegetation extended past a fence. Where stock were excluded, watercress was dominant, bordered by jointed rush and floating sweetgrass. Other hydrophytic species included wīwī, broom sedge, and celery-leaved buttercup.	0.13

Table 1: Wetland features identified at the Ohoka project site

Wetland	Vegetation Type	Notes	Area (ha)
8	Marsh foxtail-creeping bent-blue sweetgrass grassland	This wetland was located on the eastern side of the spring to the north of the farm buildings. The wetland extent was confined on its southern side by a slight rise in the landform.	0.08
9	Marsh foxtail-creeping bent-blue sweetgrass grassland	This wetland was located on the eastern side of the spring to the north of the farm buildings. It is a small extension of Wetland 8 and contains similar characteristics, but it separated by a vehicle/animal crossing.	0.01
10	Marsh foxtail-creeping bent grassland	This wetland was located within the same overland flow path as Wetland 12 but separated from it vegetatively by farm roads. Soils were heavily pugged, and ground water was at the soil surface in some small areas.	0.37
11	Marsh foxtail-creeping bent grassland	This wetland was located in a depression to the north of the main house. Soils were saturated and surface water was present. Pugging was common around the edges of the area of surface water.	0.04
12	Marsh foxtail-creeping bent-blue sweetgrass grassland	This wetland was located in a probable preferential surface water overland flow path near the main house and was hydrologically connected to the pond on the house grounds.	0.47
13	Marsh foxtail-creeping bent grassland	This wetland was located within a continuation of the overland flow path where Wetland 12 was identified.	0.90
14	Marsh foxtail-creeping bent grassland-celery leaved buttercup grassland	This wetland was located in a low area on the northern side of Ohoka Stream. A large sparsely vegetated concave surface was present, with surface water cracks and algal mats present on soil surface. Soils were moist less than 10 cm below the surface.	0.14
15	Marsh foxtail-creeping bent grassland	This wetland was located where Ohoka Stream exited the property under Whites Road within a small depression.	0.17

One plot survey was undertaken at Wetland 14 to confirm areas of uncertainty where it failed the RHV test around its margins. Results showed 41% pasture species in the area tested. Due to the clear dominance of pasture species past the testing point, it was decided that this area formed the boundary of the wetland inside of which was clearly dominated by hydrophytic vegetation.

More areas showed indications of wetland presence during the aerial review stage, and LiDAR imagery showed multiple land surface depressions. However, when investigated during site surveys many of these were pasture dominant (i.e., not wetland at that time) or consisted only of a sparsely vegetated depression with no hydrophytic vegetation. Areas of surface water pooling on roads showed pugging in the paddocks on either side, but no hydrophytic vegetation were present in these areas. It is likely ephemeral wetland extent is present on the site, however it is unknown how extensive this area is. Ephemeral wetland values are likely to be very low.

A 0.32 ha pond is present in the centre of the project site adjacent to the main house and Wetland 12. A large part of the pond, especially in its western extent, appears to have been artificially created through excavation in the mid 2000's. It is our understanding the eastern extent of the pond is spring-fed and historic imagery from the late 1970's suggests it once formed the head of a small stream. Currently the pond is surrounded by amenity trees such as weeping willow and European oak (*Quercus robur*), and some planted indigenous species such as harakeke (*Phormium tenax*) and pūkio (*Carex virgata*). The area currently contains low values in regard to the diversity of native hydrophytic species. Due to its artificial nature, the pond has not been classified as natural inland wetland as per the NPS-FM.

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SCALE : 1:6,000 (A3)

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B	FINAL	JAN 25	KB
A	ISSUED FOR REVIEW	DEC 24	KB

SOURCE:
1. AERIAL IMAGERY (FLOWN 2022) SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENCED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMAT ON AND INSET DERIVED FROM LINZ DATA.
3. WETLADS DERIVED FROM PDP SITE VISIT NOV 2024.

CLIENT
ROLLESTON INDUSTRIAL DEVELOPMENTS LTD

FIGURE
FIGURE 1: WETLAND DELINEATION, OHOKA.

PROJECT
OHOKA DEVELOPMENT WETLAND DELINEATION

5.0 Conclusions and Recommendations

Fifteen wetlands on the Ōhoka project site at 531 and 535 Mill Road met the definition of 'natural inland wetland' under the NPS-FM (MfE, 2020a & 2020b). Wetland extent totalled 4.29 ha and was associated with overland flow paths in land surface depressions, or were at the margins of spring heads and waterways. Marsh foxtail, creeping bent, and blue sweetgrass were the dominant species in almost all wetland environments. The largely uniform vegetation types are indicative of the degraded state of the wetlands due to existing and past land uses and grazing. Wetland vegetation types were more diverse at stream margins where stock were excluded, however these areas were few (e.g., at the springhead of Wetland 7).

