REPORT

Tonkin+Taylor

Drury Metropolitan Centre Stage 2

Ecological Impact Assessment

Prepared for
Kiwi Property Holding No. 2 Limited
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Statement of Experience

This Ecological Impact Assessment has been prepared by a team of authors and reviewers with a breadth of experience with projects of a similar nature within the Auckland Region.

Specifically, Dr Behrens is a senior terrestrial ecologist with 10 years of experience and has been working for Tonkin & Taylor Ltd (T+T) since 2017. She completed her PhD in Environmental Management on urban ecology at Lincoln University, holds a Diploma (equivalent to Masters degree) in Landscape Ecology from Carl-von-Ossietzky University, Oldenburg, Germany, and is a Certified Environmental Practitioner (CEnvP). Dr Behrens has prepared a number of Ecological Impact Assessments for private, local council and government clients varying in complexity since working for T+T. She is also experienced in preparing and implementing Ecological Management Plans for a range of clients including the New Zealand Trasport Agency, Auckland Council and private clients.

Ms Cairns is a freshwater ecologist with 5 years of experience, and holds a MSc (First Class Honours) in freshwater management. In her role at T+T she works on a range of projects, delivering ecological impact assessments, ecological offset modelling, preparation of management plans, construction supervision, compliance monitoring, opportunities and constraints assessments, various field assessments and GIS analysis and mapping. Ms Cairns understands the relationship between consenting phase and implementation of management plans and conditions, following her construction experience in several large infrastructure projects including Transport Rebuild East Coast (TREC), O Mahurangi - Penlink, Te Ara o Te Ata - Mt Messenger Bypass and Ara Tūhono - Pūhoi to Warkworth.

Ms Quinn is a Technical Director - Freshwater Science & Ecology and has been employed at T+T since 2017. Ms Quinn holds the qualifications of BSc (Biology), PGDipSci (EnvSci), MLS (Env Law), is a Certified Environmental Practitioner with Ecology specialisation (CEnvP Ecology) and is a certified Independent Hearings Commissioner. She has appeared as an expert witness at Council and Environment Court hearings for resource consent and/or private plan change applications of varying scales and development types. In respect of Drury, Ms Quinn has been involved in the development at this site since the private plan change application.

The contributing authors, in their capacity as authors of this report, have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023. Where this report relies on information provided by other experts, this is outlined within the report.

Executive Summary

Kiwi Property Holdings No.2 Limited are seeking a fast-track resource consent for Drury Metropolitan Centre Stage 2 project. The proposed works associated with this project will result in the development of existing rural land to urban form – specifically the subdivision and development of land for commercial, retail, accommodation and community buildings, roading networks and open spaces.

This report provides an assessment of the ecological values of the site and effects of the proposed development to accompany the consent application for the project.

The ecological values of the site are consistent with those typical to agricultural land use. Vegetation within the site is limited to grazed pasture grasses with interspersed clusters of predominantly exotic woody species along shelter belts and riparian margins. Streams within the site are degraded from unrestricted stock access and a lack of riparian margins. However, the ultimate receiving environment is Drury Creek – a marine SEA. Several seepage wetlands of low to moderate value are present across the site.

The proposed works have the potential to impact the remaining ecological values of the site. Measures to manage the effects of the proposed works on the ecological values are summarised below:

- Implementation of appropriate erosion and sediment controls in accordance with best practice methods to reduce effects on receiving freshwater and marine environments.
- Implementation of a Native Fish Relocation Plan to reduce the risk of injury or mortality of freshwater fauna during instream works.
- Removal of existing fish passage barriers within Stream A (culverts, piped stream network) to improve fish passage and construction of an arch culvert to maintain fish passage within Stream A (will be detailed in the Stream Enhancement Plan).
- Creation of new stream length comprising realigned and daylighted open channel with improved ecological value including riparian planting and instream habitat features.
- Riparian planting and addition of instream habitat features in 97 m of realigned stream channel within Stream A.
- Development of a Stream Enhancement Plan, prepared by a suitably qualified and experienced freshwater ecologist with input from stormwater engineers and geomorphologists, the purpose of which is to provide the detailed and finalised design for the enhancement of Stream A.
- Implementation of stormwater management devices in accordance with best practice guidelines to manage water quantity into receiving freshwater environments.
- Management of flows during and following construction to ensure hydrology of existing wetlands remains unchanged.
- Implementation of a Bat Management Plan, Avifauna Management Plan and Lizard Management Plan to manage effects on terrestrial fauna during vegetation clearance.

Through implementation of the above management measures, it is considered that the majority of the potential effects of the proposed works can be avoided, minimised or mitigated to an overall low level of effect. Where possible, activities and ecological values with remaining residual adverse effects (that could not be avoided, remedied or mitigated) have been addressed through offset measures on site.

Residual adverse effects remain in respect of loss of 2,172 m^2 natural inland wetland, in the order of 48 m^2 open stream channel and 56 m^2 piped stream which are not addressed through effects

management measures. There is therefore a net loss in ecological value of natural inland wetland and open stream channel, and a net loss in extent of natural inland wetland and piped stream.

1 Introduction

This report has been prepared to accompany the application by Kiwi Property Holdings No.2 Limited (the "applicant" or "Kiwi Property") for the development of Stage 2 of the Drury Metropolitan Centre as a Listed Project in Schedule 2 of the Fast-track Approvals Act 2024. In summary, the Drury Metropolitan Centre ("Drury Centre project" or "the project") involves the subdivision and development of land for the development of buildings containing commercial, retail, accommodation and community activities. The project also includes the creation of open spaces, ecological enhancements, bulk earthworks, installation of infrastructure and roading networks. The project is across multiple contiguous properties on Flanagan Road, Drury that are owned and controlled by Kiwi Property. The site for the Drury Centre project forms part of a larger land area within Drury which was rezoned as part of Private Plan Change – Drury Central (PC48) promulgated by Kiwi Property. PC48 has rezoned the land from its former Future Urban Zone (FUZ) to urban zones which include Business - Metropolitan Centre, Business - Mixed Use and Open Space – Informal Recreation zones under the Auckland Unitary Plan (AUP(OP)). The relationship of this project and PC48 is detailed in the Assessment of Environmental Effects (AEE) prepared by Barker and Associates (B&A).

This report provides an assessment of the ecological values and effects of the proposed Drury Centre project to inform the AEE and resource consent application.

1.1 Background

The Drury Centre project relates to the development of a contiguous landholding which includes 64, 68, 108, 120 and 132 Flanagan Road, Drury across approximately 24 hectares. Stage 2 of the Drury Centre compliments the development and activities approved in Stage 1 immediately south of the project area which included a series of buildings primarily for large format retail and superlots for future residential development authorised under the COVID-19 Recovery (Fast-track Consenting) Act 2020.

The purpose of the Drury Centre Precinct is to provide for the development of a new, comprehensively planned centre at Drury that supports a quality compact urban form. There is a network of streams throughout the Drury Centre Precinct, including the Hingaia Stream and Fitzgerald Stream. The Precinct seeks to maintain and enhance these waterways and integrate them within the open space network as a key feature referred to as the Blue-Green Network. In addition to the proposed Hingaia Stream Reserve, Homestead Park and Valley Park will be located in areas of existing vegetation and natural features.

1.2 Purpose and scope

The purpose of this report is to provide an assessment of ecological values and effects to accompany a fast-track resource consent application for the Drury Centre Stage 2 project. The assessment includes:

- Characterisation of the ecological values within and adjacent to the site.
- An assessment of ecological effects of the proposal on ecological values within and adjacent to the project area.
- Any recommendations or measures to avoid, remedy or mitigate potential adverse effects.

1.3 Geographical and ecological context

The site is located in the Hingaia Stream catchment within the Manukau Ecological District (Figure 1.1). The overall topography of the area is undulating, with several elevated ridgelines. The western

extent of the site is traversed by the Hingaia Stream, which forms part of an inter-connected catchment which eventually drains into Drury Creek, an estuary of the Pāhurehure Inlet and Manukau Harbour.

The catchment has been heavily modified through agricultural and industrial land uses, with little native vegetation remaining. The Manukau Ecological District comprises an area of rolling hills between the Manukau Harbour to the west and the Waikato River to the south that was originally covered in North Island lowland type forest. The areas have been significantly modified by intensive agricultural use and urban settlement.

The site consists primarily of grazed pasture grasslands, isolated exotic trees along fence lines and within paddocks and an area of mixed native and exotic vegetation adjacent to Channel D (Appendix A). Hingaia Stream flows along the western boundary of the site, discharging to Drury Creek and the Pāhurehure Inlet to the north of which are recognised as marine Significant Ecological Areas (SEA). Smaller permanent and intermittent watercourses (tributaries of Hingaia Stream) are present within the site.

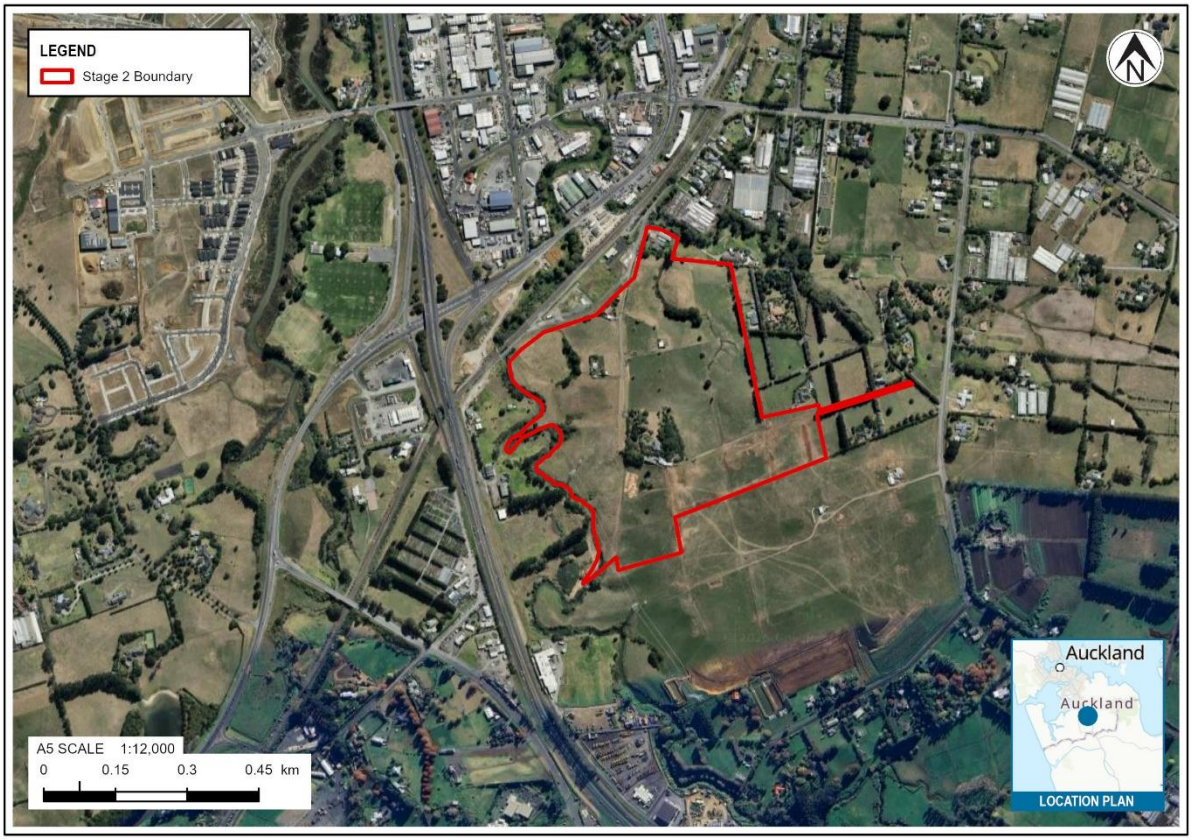

Figure 1.1: Location of Drury Metropolitan Centre site.

2 Description of the proposed works

Kiwi Property are proposing the subdivision and development of land as Stage 2 of the Drury Metropolitan Centre which will include a series of buildings for commercial, retail, accommodation and community activities with ancillary car parking. The general layout and configuration of the various buildings and activities in this project are shown in Figure 2.1 and the various design documents accompanying this application.

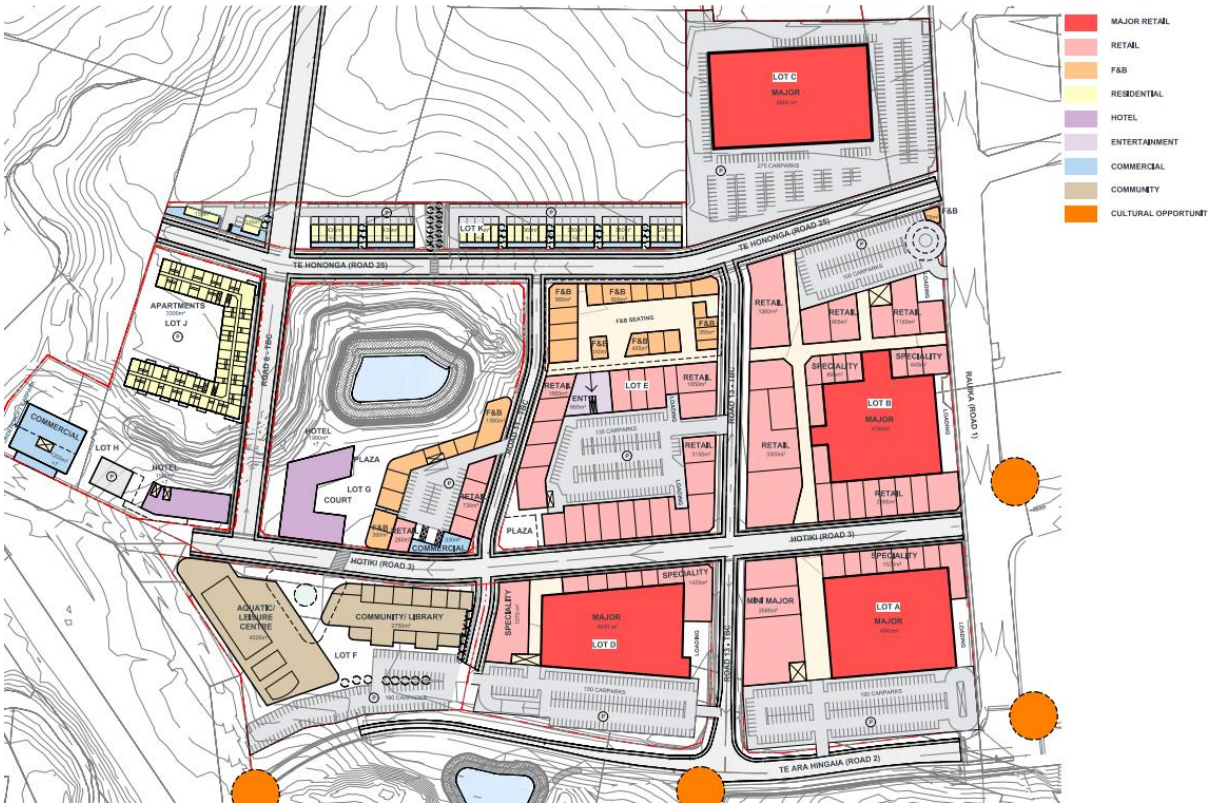

Figure 2.1: Overview of proposed Stage 2 development.

The proposed works include works within the existing watercourses within the site. Works within Stream A include reclamation of the upper tributaries of Stream A and the Stream A wetland, realignment of the upper reach of Stream A, construction of an arch culvert, and daylighting and realignment of the existing piped downstream reach (Woods Drawing P24-447-01-1151-DR REV 6). Riparian planting and enhancement of Stream A is also proposed. Vegetation clearance will be limited to shelterbelts and some riparian vegetation.

The proposal also includes the creation of an open space surrounding Stream A featuring a wetland for stormwater management functions (Wetland 2-1) and a rain garden (Woods Drawing P24-447-01-3000-DR REV5). A second stormwater wetland (Wetland 2-2) is proposed west of the proposed Road 2 North (Woods Drawing P24-447-01-3000-DR REV5).

2.1 Statutory context

While this is a technical EcIA report, there are statutory matters which are relevant to the ecological assessment. These are identified at a high level in this section and are referred to where relevant within this EcIA. A more detailed analysis of statutory matters is included in the AEE report. This section focusses on matters under the Resource Management Act and associated documentation. It is acknowledged that consent is being sought for this development under the Fast Track Approvals Act which is not discussed within this EcIA report.

- Auckland Unitary Plan which includes a range of objectives, policies and standards associated with ecology notably:
  - Chapter E3 for works associated with lakes, rivers, streams and wetlands.
  - Chapter E15 for vegetation management and biodiversity.
  - Chapter J definitions, including intermittent and permanent streams.
  - Appendix 8 biodiversity offsetting principles.
  - Appendix 16 guideline for native revegetation plantings.
- The site is located within the Drury Centre Precinct (AUP Chapter I450) which includes specific provisions for development including:
  - A specific activity status (I450.4.1(A10)) and ecology policy (I450.3(24)) for streamworks required to facilitate the construction of Drury Boulevard.
  - An ecology policy (I450.3(23)) enabling in-stream works to mitigate effects on stream health and values arising from development in the Precinct.
  - Requirements for riparian margins to be planted to 10 m (on either side) of permanent or intermittent streams (policy (I450.3(25) and standard I450.6.7). Applications for land modification, development and subdivision which adjoin a permanent or intermittent stream must be accompanied by a riparian planting plan (special information requirements I.450.9(1) which makes specific reference to AUP Appendix 16).
- National Policy Statement for Freshwater Management (NPS FM 2020, amended October 2024) (Ministry for the Environment, 2024a):
  - Alongside the policies and objectives of the NPS FM, there are some specific definitions that are relevant to this assessment including:
    - Natural inland wetland.
    - Effects management hierarchy.
    - Aquatic offset and associated principles in Appendix 6.
    - Aquatic compensation and associated principles in Appendix 7.
- National Policy Statement for Indigenous Biodiversity (NPS IB) (Ministry for the Environment, 2023):
  - Alongside the policies and objectives of the NPS IB, there are some specific definitions that are relevant to this assessment including:
    - Effects management hierarchy.
    - Biodiversity offset and associated principles in Appendix 3.
    - Biodiversity compensation and associated principles in Appendix 4.

3 Assessment methods

A combination of desktop assessments and site visits were used to determine the ecological values of freshwater and terrestrial ecosystems within the site and its surrounding environs, and the significance of those values. This Ecological Impact Assessment (EcIA) relies on data collected to inform the PC48 private plan change (which became embedded in the statutory planning frameworks as the Drury Centre Precinct I450 in the AUP), and subsequent resource consent applications for Stage 1 and the Shared User Path. The following sections briefly describe the methodology for assessing the ecological values of the site.

3.1 Desktop review

A desktop assessment was undertaken to review available information and data relating to the ecological values of the site. This included the following documents and databases:

- Previous assessments for the site:
  - Drury Metropolitan Centre Assessment of Ecological Effects (Tonkin + Taylor, 2019)[1].
  - Drury Centre Precinct Assessment of Ecological Effects (Tonkin + Taylor, 2022).
  - Drury Central Shared Use Path Wetland Ecological Impact Assessment (Tonkin + Taylor, 2024).
  - Drury Access Ramp Project – Ecological Assessment (Barnett, 2023).
- Publicly available documents and databases:
  - Ecology Assessment Drury Structure Plan (EADSP) (Auckland Council, 2017).
  - Hingaia Stream Classification Survey (Bennett, 2018).
  - Hingaia Stream Catchment Watercourse Assessment Report (Spyksma et al., 2018).
  - Auckland Unitary Plan Operative in Part (AUP).
  - Auckland Council GeoMaps database.
  - NIWA New Zealand Freshwater Fish Database (NZFFD).
  - Auckland Council Herpetofauna Database and Department of Conservation (DOC) Herpetofauna Atlas Database.
  - eBird database (https://ebird.org).
  - iNaturalist (https://iNaturalist.org).
  - DOC bat database.

3.2 Site visits

T+T ecologists have visited the Kiwi Property Landholdings on numerous occasions between 2018 and 2024.

During site visits in 2018 and early 2019, key terrestrial and aquatic habitat features were identified across the site. This work was undertaken to inform the assessment of ecological effects reporting for PC48. Wetlands and streams were classified, and their ecological value assessed.

Since then, site visits have been undertaken to confirm the ecological features of the site and identify ecological values for both the Stage 1 and Stage 2 areas. During these site visits, stream classifications were reconfirmed, and further classification of wetlands was undertaken in the

[1] Appendix 11 to the PC48 Application.

context of the National Policy Statement for Freshwater Management 2020 (NPS-FM) 'natural inland wetland' definition.

Ecological information from all site visits within the Stage 2 area and wider area has been used to inform this Ecological Impact Assessment for Stage 2 of the Drury Town project.

3.3 Field methods

3.3.1 Stream classification

Streams on site have been classified as either permanent, intermittent, ephemeral, or artificial in accordance with the criteria outlined in the AUP:

- **Permanent river or stream** is defined as "*The continually flowing reaches of any river or stream*".
- **Intermittent stream** is defined as "*Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least three of the following criteria: a) it has natural pools; b) it has a well-defined channel, such that the bed and banks can be distinguished; c) it contains surface water more than 48 hours after a rain event which results in stream flow; d) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel; e) organic debris resulting from flood can be seen on the floodplain; or f) there is evidence of substrate sorting process, including scour and deposition*."
- **Ephemeral stream** is defined as "*Stream reaches with a bed above the water table at all times, with water only flowing during and shortly after rain events. This category is defined as those stream reaches that do not meet the definition of permanent river or stream or intermittent stream*".

3.3.2 Stream ecological valuation

The Stream Ecological Valuation (SEV) method (Storey et al., 2011) was used to assess the aquatic ecological function of Stream A. The SEV provides a semi-quantitative assessment of 14 stream ecological functions that are divided into four main categories:

- Hydraulic functions.
- Biogeochemical functions.
- Habitat provision functions.
- Biodiversity provision functions.

The recorded data are used to calculate a score for each of the 14 functions and the SEV calculator provides an overall score for the assessed reach. The final score ranges from 0 to a maximum of 1, where the higher the score, the higher the observed ecological function and value of the surveyed reach. For example, a pristine stream (i.e. an unmodified stream in native forest) would score close to 1 and sites with values below this indicate a departure from pristine reference conditions.

The SEV is a robust and internationally peer-reviewed method designed to quantify the ecological function of a stream reach. Further, when required, the method also provides a means to quantify offset requirements.

An SEV was carried out in August 2023 on a 100 m reach of Stream A following the methodologies outlined in TR2011/009 (Storey et al., 2011) for permanent stream reaches. The location of Stream A is shown in Appendix A.

Field data was entered into the Permanent Stream SEV calculator to derive SEV scores for the sampled reach. Macroinvertebrate and fishing data was not included in the SEV assessment. The SEV method has been used to determine the quantum of offset required to address the residual adverse effects associated with stream loss and modification (see Section 3.4.1.1 for further detail on this approach).

3.3.3 Freshwater fauna

Fish community composition was assessed using eDNA sampling at the downstream end of Stream A within the site (see Appendix A for sample location) during a site visit in August 2023. eDNA is the genetic material that is obtained from environmental samples, in this case, surface water. This method allows for a rapid assessment of the biodiversity present at a site and records a high percentage of animal (including fish) trace DNA present within the environmental sample. This method provides information on presence/absence information only, as the number of positive eDNA reads (identification) is not directly correlated to species density.

Three replicates were taken from the sampling point within Stream A and were sent to Wilderlab NZ Ltd for basic multi-species analysis.

3.3.4 Wetland delineation

Wetlands are not specifically defined in the AUP, rather relying on the definition in the Resource Management Act (RMA):

- **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.*

Wetlands within the wider Kiwi landholdings were classified and mapped according to this definition in November 2018.

In September 2020, the NPS-FM and Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F) came into effect. The NES-F affords a higher level of protection to 'natural inland wetlands.'

The NPS-FM (October 2024) defines **natural inland wetlands** as *wetlands (as defined in the [RMA]) that are 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, and 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 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 the NPS-FM, in which case the exclusion in clause e does not apply.*

Site visits were undertaken in April and May 2021, August 2023 and March 2024 to confirm the classification of freshwater systems under the NPS-FM definition. Wetland classification and

delineation was undertaken using the wetland delineation protocols (Ministry for the Environment, 2022) to establish whether the wetlands previously assessed, or within 100 m of the proposed works, met the NPS-FM definition.

As per the wetland delineation protocol, wetlands were delineated using presence of hydrophytic vegetation. Wetland status was confirmed if more than 50% of the permanently or intermittently wet area was covered in obligate and/or facultative wetland plant species. Species lists were prepared for all species observed during the site assessment. Where wetland vegetation was not dominated by hydrophytic plant species (and therefore the wetland delineation is inconclusive), additional information for hydric soil and hydrology were collected to confirm wetland status.

Consideration of historic aerials, topography and a comparison of observations between site visits was utilised to aid in the determination of whether wetlands met the exclusion criteria above.

No wetland fauna surveys were undertaken, as the wetlands observed on site are marginal, highly modified wetlands with limited wetland fauna habitat. Site observations of wetland fauna were recorded where observed.

3.3.5 Terrestrial values

During the site visits in April and May 2021 terrestrial features, such as native and exotic trees, were mapped on T+T's ArcGIS platform. Vegetation was mapped identifying potential habitat value for bats, birds and lizards, targeting nationally and regionally 'Threatened' or 'At Risk' species and their habitat, and threatened ecosystem types. In more recent site visits, much of the vegetation within Kiwi landholdings has been cleared following earthworks associated with Stage 1.