Although a larger proportion of the property displayed potential wetland features on aerial imagery and LiDAR, these were found to not meet the criteria for either natural inland wetland or wetland as per the RMA at the time of the survey. Ephemeral wetlands may be present seasonally at the project site, but if present, their values are likely to be very low. The pond at the centre of the property has been artificially created and it currently contains low wetland vegetation values. Its eastern extent is spring-fed and likely supported greater wetland values prior to its excavation approximately 20 years ago. Due to its artificial nature, the pond does not meet the definition of 'natural inland wetland' under the NPS-FM.

We understand that the proposed development of the site into residential lots may result in the loss of wetland extent. It is our recommendation that wetland loss is mitigated through the instatement of new wetlands, and enhancement or protection of wetlands to be retained. Specifically:

- Springhead wetland habitats should be protected and enhanced by buffers planted with indigenous hydrophytic vegetation.
- Any loss of wetland extent[1] should be mitigated by the instatement of new areas of high quality wetland totalling no less than the area loss (i.e., a ratio of at least 1:1).
- Low lying stream margins should be considered for planting with wetland vegetation species.
- Wetland enhancements, including planting plans, should be informed by a detailed Enhancement Plan prepared by a qualified ecologist.

If these recommendations are followed, wetland extent across the project site will be maintained or increased. When coupled with effective enhancement planting and management, wetland values should overall improve as a result of the proposed subdivision.

6.0 References

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Ministry for the Environment (2020a). *National Policy Statement for Freshwater Management (as amended in January 2024)*. Available at: https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-freshwater-management/

Ministry for the Environment (2020b). *Wetland Delineation Protocols (amended February 2023)*. Wellington, Ministry for the Environment.

[1] Wetland extent as defined in Table 1 of this memorandum.

7.0 Limitations

This memorandum has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by CGL. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This memorandum has been prepared by PDP on the specific instructions of CGL for the limited purposes described in the memorandum. PDP accepts no liability if the memorandum is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

Prepared by

Inge Martens

Ecologist

Reviewed by

Nicki Papworth

Senior Ecologist - Botany

Approved by

Jarred Arthur

Technical Director - Ecology

Appendix A: Project Team bios

The assessments outlined in this memorandum were undertaken by the following qualified ecologists:

Nicki Papworth (Senior Wetland Ecologist)

Nicki is a botanist and wetland ecologist with five years' experience working in the private sector. She graduated from Victoria University with a Master of Science (Ecology and Biodiversity) in 2022. This followed a Post-graduate Diploma in Ecology and Biodiversity attained in 2019. She is a member of both the Environmental Institute of Australia and New Zealand (EIANZ) and New Zealand Plant Conservation Network (NZCPN).

Nicki has extensive expertise in wetland assessments and delineation, ecological impact assessments, botanical surveys, and terrestrial habitat and vegetation surveys. She has a strong technical skillset, including a high level of experience undertaking a variety of terrestrial and wetland ecological field assessment methodologies, technical reporting, and an understanding of policies affecting ecological outcomes at local, regional, and national scales

Since joining PDP in 2022, Nicki has conducted dozens of wetland delineations and impact assessments for a variety of clients. These range across the public, agricultural, urban development and industrial sectors. Her project experience includes (but is not limited to) wetland assessments for the Miramar Links Golf Club redevelopment, Waka Kotahi biodiversity offsetting and threatened plant surveys, and North Canterbury vineyards reconsenting processes.

Inge Martens (Ecologist)

Inge is a freshwater ecologist with two years' experience working at PDP. She graduated from the University of Canterbury with a Master of Science (Ecology) in 2023 and is a member of the New Zealand Freshwater Sciences Society (NZFSS).

Inge's masters research focused on how environmental DNA could be used as a biomonitoring tool in braided rivers. She investigated how sampling environmental DNA from one location of a braided river may be able to provide information at the larger scale. Inge is also a capable field ecologist, with experience in conducting standard freshwater and wetland ecosystem monitoring (i.e., macroinvertebrate, water quality, habitat and vegetation surveys). She also has experience in data analysis using R, python, and Microsoft Excel.

Since joining PDP, Inge has been involved in a variety of projects for both private and public clients. These include conducting wetland delineations across multiple sites in North Canterbury for wastewater discharge and water use consent applications.

Appendix B: Site Photographs

Photograph 1: Wetland vegetation behind an electric fence to exclude stock at Wetland 7, 535 Mill Road.

Photograph 2: Pugging consistent with the extent of Wetland 13, 535 Mill Road.

Photograph 3: Surface water pooling at Wetland 6, 535 Mill Road.

Photograph 4: Wetland 4 located within a likely overland flow path, 535 Mill Road.

Photograph 5: Sparsely vegetated depression in land surface at Wetland 4, 535 Mill Road.

Photograph 6: Pugging indicating the extent of Wetland 3, 535 Mill Road.

Photograph 7: Surface water and pugging at Wetland 11, 535 Mill Road.