No intensive native fauna surveys were undertaken as desktop assessment suggested limited habitat availability for native bats, birds and lizards.

3.4 Approach to ecological impact assessment

The method applied to this ecological impact assessment report broadly follows the Ecological Impact Assessment Guidelines 2018 (EcIAG) published by the Environmental Institute of Australia and New Zealand. The guidelines provide a standardised framework and matrix allowing a consistent and transparent assessment of ecological effects.

The guidelines were used to establish the following:

- The ecological values within the site (ref to Appendix B Table 1 and Appendix B Table 2).
- The magnitude of effect (ref to Appendix B Table 3) on ecological values from the proposed works in the absence of any controls.
- The overall level of effects to determine whether avoidance, remediation or mitigation is required (ref to Appendix B Table 5).
- The magnitude of effect and overall level of effect, taking into consideration the additional measures to avoid, remedy or mitigate effects and whether there are residual adverse effects that should be offset or compensated.

Refer to (Appendix B) for the criteria and tables used in this assessment.

This assessment of ecological effects follows the framework outlined in the EcIAG. The EcIAG guidelines state that practitioners may deviate from the guidelines framework where it is considered ecologically relevant and justifiable to do so.

While the assessment criteria for terrestrial values is fairly well defined in the EcIAG (refer Appendix B Table 2), the freshwater stream values are less so. For the purpose of this assessment, we have adapted freshwater stream values criteria based on the EcIAG (Appendix B Table 4) which assigns

ecological value based on biodiversity and ecological function values of the freshwater stream systems.

Note that the National Policy Statement Freshwater Management 2020 (NPS-FM) requires that consideration of the loss of 'potential' value of freshwater systems is incorporated into assessments of effects. As such, the ecological value of freshwater systems is provided as 'current' ecological value and 'potential' ecological value.

3.4.1 Residual effects approach

It is generally accepted that under the EcIAG if, after all efforts to avoid, remedy, mitigate and minimise effects, there remains an overall effect of **moderate** or higher, further efforts are required to address these residual adverse effects in the form of offset or compensation.

Following the NPS FM 2020 and NPS IB 2023 effects management hierarchy definition, offsetting and compensation are only required where effects are more than minor.

This EcIA report refers only to the level of effect as described in the EcIAG and leaves the determination of whether these effects are more than minor to the planning assessment, detailed within the Assessment of Environmental Effects (AEE) for this resource consent application.

Where a residual moderate ecological effect remains after appropriate avoidance, minimisation, remediation and/or mitigation activities are considered, further measures may be recommended to either offset or compensate the ecological effects.

Appendix 6 and 7 of the NPS FM provide the offsetting and compensation principles that need to be met when preparing an aquatic offset or compensation package. These are similar to those included in Appendix 8 of the AUP. These principles are discussed in the effects assessment section of this report (Section 5) where appropriate. The Environmental Compensation Ratio (ECR) Offset Accounting model has been used within this EcIA to quantify the values lost and gained in relation to streams.

3.4.1.1 Environmental Compensation Ratio

The ECR is a standardised tool used to quantify the amount of stream bed area that is required to be created or restored relative to the amount lost to maintain a 'no net loss' in ecological function as a result of the proposed works.

The SEV and ECR is a robust and internationally peer reviewed method (Neale et al. 2017), designed to quantify the ecological function of a stream reach and, where all measures to avoid, remedy and mitigate effects have been exhausted, it provides a means to quantify offset requirements. The method has been applied in New Zealand for approximately 15 years to support resource consent applications, including applications that have been heard at Council Hearings, Boards of Inquiry and at the Environment Court[2].

The ECR calculation formula requires a SEV score to be calculated for both the impact and proposed mitigation (or offset, if applicable) sites. This provides a basis from which to quantify and scale the likely loss in values and functions at an impact site and the increase in stream value and functions at a mitigation, offset or compensation site. The calculated SEV scores exclude the biotic invertebrate fauna intact and fish fauna intact functions[3] as their response to the stream realignment cannot be accurately forecast.

[2] Examples include NZTA Te Ahu a Turanga: Manawatū Tararua Highway project and Mt Messenger Bypass Project.
[3] The exclusion of the biotic functions is recommended in in Storey et al. (2011).

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

Where:

SEVi-P is the potential SEV value for the site to be impacted.

SEVi-I is the predicted SEV value of the stream to be impacted after impact.

SEVm-C is the current SEV value for the site where environmental compensation is applied.

SEVm-P is the potential SEV value for the site where environmental compensation is applied.

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

The SEV and ECR have been applied as required to quantify stream habitat area lost and is discussed in more detail in Section 5.2.4.

4 Ecological Characteristics and Values

This section describes the ecological values within the site and those areas outside of, but potentially affected by, the proposed works. Ecological features are shown in Appendix A.

4.1 Freshwater

The site is located within the lower Hingaia Stream catchment to the south of Drury (Appendix A). The catchment is approximately 5,490 ha with its headwater tributaries located within the Hunua Ranges. The main stem of Hingaia Stream meanders from south to the north, through undulating agricultural and horticultural land before discharging to Drury Creek and the upper Pāhurehure Inlet in the Manukau Harbour.

Historical and current agricultural and horticultural land use practices have resulted in a range of impacts within the wider catchment. These impacts include stream channel straightening, native vegetation removal, habitat fragmentation and installation of in stream structures.

Although the Hingaia Stream catchment is heavily modified, the upper reaches of the main tributaries maintain some natural habitats, particularly where remnant native vegetation and forest fragments are present at the edge of the Hunua Ranges. The Hingaia Stream remains an important link between the marine environment and an array of freshwater ecosystems located within the upper catchment. These links provide important migration pathways for diadromous native fish species and provides for the movement of water, sediment and organics downstream to the marine environment.

4.1.1 Hingaia Stream

The Hingaia Stream meanders along the western boundary of the site (Appendix A). The stream continues to flow in a northerly direction along the boundary of the site before its confluence with Drury Creek.

Hingaia Stream is characterised by large run and pools sections. Cascade sequences become apparent along the length of the stream when flows are low (Figure 4.1). The meandering nature of the stream has resulted in a substrate primarily made up of soft silts, with areas of bedrock forming cascades and providing some instream heterogeneity. Areas of macrophyte growth including oxygen weed (*Lagarosiphon* sp.) and willow weed (*Persicaria* sp.) were observed.

Riparian vegetation on the true left bank (opposite bank to the site) comprised primarily exotic weed tree species. The true right bank (within the site) was fenced along its length and vegetation comprised rank pasture grasses and occasional exotic trees (Figure 4.2). Outside of the fenced areas, the riparian vegetation was limited to grazed pasture. The stream was typically incised, and bank erosion was present throughout the reach. Erosion has likely been exacerbated due to the loss of mature riparian vegetation that would help with binding soils along the margins.

The lower Hingaia Stream (in the vicinity of the site) is typical of soft-bottom lowland river systems that have undergone periods of extensive historic habitat modification. Due to its close proximity to the marine environment, the Hingaia Stream remains an important waterway that contributes to biological processes within the downstream marine environments.

The Hingaia Stream is considered to be of **high** current ecological value. Its potential value is also considered to be **high**, as while it could benefit from some riparian restoration, upstream catchment influences will limit its potential for enhancement.

Figure 4.1: Cascade within Hingaia Stream, at the approximate upstream boundary of the Stage 2 site (Taken 30/04/2021).

Figure 4.2: Hingaia Stream looking upstream (Taken 13/04/2021).

4.1.2 Stream A

Stream A comprises intermittent and permanent stream reaches of approximately 400 m length in the north-eastern part of the Stage 2 development area. It emerges in a paddock, via a series of small intermittent tributaries (Figure 4.3), before becoming a permanent channel (Figure 4.4) which flows south to north to the Fitzgerald Stream (river 438401[4]) before discharging under Flanagan Road to the Hingaia Stream (Appendix A).

An SEV assessment was undertaken on the middle reaches of Stream A to assist in determining its ecological value. An SEV value of 0.41 was recorded at this site, indicating a moderate current ecological function, typical of rural streams but reflecting the part of the reach assessed.

The assessed reach comprised a defined permanently flowing wetted channel with an average width of 1.2 m. It was located in an area of relatively stable banks and mature exotic trees.

Upstream, and downstream of the assessed reach, the stream had unrestricted stock access that has resulted in poor bank stability, slumping, pugging and channel degradation. Riparian vegetation was absent across much of the stream, with grazed grass to the stream edge and only limited shading of the stream channel by a shelterbelt of large non-native trees (*Quercus* sp.) and gorse (*Ulex europaeus*) (Figure 4.5 and Figure 4.6).

The instream habitat was characterised by a lack of pools and a relatively deep/straight channel with a silt and sand dominated substrate. Patches of leaf litter, woody debris, emergent macrophytes and riparian roots were common. In the lower reaches, emergent macrophytes smothered the channel, likely due to a complete lack of shade and ongoing nutrient inputs from agricultural land use.

Whilst no macroinvertebrate community index (MCI) scores have been recorded within the streams of the site, an MCI score has been calculated in Fitzgerald Stream (Spyksma et al., 2018). The MCI score of Fitzgerald Stream has been regarded as “poor” quality (MCIsb = 68), which is representative of a degraded aquatic system. This MCI is lower than the ‘rural areas’ and the same as the ‘urban areas’ guideline within the AUP[5]. It also sits within Attribute Band ‘D’ of the NPS-FM, being below

[4] River number derived from Auckland Council GeoMaps (19/02/2019).
[5] Table E1.3.1, Chapter E1 Auckland Unitary Plan.

the bottom line[6]. Stream A is thought to have similar MCI scores to Fitzgerald Stream based on similar stream characteristics.

Stream A is considered to be of **moderate** current ecological value, however, has a potential value of **high** on the basis that riparian restoration would be easily facilitated to improve aquatic ecosystem function.

Figure 4.3: Upper reaches of Stream A, looking upstream (Taken 30/04/2021).

Figure 4.4: Upper to middle reach of Stream A, looking downstream from existing farm culvert (Taken 16/08/2023).

Figure 4.5: Middle reach of Stream A, looking downstream (Taken 16/08/2023).

Figure 4.6: Middle reach of Stream A immediate riparian margin of non-native vegetation (Taken 16/08/2023).

4.1.3 Fitzgerald Stream

Fitzgerald Stream flows in north-west direction along the northern boundary of the site. Fitzgerald Stream is a permanently flowing highly modified natural watercourse and is fed by numerous small and unnamed watercourses, including Stream A, draining agricultural land. Downstream of the site, the stream is piped under roads and railway lines where it discharges into Hingaia Stream. The piped nature and presence of a perched culvert under Fitzgerald Road, likely presents at least a partial barrier to fish migration upstream at its downstream extent.

[6] Table 14, National Objectives Framework NPS-FM.

Fitzgerald Stream is a soft-bottomed stream typical of agricultural land use and has been previously assessed as having an SEV of 0.35 (Spyksma et al., 2018) and a 'poor' quality MCI score (see Section 4.1.3). Adjacent to the site boundary, Fitzgerald Stream is partially shaded by a narrow predominantly exotic riparian margin; riparian vegetation and shading upstream is limited. No ecological investigations have been undertaken on Fitzgerald Stream as part of this project, given its location outside of Kiwi's landholdings and the previous information available. Given the surrounding land use, the ecological condition of Fitzgerald Stream is unlikely to have changed since previous assessments.

The current ecological value of Fitzgerald Stream has been assessed as **moderate** and its potential value as **high** on the basis that riparian planting would result in improved ecological function across its length.

4.1.4 Fauna

A desktop review of the Hingaia Stream catchment was carried out using the NZFFD (2024). There are no NZFFD records within the site, however the records show that a range of native fish are present within the wider Hingaia Stream catchment. In total ten native species have been identified of which some have been classified as nationally 'At Risk – Declining' and regionally 'Threatened – Nationally Vulnerable' (Table 4.1). It is likely the species identified in the wider Hingaia Stream catchment will inhabit the lower Hingaia Stream and those species tolerant of habitats influenced by agricultural degradation may be present in the tributaries located on the Kiwi landholdings.

Diadromous migration is an important life history trait of many of the species that were identified within the Hingaia Stream catchment. Fish species that undertake diadromous migration must undertake a period of time at sea to complete their life cycle. The occurrence of diadromy within the Hingaia Stream catchment shows that the connection between marine habitats and upstream freshwater habitats is vital for these species. Likewise, it is important to highlight that as fish are highly mobile, migration between freshwater habitats will occur during most of the year and not just at key migration times. The presence of the aforementioned Threatened and At Risk species within the Hingaia Stream catchment identifies that maintaining and/ or improving instream habitat health and connectivity to higher quality upstream habitats is an important priority.

Stream A is piped for approximately 100 m from its lower reaches to the confluence with Fitzgerald Stream which is likely to present a barrier to fish entering the upper open reaches of Stream A. eDNA sampling detected shortfin eel (*Anguilla australis*) within the open channel section of Stream A within the proposed works area. No other fish species were identified, likely due to the presence of several perched culverts restricting access along the length of Stream A. As such, the ecological value of fauna within Stream A has been assessed as **low**.

Shortfin eel, gambusia (*Gambusia affinis*) and īnanga (*Galaxias maculatus*) have previously been recorded within Fitzgerald Stream (NZFFD). Other species present within the wider Hingaia catchment are likely not present due to length of piped stream in the lower reaches of Fitzgerald Stream.

Table 4.1: Freshwater fauna present within the Hingaia Stream Catchment (source: NZFFD)

Species	Common Name	Threat Status	
		National (Dunn et al., 2018; Grainger et al., 2018)	Regional (Bloxham et al., 2023)
Anguilla dieffenbachii	Longfin eel	At Risk – Declining	At Risk – Regionally Declining
Cheimarrichthys fosteri	Torrentfish	At Risk – Declining	Threatened – Regionally Vulnerable
Galaxias maculatus	Īnanga	At Risk – Declining	At Risk – Regionally Declining
*Anguilla australis**	Shortfin eel	Not Threatened	Not Threatened
Galaxias fasciatus	Banded kōkopu	Not Threatened	Not Threatened
Gobiomorphus basalis	Crans bully	Not Threatened	At Risk – Regionally Declining
Gobiomorphus cotidianus	Common bully	Not Threatened	Not Threatened
Gobiomorphus huttoni	Redfin bully	Not Threatened	At Risk – Regionally Declining
Retropinna retropinna	Common smelt	Not Threatened	Threatened – Regionally Vulnerable
Paranephrops planifrons	Kōura	Not Threatened	N/A
Paratya curvirostris	Freshwater shrimp	Not Threatened	N/A
Ameiurus nebulosus	Brown bullhead catfish	Introduced and Naturalised	Introduced and Naturalised
Cyprinus carpio	Koi carp	Introduced and Naturalised	Introduced and Naturalised
Gambusia affinis	Gambusia	Introduced and Naturalised	Introduced and Naturalised

Note:

* Also detected in eDNA sampling at Stream A – likely the only fish species within Stream A.

**Sea-going populations occur in river and streams near to the coast.

4.1.5 Wetlands

Several wetlands were classified within and immediately adjacent to the site. To the west of the site, Wetland 1 and Wetland 2 (Appendix A) are located along the Hingaia Stream and Channel D wetland is located on a remnant channel which has historically been cut off from the Hingaia Stream. Stream A Wetland is the only wetland located within the Stage 2 footprint (Appendix A). The wetlands are described and assessed below.

<u>Hingaia Stream - Wetland 1</u>

Wetland 1 was classified as seepage wetland located within a depression on the true right margin of the Hingaia Stream (Appendix A), meeting the RMA and Natural Inland Wetland (NIW) wetland definitions. The wetland extent is approximately 355 m^2 and has been accessed by stock in the past. At the time of the assessment (2021) the wetland was highly degraded with bare ground making up over 40% of the wetland extent. Duckweed (*Lemna minor)* and creeping buttercup (*Ranunculus*

repens) formed the dominant vegetation, with some willow weed (*Persicaria maculosa),* arum lily (*Zantedeschia aethiopica*) and willow (*Salix spp.*) also present (Figure 4.7).

Due to the modification of the wetland, the dominance of exotic vegetation and the limited values of wetland fauna, the current and potential ecological values of Wetland 1 are considered to be **low**.

Hingaia Stream - Wetland 2

Wetland 2 was also classified as seepage wetland, meeting the RMA and AUP wetland definitions, and is also located within a depression on the true right margin of the Hingaia Stream approximately 180 m north of Wetland 1. This wetland also meets the NIW definition (NPS-FM). Wetland 2 is approximately 1,580 m^2 in size. The upper section is unfenced with vegetation consisting of grazed pasture grasses, sporadic gorse and *Juncus spp.* The lower section of Wetland 2 is located alongside the Hingaia Stream edge and is fenced with willow, creeping buttercup, mercer grass (*Paspalum distichum*), Yorkshire fog (*Holcus lanatus*) and *Gahnia spp.* being the dominant species present (Figure 4.8). Similar to Wetland 1, Wetland 2 has been assessed as having **low** current and potential ecological value.

Figure 4.7: Wetland 1, viewed from margin of Hingaia Stream looking upslope (March 2024).

Figure 4.8: Wetland 2, viewed from eastern extent looking west toward Hingaia Stream (March 2024).

Channel D Wetland

Channel D (Figure 4.9) is a remnant channel which has historically been cut off from the Hingaia Stream. The land surrounding the channel has been filled, with evidence of petrochemicals, asbestos, and old rail waste recorded. This adjacent filling and the presence of a pipe has resulted in the formation of a 320 m² area with wetland characteristics. The wetland is dominated by exotic wetland species including arum lily, Yorkshire fog, and creeping buttercup, with some native species such as *Carex geminata* present. Hydric soils were evident, although these were also discoloured orange with evidence of unnatural oils on the water surface. Stock have been excluded from the

Channel D wetland which is buffered by a 10 - 15 m wide margin of mixed native and exotic vegetation on its uphill side, including rimu (*Dacrydium cupressinum*), tōtara (*Podocarpus totara*), mānuka (*Leptospermum scoparium*), kātote (*Cyathea smithii*), and kahikatea (*Dacrycarpus dacrydioides*).

The human modification to the landscape and channel has resulted in the formation of an area with wetland characteristics. It is considered to be a NIW in that it does not meet the exclusion clauses outlined in the NPS-FM (Section 3.3.4).

Due to the presence of native buffering vegetation and stock exclusion fencing, the Channel D wetland is considered to have **moderate** current ecological value, with limited potential for enhancement given the presence of fill materials adjacent and its small contributing catchment.

Stream A Wetland

Stream A Wetland, approximately 2,172 m^2 in size, is located at the headwater of Stream A and was classified as seepage wetland. It is a wetland under the RMA definition and meets the NIW definition (NPS-FM) (Appendix D). Stream A Wetland is not fenced, and vegetation consists of predominately creeping bent (*Agrostis stolonifera*), creeping buttercup, *Juncus effusus*, perennial ryegrass (*Lolium perenne*) and mercer grass (*Paspalum distichum*) (Figure 4.10). Hydric soils were detected, although not at all wetland plots. Stream A Wetland is considered to be of **low** current value due to its modification and **moderate** potential ecological value, due to its size and location at the headwaters of Stream A, forming a contiguous aquatic system with some potential for improvement if retained.

Figure 4.9: Channel D Wetland (August 2023).

Figure 4.10: Stream A Wetland (August 2023).

4.2 Terrestrial

Neither the site nor areas within the site are classified as SEA under the AUP. However, the site is situated between mosaics of SEAS; namely a large marine SEA to the west (Manukau Harbour) and several terrestrial SEAs located at the foothills of the Hunua Ranges to the east. Small land parcels along the western bank of the Hingaia Stream are an Environmental Asset owned by DOC.

4.2.1 Vegetation

The vegetation on site is predominantly grazed pasture grasses with some interspersed clusters of predominantly of mainly exotic woody vegetation. The clusters of exotic woody vegetation occur primarily along shelterbelts and streams.

Figure 4.11: Vegetation along Channel D (August 2023).

Figure 4.12: Shelterbelt vegetation (March 2024)

The native plant species outlined in Table 4.2 were observed in 2019 (site walkovers undertaken by T+T ecologists on several occasions in 2018 and early 2019). Many of these are located outside of the Stage 2 footprint along Channel D and the Hingaia Stream.

Table 4.2: Native plant species observed within Stage 1 and Stage 2 of the Drury Metropolitan Centre, predominately along Channel D and the Hingaia Stream

Scientific name	Common name	Regional Threat Status[1]	Regional Threat Status[2]
Agathis australis	Kauri	At Risk - Declining	At Risk - Declining
Alectryon excelsus	Titoki	Not Threatened	Not Threatened
Carex geminata	Rautahi	Not Threatened	Not Threatened
Corynocarpus laevigatus	Karaka	Not Threatened	Not Threatened
Cyathea smithii	Kātote	Not Threatened	Not Threatened
Dacrycarpus dacrydioides	Kahikatea	Not Threatened	Not Threatened
Dacrydium cupressinum	Rimu	Not Threatened	Not Threatened
Leptospermum scoparium	Mānuka	Threatened – Regionally vulnerable	Not Threatened
Meryta sinclairii	Puka	N/A	At Risk – Naturally uncommon
Metrosideros excelsa	Pōhutukawa	At Risk - Declining	Not Threatened
Muehlenbeckia sp.	Muehlenbeckia	Not Threatened	Not Threatened
Myrsine australis	Red mapou	Not Threatened	Not Threatened
Pittosporum crassifolium	Karo	Not Threatened	Not Threatened
Phormium tenax	Harakeke	Not Threatened	Not Threatened
Podocarpus totara	Tōtara	Not Threatened	Not Threatened

Scientific name	Common name	Regional Threat Status[1]	Regional Threat Status[2]
Rhopalostylis sapida	Nīkau	Not Threatened	Not Threatened
Sophora sp.	Kōwhai	Not Threatened	Not Threatened
Vitex lucens	Pūriri	Not Threatened	Not Threatened

Note: [1] According to Simpkins et al. (2022); [2] According to de Lange at al. (2024).

Overall, the vegetation with the Stage 2 Drury Centre project is of **low** ecological value. It is dominated by exotic species with very few, mostly 'Not Threatened' (Simpkins et al. 2022; de Lange et al. 2024) native species interspersed. The assessment of the ecological value is described in more detail against the assessment criteria with the EIANZ assessment guidelines in Table 4.3.

Table 4.3: Assessment of ecological value of vegetation onsite

Assessment matters	Summary value
Representativeness Vegetation on site is highly modified, mostly comprised of exotic tree species, pest plants and pasture grasses/ruderal weeds with few native, mostly 'Not Threatened' species present. This vegetation is not representative of any recognised indigenous ecosystem. Vegetation rates **Very Low** for this assessment matter.	Area rates **Moderate** for one and **Very low** to **Low** for three assessment matters and is therefore assessed as being of **Low** overall ecological value.
Rarity/distinctiveness The vegetation community within the site is dominated by species of exotic origin. Few native species were identified during the site visit in 2019, of which pōhutukawa are classified as regionally 'At Risk Declining' and puka are nationally 'At Risk Uncommon'. Vegetation rates **Moderate** for this assessment matter.	
Diversity and pattern There is limited diversity and pattern within the vegetation on site as mostly dominated by pasture grasses. Even within the riparian margins the vegetation is impacted and tiers and structure expected in a natural vegetation community are mostly lacking. Vegetation rates **Low** for this assessment matter.	
Ecological context The site has been highly modified through agricultural use, with native vegetation restricted to riparian margins along Stream A, D and the Hingaia Stream. Natural regeneration was not observed as is unlikely due to the presence of stock. As a result, it is unlikely, that the site is contributing to the wider ecological context through connecting existing remnant bush block or contributes through seed dispersal. Vegetation rates **Low** for this assessment matter.	

Note: In accordance with EIANZ assessment guidelines.

4.2.2 Fauna

At a local and/or landscape-level shelter belts and remnant trees present across the site have the potential to provide habitat, refugia, food source, flight path connectivity for native fauna. The fauna groups to be most likely adversely affected by the proposed works are discussed below.

4.2.2.1 Bats

A known population of nationally 'Threatened - Nationally Critical' (O'Donnell et al. 2023) and regionally 'Threatened – Regionally Critical' (Woolly et al. 2023) long-tailed bats (*Chalinolobus*

tuberculatus) is located in the Hunua Ranges and sightings have been recorded within approximately 4 km of the site[7]. Several bat surveys have been undertaken around the site and no long-tailed bats have been recorded[7]. No on-site bat survey was undertaken; however, they are a highly mobile species with home ranges (the areas they regularly use) as wide as 25 km and can therefore be expected within the site.

Shelterbelts and mature vegetation are likely to support bat foraging and movement pathways across the site. Mature specimen trees (exotic and native) observed along the streams and distributed throughout the site may act as temporary habitat for foraging or roosting (i.e. mature pūriri trees with abundant crevices), however, these areas as small and highly dispersed across the site.

Due to their threat status, long-tailed bats have a **very high** ecological value, however, the likelihood of long-tailed bats being present, especially for roosting, is considered low.

4.2.2.2 Avifauna

A wide range of native and exotic birds were observed on site in 2019, although bespoke bird surveys were not undertaken. In addition, e-bird and iNaturalist databases were checked for bird records on the site as well as the surrounding area. Overall, it is expected that the vegetation on site, especially the clustered trees and the wetlands along Hingaia Stream, provide foraging and breeding habitat for a range of open space bird species. Wetland bird species are unlikely to be present, because the wetlands along the Hingaia Stream, Channel D and Stream A are highly degraded and lack dense wetland vegetation required by most wetland bird species.