Photograph 8: Vehicle tracks in wet soils near Wetland 8. Surface cracking indicates the disturbance was not recent, 535 Mill Road.

Photograph 9: Marsh foxtail-creeping bent grassland, Wetland 10. This vegetation was typical of many wetlands identified onsite, 535 Mill Road.

Photograph 10: Pasture grasses typical of the site at 531 Mill Road.

Photograph 11: Overgrown pasture grasses situated behind the unoccupied dwelling at 531 Mill Road.

Photograph 12: Small amount of creeping buttercup (*Ranunculus repens*) growing within pasture grass within a small depression at 531 Mill Road.

Appendix C: Wetland Plant Species

Wetland plant species identified at the Ohoka project site		
Name	**Common Name**	**Hydrophytic Ranking**
Agrostis stolonifera	Creeping bent	FACW
Alopecurus geniculatus	Marsh foxtail	FACW
Callitriche stagnalis	Starwort	OBL
Carex scoparia	Broom sedge	FACW
Carex virgata	Pūkio	OBL
Glyceria declinata	Blue sweetgrass	OBL
Glyceria fluitans	Floating sweetgrass	OBL
Juncus articulatus	Jointed rush	FACW
Juncus bufonius var. bufonius	Toad rush	FACW
Juncus edgariae (syn. *gregiflorus*)	Wīwī	FACW
Myosotis scorpioides	Water forget-me-not	FACW
Nasturtium microphyllum	One-rowed water cress	OBL
Nasturtium officinale	Watercress	OBL
Persicaria hydropiper	Water pepper	FACW
Persicaria maculosa	Willow weed	FACW
Phormium tenax	Harakeke	FACW
Ranunculus repens	Creeping buttercup	FAC
Ranunculus sceleratus	Celery-leaved buttercup	OBL
Salix babylonica	Weeping willow	FACW
Stellaria alsine	Bog stitchwort	FACW

APPENDIX 5: INSTREAM ECOLOGY SUMMARY SURVEY RESULTS

Table 9: Spot water quality results from each ecological survey site.

	Ōhoka Stream Tributary			Groundwater Seep	Southern Spring Channel	Northern Spring Channel		South Ohoka Branch		Unnamed Drain 2	Whites Road Drain
	U/S	Mid	D/S	D/S	D/S	U/S	D/S	U/S	D/S	Mid	Mid
Temperature (°C)	16.1	16.5	15.8	15.3	17.1	15	15.2	12.2	14.6	9.5	11.9
Dissolved Oxygen (%)	88	91.5	88.1	22.8	5.3	22.6	32	35.6	31	52.6	22.8
Dissolved Oxygen (mg/L)	8.66	8.94	8.72	2.28	0.51	2.29	3.21	3.82	3.14	5.99	2.43
Conductivity (u/cm)	212.1	214.9	211.8	204.7	177.3	200.2	193.6	320.4	193.1	198.4	196.1
pH	7.03	7.34	7.47	6.61	6.75	6.28	6.82	6.79	6.6	7.14	6.69
Mean Velocity (m/s)	0	0.004	0.01	0.136	0.014	0.106	0.03	0.024	0.006	0.002	0
Depth(m)	0.436	0.304	0.44	0.248	0.302	0.123	0.361	0.418	0.202	0.054	0.038
Total Macrophyte Cover (%)	100	100	100	32	100	46	35	100	95	100	100
Total RHA score	29	28	27.5	66.5	32	48	59	35	31.5	32.5	33.5

Table 10: Rapid habitat assessment scores for each sampling site. Higher scores indicate a better category condition.

Waterway	Ōhoka Stream Tributary			Ground-water Seep	Northern Spring Channel		Southern Spring Channel	South Ohoka Branch		Unnamed Drain 2	Whites Road Drain
Site	**U/S**	**Mid**	**D/S**	**D/S**	**U/S**	**D/S**	**D/S**	**U/S**	**D/S**	**Mid**	**Mid**
Deposited sediment	1	1	1	5	4	2	1	1	1	1	1
Invertebrate habitat diversity	1	1	1	10	6	10	1	2	1	1	1
Invertebrate habitat abundance	1	1	1	7	3	4	1	1	1	1	1
Fish cover diversity	2	2	1	5	6	5	2	4	2	1	2
Fish cover abundance	10	9	10	8	7	9	10	10	8	10	10
Hydraulic heterogeneity	1	1	1	6	5	6	1	1	1	1	1
Bank erosion	9	8.5	8.5	9.5	9.5	9	10	10	10	10	10
Bank vegetation	2	2	1	4	2	4	2	2	3	2	2
Riparian width	1	1.5	2	3	2.5	3	3	3	3.5	4.5	3.5
Riparian shade	1	1	1	9	3	7	1	1	1	1	2
Total RHA score	**29**	**28**	**27.5**	**66.5**	**48**	**59**	**32**	**35**	**31.5**	**32.5**	**33.5**