No bird records exist from the site. On eBird, a total of 35 native and exotic bird species were recorded at Opaheke Reserve, approx. 2.5 km north of the site, including native species such as tūi (*Prosthemadera novaeseelandiae*), Paradise shelduck (*Tadorna variegata*), Welcome swallow (*Hirundo neoxena*) and Silvereye (*Zosterops lateralis*). iNaturalist records from adjacent areas include Masked lapwing (*Vanellus miles novaehollandiae*) and kereru (*Hemiphaga novaeseelandiae*).

It is unlikely that 'Threatened' or 'At Risk' (Robertson et al. 2021; Woolly et al. 2024) birds will use the site. As a result, the ecological value for birds has been assessed as **low**.

4.2.2.3 Lizards

With most of the site having been heavily grazed in the past, and no ecological connection to existing known native lizard populations, it is considered unlikely that any regionally and/or nationally 'Threatened' or 'At Risk' lizard species are present onsite. However, if copper skink were present, the ecological value for native lizards is considered to be **high**.

[7] Department of Conservation, National Bat Database.

4.3 Marine

The streams within and adjacent to the site discharge to the Pāhurehure Inlet of the Drury Creek approximately 2 km downstream of the site. The intertidal marine areas of the Drury Creek are recognised as a SEA.

The upper tidal reaches of Drury Creek are identified as an SEA-M1 (M1-29b) indicating that its physical form, scale or inherent values are considered to be the most vulnerable to any adverse effects of inappropriate subdivision, use and development. This area is identified as an SEA due to the value of the habitat present, comprising a variety of marshes, grading from mangroves through to extensive areas of jointed rush-dominated saltmarsh, to freshwater vegetation in response to salinity changes. This area is identified as a valuable migration pathway for a number of different species of native freshwater fish.

Beyond this, the wider intertidal area is classified as an 'SEA-M2' being an area of regional, national or international significance which does not warrant a SEA-M1 identification as they are generally more robust. These more intertidal and estuarine reaches (M2-29a) are comprised of a variety of intertidal habitats ranging from sandy mud intertidal flats to tidally exposed rocky reefs and a variety of saline vegetation. Areas of mangroves grow in the Whangamaire Stream, Drury Creek and Whangapouri Creeks. Notable eel grass (*Zostera spp.*) beds are present in the southern half of the Whangapouri Creek. Drury Creek is comprised of a variety of intertidal habitats ranging from sandy mud intertidal flats to current-exposed rocky reefs and a variety of saline vegetation. Wading bird roosting habitats are present, including an important area for pied stilt (*Himantopus Himantopus*).

Due to the depositional nature of this area, it is sensitive to sedimentation and contaminants transported from the wider catchment. The marine environment has been classified as an SEA and therefore is considered to have **high** ecological values.

4.4 Summary of ecological values

In summary, the ecological values of the site have been assessed as being **low** to **very high**, consistent with agricultural land use close to remnant native bush and natural stream channels (Table 4.4).

Table 4.4: Summary of ecological values within the site

Ecological Feature		Ecological value	
		Current	Potential[1]
Freshwater	Hingaia Stream – Habitat & Fauna	High	High
	Stream A - Habitat	Moderate	High
	Stream A - Fauna	Low	N/A
	Fitzgerald Stream – Habitat	Moderate	High
	Fitzgerald Stream – Fauna	High	N/A
Wetlands	Hingaia Stream – Wetland 1	Low	Low
	Hingaia Stream – Wetland 2	Low	Low
	Channel D Wetland	Moderate	Moderate
	Stream A Wetland	Low	Moderate
Terrestrial	Vegetation	Low	N/A
	Bats	Very high	N/A
	Avifauna	Low	N/A
	Lizards	High	N/A

Note: 1. Potential value only considered for freshwater habitat values.

5 Assessment of Ecological Effects

This section provides an assessment of the ecological effects of the proposed works on the surrounding environment. Conclusions on the overall level of effect are outlined below in accordance with the EcIAG matrix (Appendix B Table 7).

5.1 Proposed works and summary of actual and potential ecological effects

The proposed works involve several components as described in Section 2 which will have potential effects on the freshwater, terrestrial and marine ecological values described in Section 4 above. The following activities are specifically addressed in the following sections:

- Potential sediment discharges to the receiving freshwater and marine environments as a result of earthworks.
- Potential injury or mortality of freshwater fauna during instream works.
- Modification of fish passage during and following construction due to instream works and stream realignment and daylighting.
- Construction of an arch culvert across Stream A to facilitate Road 6 crossing.
- Reclamation of 176 m of existing open channel stream length (211 m^2 stream bed area) and 112 m of existing piped stream (56 m^2), creation of 97 m of stream length through realignment of existing stream (approximately 135 m^2 stream bed area) and creation of 80 m of stream length (112 m^2 stream bed area) through daylighting.
- Permanent modification of contributing flows to Stream A.
- Effects on hydrology of Wetland 1 and 2 during construction.
- Reclamation of 2,172 m^2 of existing Stream A Wetland.
- Removal of approximately 5,837 m^2 covered in exotic trees and shrubs and approximately 8.95 ha of grazed land.

Several outfalls are proposed to discharge to Stream A, all of which are assumed to meet permitted activity criteria and no further assessment has been provided in respect of this.

5.2 Freshwater

5.2.1 Sedimentation during construction

In the absence of controls, earthwork activities associated with the proposed works have the potential to result in an uncontrolled discharge of sediment laden water. Increased sediment in the receiving environment can impact water quality within the freshwater and marine environment and result in sediment deposition, changing habitat features. Further, modifications to landforms through earthworks can result in changes to contributing catchments (discussed further in Section 5.2.6 below).

The effect of excess in-stream sedimentation is recognised as a major impact of changing land use on river and stream health, through changes in water clarity and sediment deposition. Sediment entering stream systems can impact water clarity through sediment suspended within the water column (‘suspended sediments’). Many native species are tolerant of elevated suspended sediment, measured either by turbid water or high concentrations of total suspended solids ("TSS")[8]. The

[8] For summary of research see Clapcott, J.E., Young, R.G., Harding, J.S., Matthaei, C.D., Quinn, J.M. and Death, R.G. (2011) Sediment Assessment Methods: Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values. Cawthron Institute, Nelson, New Zealand.

banded kōkopu (*Galaxias fasciatus*) is a notable exception, known to exhibit avoidance behaviours at 25 NTU[9].

Sedimentation has more noticeable effects on physical habitat in streams when it is deposited on the streambed ('deposited sediments'). Excess deposited sediment can clog the small spaces (interstitial) between hard stream substrates which impacts aquatic macroinvertebrates, alters food sources (i.e. macroinvertebrates for predation by fish) and removes egg-laying sites for fauna.

Sedimentation resulting from the proposed site works has the potential to impact Stream A (and Fitzgerald Stream where 'tie ins' are proposed) within the site, as well as the downstream receiving environment (Hingaia Stream and ultimately Drury Creek and the Manukau Harbour).

The Hingaia Stream and the Drury Creek are both sensitive to sediment deposition, particularly the marine environment which is an SEA. Stream A is impacted by sediment resulting from agricultural land use, bank instability and lack of riparian margins.

Earthworks within the site are proposed to be completed within seven months during one earthworks season (October to April inclusive). In the absence of controls, the potential magnitude of earthworks and sediment effects on receiving environments could be **high**.

Earthworks and streamworks methodologies for the proposed works have been designed to, and will be implemented to meet or exceed, the guideline standards of Auckland Council GD05 – Guidance for Erosion and Sediment Control (Leersnyder et al., 2016; Woods, 2025). The Erosion and Sediment Control Plan will be updated prior to construction commencing to detail the final approach proposed for works across the project.

A combination of erosion and sediment control devices including sediment retention ponds, super silt fences, stabilised entrances and grass filter strips are proposed to be used during earthworks to reduce the potential for an uncontrolled discharge of sediment laden water from earthworks activities.

In addition to the built controls, progressive stabilisation of the site will be implemented to minimise the open areas during the construction period. To the greatest extent possible, streamworks will be undertaken in dry environments to minimise disturbance and sediment releases into the receiving environment.

The construction of the daylighted channel and Stream A realignment will be undertaken offline to reduce the level of disturbance to the receiving environment. Topsoil bunds will be used to prevent runoff entering the works area for the duration of the realignment works. Areas will be stabilised prior to livening of the channel. The tie in of the upstream and downstream of the created channel will be undertaken in as short as duration as possible and connection points will be stabilised immediately. All instream works will be undertaken during a period of forecasted fine weather.

Minimal instream works are expected to be required for the construction of the arch culvert on the middle reach of Stream A (Road 6). Appropriate erosion and sediment controls will be detailed in the project's Erosion and Sediment Control Plan to minimise effects on the receiving environment.

It is considered that the implementation of robust erosion and sediment control measures during earthworks (specific methodologies for works in proximity to streams and measures to minimise changes to contributing catchments), detailed through an approved Erosion and Sediment Control Plan will reduce the potential magnitude of effect to **low.** This will result in an overall level of effect of **low** on the receiving environment.

[9] NTU is a Nephelometric Turbidity Unit. NTU is the unit used to measure the turbidity of a fluid or the presence of suspended particles in water.

5.2.2 Injury or mortality of fauna during construction

Instream works have the potential to cause injury or mortality of freshwater fauna. The magnitude of potential effect on native freshwater fauna is driven by the nature of the activity, the area of stream disturbance, density of fish present in each area, the ability of fish to escape disturbance and the controls applied. The conservation status of fish species is also relevant when assessing the potential overall level of effect.

The proposed works include instream works to tie in the created daylighted channel and realigned channel to the existing watercourse upstream and downstream (Stream A and Fitzgerald Stream).

During the offline construction of the daylighted stream, the existing pipe will act as a bypass for the duration of the construction of the daylighted channel. When the daylighted stream is 'tied in' to the existing channel upstream and existing Fitzgerald Stream downstream, there is potential for injury or mortality of freshwater fauna that may be present. A maximum of 5 m existing stream length will be impacted at each the upstream and downstream points of tie in on Stream A and Fitzgerald Stream respectively.

Additional to the tying in of the daylighted section, where the realignment of a 76 m section of Stream A (includes 10 m of existing culvert) is proposed, there will be reclamation of the existing alignment within this section. In addition, instream works associated with the tie in of the realigned channel upstream and downstream on Stream A (maximum of 5 m length tie in at each end) will also occur.

Instream works may also be required for the construction of the arch culvert.

The detail of likely construction approach for the arch culvert is unknown at this stage, however it is expected that standard and accepted instream construction methods can be easily used at this location. The final construction approach will be detailed in an approved Erosion and Sediment Control Plan.

With no management measures in place, any freshwater fauna present in the stream sections that will require instream works could be injured or killed. As a result, there would be a moderate magnitude of effect on the basis that there could be loss of a moderate proportion of the known population within Stream A and a low magnitude of effect on Fitzgerald Stream given the small proportion of the known population within this watercourse. A Native Fish Relocation Plan (NFRP) has been prepared to avoid and mitigate these effects. The plan involves the isolation of the reaches with fish exclusion barriers and the de-fishing and relocation of native freshwater fish prior to instream works commencing. There is also the potential for fish to be present within the section of piped stream within the site that is proposed to be daylighted. The NFRP includes an accidental discovery protocol that would be used during the removal of the existing pipe.

The draft NFRP provided with this consent application includes (but is not limited to):

- The timing and duration of fish capture.
- The methodologies used to ensure all fish are captured and transported in accordance with best practice.
- Specific measures for ensuring fish elsewhere in the catchment do not enter the works area.
- Fish relocation sites.
- The names, experience and qualifications (including any necessary permits) of those involved in undertaking the fish relocations.

Reclamation of the intermittent headwaters of Stream A is proposed. Given the intermittent nature of these sections of stream and limited habitat availability particularly in summer months when

works are proposed, reclamation is unlikely to cause harm to freshwater fauna. If water is present at the time of works, freshwater salvage methodologies will be implemented as per the NFRP.

It is considered that the implementation of an approved NFRP to undertake native fish salvage and relocation prior to the commencement of instream works including stream reclamation and 'tie ins' will reduce the magnitude of effect on native fish species to **low**. This should result in an overall **very low** level of effect for injury or mortality during construction on the freshwater fauna present within Stream A and **low** overall level of effect for Fitzgerald Stream.

5.2.3 Fish passage

Many of New Zealand's native fish are diadromous, meaning they migrate to and from the sea as part of their lifecycle. Artificial structures, poor culvert design and certain construction methodologies can restrict fish migration by preventing fish passage. Temporary restrictions to fish passage during construction may impact a population's reproductive success by preventing fish to move upstream during their migration period. The resultant decrease in fish mobility can cause fragmented populations, a reduction in population size, and limit overall available habitat for freshwater fauna.

Eels are catadromous meaning they live in freshwater and migrate to sea to breed, with juveniles returning to freshwater (Hamer, 2007). Shortfin eels are accomplished climbers and are well adapted to negotiating barriers to reach headwater catchments. Juvenile eel migration upstream typically occurs between December and March with adult eels migrating downstream between February and May.

5.2.3.1 During construction

Construction activities may also result in very short-term impediments to fish passage in Stream A during instream works.

During construction of the daylighted channel, the existing piped section of Stream A will remain operational and continue to allow fish passage as is currently present within the stream. As only shortfin eels are likely to be present within Stream A, fish passage for eels will continue as per existing conditions. Fish passage may be temporarily impacted during the tie in of the daylighted stream upstream on Stream A and downstream on Fitzgerald Stream (expected to take a maximum of two days per tie in section).

During realignment of the section of Stream A, the realigned channel will be constructed offline allowing flows to remain within the existing impacted section. Little to no habitat exists upstream of this section, therefore tie in works and reclamation of the existing section are not expected to impact upstream migration during this period.

Given the limited habitat upstream on Stream A and the small disruption in passage during tie in periods, the magnitude of effect on fish passage during construction is expected to be **low** within Stream A. Although greater upstream habitat is present within Fitzgerald Stream and greater species diversity is expected compared to Stream A, given the short duration of disruption to passage, the magnitude of effect is also expected to be **low**. This would result in an overall **low** level of effect.

5.2.3.2 Following construction

The downstream parts of Stream A are piped and currently present a likely fish passage barrier to most species. The presence of farm culverts within Stream A is also expected to restrict passage upstream.

The works within Stream A will result in improved fish passage outcomes within the site. The AUP directs that where works occur in stream channels, the stream bed must be restored to a profile that

does not inhibit flow or prevent the passage of fish upstream and downstream in the waterbodies that contain fish.

The new daylighted channel proposed is a shift away from the existing condition (stormwater pipe). Only shortfin eels have been identified within the stream, which are considered good climbers. It is likely most would be able to move through the existing pipe and as such the existing pipe would only be acting as a partial barrier to this species. The proposed daylighted stream will enhance fish passage by removing the pipe and providing an open channel environment. This will allow continuity of stream habitat as well as geomorphic and sediment processes within the stream system. Connection to the upstream and downstream catchment will be consistent with the direction within the New Zealand Fish Passage Guidelines (Franklin et al., 2024) to provide passage of native species. It is worth noting Fitzgerald Stream downstream of the Stream A confluence (and outside of Kiwi's landholdings) is piped and its provision of fish passage is unknown.

The proposed realignment of the existing open channel in the upper reaches will result in improved fish passage outcomes through the removal of existing farm culverts across the stream length that will be realigned.

The proposed constructed channels, daylighted and re-aligned, are expected to be at a similar grade and width to those currently present in the open sections. While there is proposed change to the upstream contributing catchment imperviousness and consequently hydrology, the proposed stormwater wetland will moderate flows to minimise significant changes to in-stream flow conditions within Stream A. It is expected that the post-construction fish passage within the newly created sections of stream channel will be similar to the current open sections of stream.

An arch culvert is proposed where Road 6 will cross Stream A. The arch culvert will be approximately 49 m in length. Further details will be provided following the detailed design, however the structure will be designed and constructed to avoid permanent structures within the stream channel and will therefore enable the same fish passage conditions upstream and downstream as would naturally exist without the structure. As such, no modification in fish passage within Stream A is expected as the result of the arch culvert.

Overall, the magnitude of effect on permanent modification to fish passage will be **positive** due to the removal of the pipe, existing farm culverts and construction of a crossing in arch culvert form. This will result in an overall **net gain** level of effect according to Appendix B Table 5.

5.2.4 Permanent modification or loss of stream habitat

The proposed works will result in the permanent loss, modification and creation of stream habitat on Stream A (see Woods Drawing P24-447-01-1151-DR REV6).

Permanent loss or modification of existing stream on Stream A and its intermittent and permanent tributaries involves three components:

- The permanent loss/reclamation of open sections of Stream A in its upper reaches.
- The realignment of existing Stream A in its upper reaches.
- Reclamation of existing piped stream (resulting from diversion of flows to a new stream alignment).

This section assesses the effects of these in two parts – first the 'open stream channel' and then secondarily the 'piped stream'.

5.2.4.1 Open stream channel

In its upper reaches, 176 m / 211 m^2 (10 m of which is culverted) of the existing Stream A will be reclaimed to enable the construction of Road 25. Stream flows in the upper section of Stream A will

be diverted into a new single realigned channel to the west of its existing flow path(s). The realigned channel will be 97 m in length (135 m^2) resulting in the net loss of approximately 79 m of existing stream length in the upper reaches of Stream A (Figure 5.1). The realigned channel will have a low flow width of 1.4 m (Woods Drawing P24-447-01-1160-DR REV4) and will be designed to reflect existing or improved stream habitat conditions (width, flow depth, etc.).

In the context of Stream A, the permanent loss of intermittent and permanent stream as the result of reclamation and/or realignment within Stream A results in a **high** magnitude of effect and overall **moderate or very high** level of effect (considering current and potential value respectively). As such, offsetting of permanent loss is proposed to address these residual adverse effects through riparian planting and habitat creation in the realigned channel and 'daylighting' of existing piped stream.

The ECR (described in Section 3.4.1.1) has been used to quantify the benefits of the proposed effect management measures to address the residual adverse effects (see modelling assumptions in Appendix E). Ecological and geomorphological principles will be incorporated into the stream design for both the realigned and daylighted sections which will support the development of natural geomorphic processes and enable creation of potential habitat for aquatic biota including macroinvertebrates and eel species.

Final stream design of the realigned and daylighted stream sections is proposed to be detailed through the preparation of a Stream Enhancement Plan (SEP) as a condition of consent. The purpose of the SEP will be to provide the detailed and final design of the enhancement proposed for Stream A. A toolbox approach will be employed, whereby the development of the SEP will draw on existing guidance alongside expert input, to ensure that the final design includes site appropriate stream features. Where practicable, features selected will provide dual benefit (i.e. stream stability/erosion protection as well as habitat for fauna) and may include a combination of:

- Step/pool sequences.
- Riffle/run sequences.
- Wood structures (in-stream and/or bank edge).
- Sinuous low flow channel.
- Benching for immediate floodplain engagement.
- Overhanging vegetation.
- Daytime refugia for fish.

In addition to the instream features above, the SEP will include the detail of fish passage and riparian planting, which will be stratified from the wetted margin to the more terrestrial riparian zone.

The design of the stream (and its features) will be based on the modelled assumptions included in Appendix E, which sets out the detailed expectations for the ecological benefits anticipated from the stream design, with updates as required to reflect the final conditions of consent. In addition to the modelled assumptions, consideration will also be given to relevant best practice published guidelines including:

- Tasman District Council Natural Channel Design Guideline (Tonkin + Taylor, 2019).
- New Zealand Fish Passage Guidelines Version 2.0 (Franklin et al., 2024).
- Auckland Council Unitary Plan Appendix 16 - Guideline for native revegetation plantings.
- Guidance for large wood installations in New Zealand rivers (Barrett et al. 2024).
- Technical guidelines for waterway management (Victoria State Government, 2024).

The SEP will include updated Stream Ecological Valuation and ECR modelling to reflect the final design and a monitoring and maintenance plan to enable the ecological outcomes sought to be

achieved. The SEP will be prepared by a suitably qualified ecologist, with technical inputs from stormwater engineers, geomorphologists and landscape architects as required, alongside inputs from mana whenua as appropriate.

It is considered that the detail provided through the SEP, which will be certified by Auckland Council, will be appropriate and adequate to provide confidence that the ecological outcomes sought to address the ecological effects, will be achieved.

Realigned stream

The realigned upper reach of Stream A has been designed to enhance the existing stream ecological value. A riparian margin of approximately 8 m width (on each bank) will be planted along the realigned section of stream to increase shading, bank stability, provide filtering capacity and increase organic material (see Ecological Management Plan and Landscape Plan for details, Tonkin & Taylor, 2025 a; Boffa Miskell, 2025). Instream habitat features and hydrologic heterogeneity will be created through placement of boulders and large woody debris.

Daylighted stream

In addition, 'daylighting' of the existing piped section of the lower reaches of Stream A is proposed to contribute towards addressing the loss of stream extent and value. In its current state, the lower reach of Stream A, near the northern boundary of the site, is piped to its confluence with Fitzgerald Stream, providing little ecological value. The flows currently entering this piped section (modified natural watercourse) will be diverted to the east of the existing piped alignment along a new created stream path as part of the proposed works (Figure 5.1). Within this report, this action is referred to as ‘daylighting’. Daylighting is a form of restoration which aims to recreate an open channel and associated stream habitat from a buried or piped channel thus restoring a historically modified/degraded system (Neale & Moffat, 2016). Inclusion of hydraulic and geomorphic diversity, instream habitat features, connectivity to the catchment and appropriate riparian planting are important design considerations to achieve ecological benefit. The proposed daylighting will result in the removal of approximately 112 m of piped stream[10] and creation of approximately 80 m stream length/112 m^2 of stream bed area. The created channel will tie into the Fitzgerald Stream upstream of Flanagan Road.

A 10 m riparian margin will be planted along the daylighted section of stream to enhance ecological function of the stream (see Section 7 of the Ecological Management Plan for riparian planting details; Tonkin + Taylor, 2025 a). A two-stage channel will be provided to retain habitat and reduce water temperatures during warmer months. Boulders, large woody debris and variation in channel morphology will increase hydrologic heterogeneity and provide instream habitat for freshwater fauna.

[10] Considering the new alignment of the ‘daylighted’ channel and the status of the piped stream as a modified natural watercourse, the removal of 112 m of piped stream has been assessed as reclamation. The effects of this action are addressed in the following section.

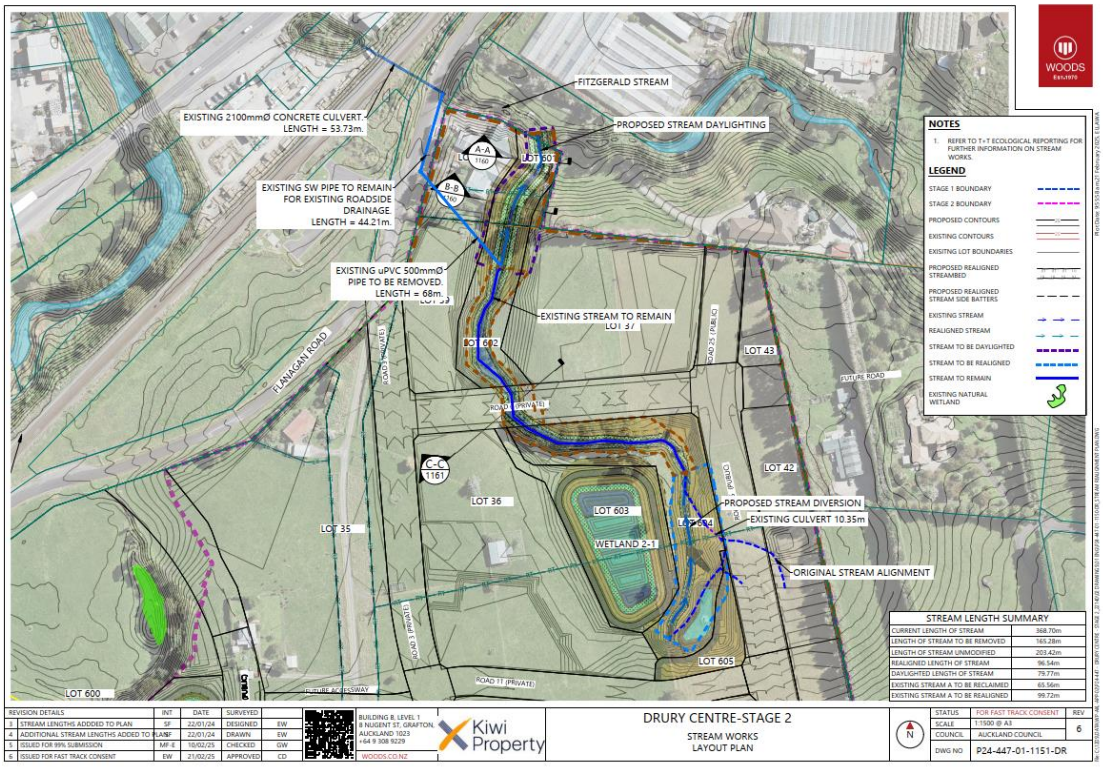

Figure 5.1: Proposed streamworks layout plan for Stream A (Source: Woods Fast Track Consent Plan Set).

Quantification of ecological benefits

Through the creation of approximately 176 m / 247 m^2 (daylighting and stream realignment), there is no net loss of stream extent (length of open channel) as the result of the proposed works. There is a net loss in stream bed area.

For both the realigned and daylighted sections of stream, the channel has been modelled to have an SEVm-P of 0.52, of higher ecological value than the existing open stream habitat on Stream A (SEV of 0.41, see Table 5.1). Due to the nature of the catchment (piped sections of Fitzgerald Stream between the site and its confluence with Hingaia Stream), site gradient, flood attenuation requirements and existing land uses, there are limits on what can be provided in terms of instream habitat features and riparian planting.

Using the ECR method to quantify the change instream ecological function ('value'), the proposed daylighting of the piped section of Stream A and realignment of the upper section of Stream A, will offset 77% of the loss of open channel of Stream A. This leaves approximately 48 m^2 of open channel of Stream A for which the ecological function ('value') is not offset.

5.2.4.2 Piped stream

As indicated above, the lower reaches of Stream A are piped. As this pipe is historic piped stream it is considered a modified natural watercourse and subject to the provisions of Chapter E3 of the AUP. The post-development alignment of this section of stream follows a different path and will be of shorter length. Therefore, the effects of the loss of this piped section of stream are considered separately within this section.

The works will result in the loss of stream value and extent of 112 m / 56 m^2 of existing piped stream which cannot be offset within the site. It is acknowledged that the piped stream is of lesser

ecological value than the open channel and in its current state, provides little ecological habitat or value.

5.2.4.3 Overall effects summary

The proposed works will result in permanent loss of Stream A extent (length and streambed area) and values (ecological function). The proposed realignment and daylighting of Stream A can provide for 77% of the offset required to address the permanent loss of ecological value of the upper reaches of Stream A (open channel). This equates to 162 m^2 of Stream A being offset to achieve no net loss of ecological value. This leaves a residual 48 m^2 of Stream A open channel where the effects on ecological values are not addressed. The realigned and daylighted sections do however provide for no net loss of extent of open channel (measured as stream length).

The loss of extent and values of piped stream cannot be addressed within the site.

When considering the combined effects on both open and piped channel, a total of 61% of the loss of stream value is offset through the proposed offset measures above. There is a shortfall in extent (length) when combining the open and piped channel.

There are no further options to address these residual adverse effects within the site. No additional offsetting is proposed to be undertaken on other landholdings. Therefore, there will be an overall net loss in ecological value and extent resulting from the proposed works.

Although not counted as offset for the proposed works addressed in this assessment, under the Precinct Plan, a 10 m width of riparian planting along each side of the existing stream length of Stream A within the site is required. In the context of the wider stream, this will contribute to continuity of the riparian margin, increasing the ecological value of Stream A following the proposed works.

Table 5.1: SEV values of impact and offset reaches and ECR calculations to determine offsetting required on Stream A

Impact							Offset				ECR			
Representative SEV	SEVi-C	SEVi-I	SEVi-P	Average width (m)	Length (m)	Streambed area (m^2)	Representative SEV	SEVm-C	SEVm-P	Streambed area available (m^2)	ECR	Streambed area compensation required (m^2)	Proportion of impact reach offset (%)	Offset streambed area still available (m^2)
Stream A (reclaimed)	0.41	0.00	0.53	1.2	75.9	91	Daylighted Stream A (D/S)	0.00	0.52	112	1.52	138	81	0
Stream A (realigned)	0.41	0.00	0.53	1.2	99.7	120	Stream A Diversion (U/S)	0.00	0.52	135	1.52	182	74	0
Stream A (pipe reclamation)	0.15	0.00	0.15	0.5	112	56	Daylighted Stream A (D/S)	0.00	0.52	0	1.00	56	0	0
													Proportion of impact open channel offset (%)	77
													Total proportion of impact channel offset (%)	61

Note: SEV definitions outlined in Section 3.4.1.1.

5.2.5 Assessment of offset proposal against offsetting principles

While the project does not propose to provide for no net loss of ecological value and extent, the proposal is considered to align well with many of the offsetting principles within Appendix 6 of the NPS FM. Specifically, where offsetting is proposed for the loss of open stream channel of Stream A, this has been summarised in Table 5.2. This offset assessment relates only to the proposed measures to reduce the net loss of stream values and extent within the site. There is a residual net loss of stream values and extent resulting from the project.

Table 5.2: Alignment of proposed offsetting with the offsetting principles

Principle	Alignment with offset principle
Adherence to the effects management hierarchy	The project team, including ecologists, were involved in extensive discussion to determine the final alignment of Road 25 and stormwater devices to avoid and minimise to the extent practicable the effects on Stream A. The final extent of impact is therefore unavoidable (further detail as to the alternatives considered is provided in the AEE).
When aquatic offsetting is not appropriate	None of the ecological values of Stream A open channel are of sufficiently high value or are uncertain, that offset is not feasible.
No net loss or net gain	No net loss of open stream extent has been achieved through the creation of stream (realignment and daylighting of existing piped stream). The project does not provide no net loss of ecological value although an appropriate offset accounting model (ECR) has been used to calculate the quantum of benefit being provided as offset.
Additionality	Daylighting of existing piped stream and riparian planting of the daylighted and realigned sections of Stream A will result in ecological gains that would not have occurred in the absence of the Project[11].
Leakage	The proposed daylighting and realignment of Stream A will not result in displaced harm to other locations.
Long-term outcomes	The daylighting and realigned Stream A will be a key feature of the Drury Centre and will remain in private ownership of Kiwi Property. As a key feature of the Drury Centre, it is anticipated to be present in perpetuity. The detail of the SEP will include a requirement for monitoring and maintenance to ensure that the ecological outcomes proposed are achieved.
Landscape context	The proposed offset measures (daylighting and realignment of Stream A) are proposed within the same stream as that being impacted. This provides for a like-for-like offset which is immediately proximate to the impact areas. This approach provides for the best ecological outcome for the habitat and fauna potentially affected by the project.
Time lags	The loss of extent of open stream will be offset within the construction timeframes (daylighting and realignment). The extent of offsetting of values proposed will be achieved within the 20 year period applied in the offset model.
Science and Mātauranga Māori	An accepted offset model (ECR) was used in the quantification of the benefits of the daylighting and realignment of Stream A. Hui have been held with mana whenua and ecologists in the development of

[11] Precinct provisions require riparian planting along existing stream length. As newly created stream, the riparian planting is not therefore otherwise required by precinct provisions.

Principle	Alignment with offset principle
	the project design, with many of those principles raised in discussion captured in the approach proposed.
Tangata whenua or stakeholder participation	Full detail of the engagement with stakeholder and Tangata whenua is provided within the AEE.
Transparency	This EcIA provides the methods used to determine the offset proposal which are in keeping with best practice (i.e. the ECR). The EcIA also clearly documents the limitations of the effects management package.

5.2.6 Modification of contributing flows to streams and wetlands

During and following construction, the contributing catchments and quantity of flow to streams and wetlands can be modified. This can arise from changes to the contour of the land or due to reconfiguration of discharge points of the stormwater network. During construction, the placement of sediment retention devices can alter the number and location of points of discharge to the receiving environment. Post-construction, increased impervious surfaces have the potential to change the volume and rate at which stormwater enters the receiving environment. Further, the change in contributing catchment area, the discharge point and the peakier nature of runoff can contribute to changes in the baseflow regime in streams, thereby affecting habitat quality and availability. High velocity flows can cause stream or wetland erosion and scour, which contributes to bank instability, sediment deposition and modification of wetland habitats.

During construction, modification of contributing flows has been modified to the extent practicable while also enabling effective sediment management to be undertaken. There are sediment retention ponds (SRP) proposed across the site (in addition to one existing SRP), which will discharge at several locations along the length of Stream A and Hingaia Stream. The potential modification to flows during construction is likely limited to rainfall events, when runoff will be preferentially directed to SRP's prior to discharging to streams. As such, it is expected that during construction, modifications to the flow regime will not be notable.

Following construction there will be a small change in the contributing catchments discharging to Stream A[12] and Hingaia Stream pre- and post-development. The Stream A catchment (draining into Fitzgerald Stream) will be reduced from 15.15 ha to 14.55 ha and Hingaia Stream catchment will increase from 9.12 ha to 9.72 ha (taken from Table 3 in Woods, 2025a). This section discusses the potential effects on Stream A, Hingaia Stream and natural inland wetlands.

Post-construction, retention and detention of stormwater across all impervious areas including roof areas and impervious hardstand will be managed in accordance with SMAF 1 requirements[13]. Stream hydrology will be equivalent to existing pre-development levels (i.e. infiltration, runoff volume, peak flow) in accordance with the AUP and Regionwide Network Discharge Consent. Raingardens and two constructed wetlands will meet the stormwater management requirements for the proposed development. Raingardens are located along the proposed Road 3, Road 6 and Road 25 for hydrological mitigation and water quality treatment of public and private roads. The constructed wetlands have been designed in accordance with the guidelines for Stormwater management devices in the Auckland Region (GD01; Cunningham et al., 2017).

[12] Changes to contributing catchments previously authorized through the Stage 1 consent are not considered within this assessment.
[13] Stormwater Management Area Flow 1.

5.2.6.1 Stream A

Post-development there are two key potential effects resulting from changes to contributing flows for Stream A; increased variability in stream flows in response to rainfall and a reduction in baseflows[14].

In relation to managing increased flow variability, Wetland 2-1 or Raingarden 2-1 will capture stormwater runoff up to the 95th percentile from the majority of the existing Stream A upper catchment (9.75 ha) and discharge this to the upstream point of Stream A via a piped outflow. Flows greater than the 95th percentile are proposed to bypass these stormwater management devices and discharge directly into Stream A at five additional outfalls located within the upper to middle reaches of Stream A. Runoff from small, frequent storms (95th percentile) will be slowed by the devices, so that the discharges to Stream A are more in keeping with a non-modified catchment. This is a standard approach to stormwater runoff management and consistent with GD01.

Post-development there will be a small decrease in contributing catchment to Stream A (~4%) and impervious surfaces will increase. It is expected that infiltration will decrease which may result in changes to the baseflow state in Stream A. A combination of measures are proposed to address this, including continued contribution of flows from the catchment from the east of Road 25 directly to the Stream A and a subsoil drainage network which will capture subsoil flows and divert these to the Wetland 2-1. As a result, it is expected that the permanent water level of Wetland 2-1 will be supplemented by subsoil flows, which will enable the orifice (set above the permanent water level) to discharge flows to the head of Stream A more frequently than just following rainfall events. It is envisioned that, during detailed design and construction, the location of the orifice, alongside the provision of subsoil drains will be optimised to enable this to occur. This is considered to contribute to managing potential baseflow effects on Stream A.

The approach proposed to manage the anticipated changes in flow regime is consistent with best practice and, specifically in respect of baseflows, has been specifically developed to minimise potential changes to Stream A flow. It is critical that baseflows are maintained, both for the ecological integrity of the stream itself, as well as the reliance on sections of this stream to address reclamation effects discussed earlier. It is recommended that ecologists work with the engineers during detailed design and construction of the subsoil drainage network and wetland devices to optimise the potential for baseflows to enter Stream A.

Given the proposed stormwater management approach aligns with GD01, and provided stormwater is retained/detained and baseflows are provided to streams as intended, the magnitude of effect is considered **low** and overall level of effect **low** for Stream A.

5.2.6.2 Hingaia Stream

Wetland 2-2 will capture all stormwater runoff up to the 95th percentile from the western side of the site (area of 2.88 ha) and discharge via a piped outflow) into Wetland 2 (natural inland wetland). Flows greater than the 95th percentile will discharge directly into Wetland 2, bypassing the constructed wetland (Wetland 2-2). The effects of this on Wetland 2 are described in Section 5.2.6.3. While there is a small increase in contributing catchment to the Hingaia Stream, given the scale of the Hingaia Stream catchment, this change is immaterial, and no effects are anticipated on the Hingaia Stream.

[14] Where 'baseflows' are those that exist in a stream in the absence of rainfall events.

5.2.6.3 Effects on wetland hydrology

Enabling works, earthworks and associated temporary works, such as erosion and sediment control measures can affect the hydrology of wetlands. All earthworks within a 10 m and 100 m buffer of a NIW need to be considered for their hydrological impact (partial or full drainage) on the NIW (NES-F). For the Drury Metropolitan Centre Stage 2 development, Wetland 1 and Wetland 2 are located within 10 m of the development extent and Channel D Wetland is located within 100 m of the enabling and earthworks footprint (P24-447-0010-GE).

Previous geotechnical investigations (undertaken by Aurecon during Stage 1 works) for Wetland 1 and Wetland 2 have established that both are groundwater fed from the Hingaia Stream. Although surface water will contribute to the hydrology of the wetlands, it is not the sustaining hydrological feature. Based on the stormwater design the following impacts can be expected:

- Wetland 1:
  - The catchment will be reduced from the construction of Road 2 North and Lot 31. It can be reasonably expected based on contour lines that surface water input is likely to reduce by more than 50%.
- Wetland 2:
  - The catchment will increase from approx. 1.74 ha in size to 2.88 ha in size. The water will be captured and cycled through the stormwater Wetland 2-2 before the water will be released into Wetland 2.

For Wetland 1 the changes to the catchment from temporary and/or permanent works are likely to cause some hydrological changes. The ecological effects could range from **moderate** (loss of a moderate portion of wetland extent) **to low** (minor changes to wetland extent) or **possibly negligible**. As a result, the overall level of effect on Wetland 1 could range from **very low to low**.

The effects on wetland hydrology at Wetland 2 from an increase in contributing catchment is likely to be overall positive, with a potential increase in wetland extent at the base (adjacent to Hingaia Stream) of Wetland 2 based on current contour information. Adverse ecological effects may be caused where the water from Wetland 2-2 is released into Wetland 2 at high velocities, causing potential scouring of wetland area and habitat. This could cause potential loss of wetland extent and value, resulting in a potentially **moderate** magnitude of effect.

To minimise potential adverse effects, the Wetland 2-2 outlet is proposed to consist of rock rip rap and wing wall which will be interplanted with suitable native plants, creating a 'green outfall'. To further reduce the risk of scouring, placement of large river type rocks in the upper wetland gully will be considered during the detailed design stage.

The outcomes of the increase in contributing catchment and impacts on the wetland ecology may range from **positive** (increase in wetland extent) to **moderate** magnitude of effect (loss/scouring of wetland), resulting in a potential **net gain** or **low to very low** overall level of effect. No further measures are required to address effects at this level. However, as these wetlands are required to be restored through conditions of the Stage 1 consent, some detail is proposed in the accompanying Wetland Restoration Plan (submitted within the EMP) to ensure basic monitoring of the wetlands and the outfalls to identify maintenance measures that may be required to minimise the potential for wetland impact.

Channel D Wetland is located within a historic stream channel of the Hingaia. It is unclear if the wetland hydrology is groundwater fed or sustained through discharge of water through pipes, however, it can be established that it is unlikely to be surface water fed due to the steep banks and therefore small catchment. The magnitude of effect of construction within 100 m of the wetland

predominately uphill of Channel D Wetland, including change of contours, has been assessed as **negligible**, resulting in a **very low** overall level of effect (Appendix B Table 5).

5.2.7 Permanent modification or loss of wetland habitat

The Stream A Wetland will be reclaimed to enable the construction of Road 25. Significant discussion between ecologists, engineers and planners was undertaken to consider an alternative route for Road 25, which could avoid the wetland. Refer to the AEE for discussion on this process.

It is expected that 2,172 m^2 of natural inland wetland will be lost (reclaimed) due to the proposed works. New Zealand has sustained a significant loss of wetlands in the past and wetland conservation is now prioritised through the NPS-FM and associated NES-F. As few wetlands are present within the wider landscape, and the loss of Stream A Wetland results in approx. 50 % loss of known wetlands (considering the retention of Wetland 1, Wetland 2, Channel D Wetland) within the site, the magnitude of effect is considered to be **high**. In accordance with the EcIAG (Appendix B Table 5), a **low** current ecological value (**moderate** potential ecological value) combined with a high magnitude of effect results in a **low** (**moderate)** overall level of effect. These effects cannot be further reduced through avoidance, minimisation or remediation measures. No offset or compensation measures are proposed, resulting in a net loss of extent and values of 2,172 m^2 of natural inland wetland. This leaves an overall moderate level of residual adverse ecological effect that is not proposed to be otherwise addressed through offset or compensation measures.

5.3 Terrestrial

Terrestrial native fauna and flora will be impacted through the removal of approximately 5,837 m^2 of exotic trees and shrubs and approximately 8.95 ha grazed vegetation. Impacts associated with each ecological feature outlined in Section 4.2 are described in the following paragraphs.

5.3.1 Vegetation

For the proposed works, it is anticipated that all the vegetation currently present on site will be permanently removed including trees and shrubs along streams and shelterbelts, and grazed areas. The treed/shrub areas are approximately 5,837 m^2 in size, while the grazed areas cover combined approximately 8.95 ha (89,574 m^2).

The vegetation present on site is common within the wider landscape. However, with more urban development undertaken in this area, the cumulative effects of vegetation loss need to be taken into account. The magnitude of effect has been assessed as **moderate**, on the basis that large areas of the site will be constructed, and any ecological value will be permanently lost.

As part of the proposed works, landscape planting along the proposed streets and open space features adjacent to hotels, apartment and office buildings is proposed (Boffa Miskell, 2025). This includes ecological planting around the stormwater wetland, the raingarden and the riparian margin to be restored along each side of Stream A. Precinct provisions[15] for riparian margins require a minimum of 10 m width from the top of the stream bank, which cannot be met through the proposed riparian planting. As shown on the Landscape Plan (Boffa Miskell, 2025) the riparian margin extends as far as possible with an approximate average of 8 m in width across the entire stream length. Further, walkways are located within the riparian margin, contrary to the Precinct provisions. Although Precinct provisions[15] are not met, the plantings provide ecological benefits through shading of the stream and terrestrial fauna habitat provision. Further, the stormwater wetland and riparian planting consists of low stature, understory and canopy tier species, with the aim to create a diverse environment for plant species as well as fauna species to thrive. Based on the

[15] I450 Drury Centre Precinct.pdf.

landscape plan (Boffa Miskell, 2025), approximately 1/5 of the site will consist of planted landscape features. The ecological value of these areas in the medium to long term are considered to reduce the magnitude of effect of the permanent vegetation loss to **low**.

The overall level of effect on vegetation has been assessed as **very low** (Appendix B Table 5).

5.3.2 Fauna

5.3.2.1 Bats

The vegetation on site provides limited long-tailed bat foraging and roosting habitat in the form of shelterbelts and riparian margins. Even though, some of this vegetation, for example along the Hingaia Stream, will not be removed, the proposed works will restrict its potential use by long-tailed bats through increased lighting and building structures permanently. However, with other, possibly more suitable habitat features available in the surrounding landscape, especially in the foothills of the Hunua Ranges, the likelihood of long-tailed bats using the habitat features onsite is considered to be low (Section 4.2.2.1). The magnitude of effect of permanently losing these features to vegetation clearance is considered to be **negligible**. The increase in lighting and built structures adds to the existing built environment in Drury and beyond. The magnitude of effect locally is considered to be **negligible**, on the basis that light pollution from the surrounding areas will already affect the use of the site in its current state by long-tailed bats. The overall level of effect has been assessed as **low** (Appendix B Table 5).

In Section 4.2.2.1, it was described that long-tailed bats are unlikely to use the bat habitat features on site, which is supported through automatic bat surveys that have been undertaken around the site (by others) and have not resulted in bat records[7]. However, due to their home ranges long-tailed bat absence cannot be concluded, resulting in a potential direct effect (harming or killing) on long-tailed bats during tree clearance. The magnitude of effect of tree clearance on long-tailed bats without mitigation measures is considered to be **low** on the basis that individual long-tailed bats could be harmed or killed during tree clearance (temporary effect) but the effect on the known population would be small, as the habitat on site does not support roosting for a large number of long-tailed bats.

To avoid harming or killing long-tailed bats, a Bat Management Plan has been prepared (Tonkin + Taylor, 2025 a) outlining the following in accordance with DOC's 'Protocol for minimising the risk of felling occupied bat roosts' Version 4 or subsequent updates:

- Identification of high-risk bat roost trees.
- Measures to be undertaken prior to tree clearance.
- Measures to be undertaken post tree clearance.
- Compliance reporting.

With the implementation of the Bat Management Plan, the magnitude of direct effects on long-tailed bats can be reduced to **negligible**, resulting in an overall **low** level of ecological effect (Appendix B Table 5).

5.3.2.2 Native avifauna

The vegetation on site provides some suitable bird habitat features, including for breeding. The permanent loss of approximately 5,837 m^2 of exotic trees and shrubs is considered to have a **low** magnitude of effect on native bird habitat. This is based on birds being a highly mobile species and use not only habitat within the site but in the surrounding landscape. Furthermore, long-term the proposed landscape planting required under the Precinct provisions[15] including the riparian planting along Stream A, Fitzgerald Stream and Hingaia Stream will provide habitat features for bird feeding,

perching and potentially roosting. The approximately 8.95 ha of grazed vegetation are not considered suitable breeding habitat for birds (i.e. Pīhoihoi/NZ pipit (*Anthus novaeseelandiae*)) and its loss has not been accounted for in the magnitude of effect assessment for native bird habitat (above). The overall level of effect has been assessed as **very low** in accordance with Appendix B Table 5.

Similarly to bats, native birds can be directly impacted by construction activity. During bird breeding season (depending on species this can range from August to March), birds are less mobile as they incubate eggs and raise their chicks and fledglings. During this time, vegetation clearance and other construction activities can cause harm or death to birds. Without any mitigation measures implemented, the magnitude of effect on native birds is considered to be **moderate**.

To avoid harming or killing native birds, an Avifauna Management Plan has been prepared (Tonkin + Taylor, 2025 a) outlining the following:

- Restriction of vegetation clearance to outside of bird breeding season where practicable.
- Measures to undertake prior to vegetation clearance during bird breeding season, including but not limited to bird nest checks.
- Measures to protect native avifauna from direct harm in compliance with the Wildlife Act 1953.
- Compliance monitoring and reporting.

With the implementation of the Avifauna Management Plan, the magnitude of direct effects on native birds can be reduced to **low**, resulting in an overall **very low** level of ecological effect (Appendix B Table 5).

5.3.2.3 Lizards

[redacted] With no native lizards recorded onsite, it is unlikely that these suitable habitats are used. Furthermore, suitable lizard habitat similar to what has been detected onsite is available on the surrounding land parcels, such as along the Hingaia Stream and on Fitzgerald Road. Following the above, the magnitude of effect on loss of lizard habitat has been assessed as **low**. Landscape planting and riparian planting is proposed along Stream A. The restoration planting plan includes habitat enhancements for lizards, such as re-use of woody material for refugia. It is anticipated that a similar amount of suitable lizard habitat will be restored if not more. As a result, the magnitude of effect can be reduced to **negligible**, with a potential for positive magnitude of effect. The overall level of effect has been assessed **very low** (Appendix B Table 5).

Removal of lizard habitat can result in direct adverse effects on native lizard species through injury or killing. Often native lizards occur in 'hotspots' especially on sites such as the Drury Metropolitan Centre Stage 2 sites, where lizard habitat is sparse. The magnitude of effect without management measures is considered to be **moderate**, as the loss of a native lizard hotspot in this fragmented landscape is regarded a moderate loss to the known population.

To avoid injuring or killing native lizards through construction activities, a Lizard Management Plan has been prepared (Tonkin + Taylor, 2025 a) outlining the following:

- Restriction of vegetation clearance to between 1 October and 30 April.
- Preventive management measures to undertake prior to vegetation clearance.
- Accidental discovery protocol and adaptive management actions.
- Compliance monitoring and reporting.

With the implementation of the Lizard Management Plan, the magnitude of direct effects on native lizards can be reduced to **low**, resulting in an overall **low** level of ecological effect (Appendix B Table 5.

5.4 Summary of effects

Table 5.3: Summary of ecological effects of the proposed works

Activity	Current ecological value	Potential ecological value	Magnitude of effect – with mitigation measures	Overall level of effect
Sedimentation during construction				
Stream A and Fitzgerald Stream	Moderate	High	Low	Low
Hingaia Stream	High	High	Low	Low
Injury or mortality of fauna				
Stream A	Low	N/A	Low	Very low
Fitzgerald Stream	High	N/A	Low	Low
Fish passage during construction				
Stream A	Low	N/A	Low	Very low
Fitzgerald Stream	High	N/A	Low	Low
Fish passage following construction				
Stream A	Low	N/A	Positive	Net gain
Permanent modification or loss of stream habitat				
Stream A	Moderate	High	High	Very high
Modification to contributing flows to streams and wetlands				
Stream A	Moderate	High	Low	Low
Wetland 1	Low	Low	Negligible to moderate	Very low to low
Wetland 2	Low	Low	Positive to moderate	Low to net gain

Activity	Current ecological value	Potential ecological value	Magnitude of effect – with mitigation measures	Overall level of effect
Channel D Wetland	Moderate	Moderate	Negligible	Very low
Permanent modification or loss of wetland habitat				
Stream A Wetland	Low	Moderate	High	Moderate
Vegetation clearance – Vegetation	Low	N/A	Low	Very low
Vegetation clearance – Bats				
Loss of habitat	Very high	N/A	Negligible	Low
Bat injury and mortality	Very high	N/A	Negligible	Low
Vegetation clearance – Native avifauna				
Loss of habitat	Low	N/A	Low	Very low
Bird injury and mortality	Low	N/A	Low	Very low
Vegetation clearance – Lizards				
Loss of habitat	High	N/A	Negligible	Very low
Lizard injury and mortality	High	N/A	Low	Low

Note: Overall level of effect has been assessed using the potential value of freshwater and wetland ecosystems.

6 Summary and conclusion

The proposed works associated with the Stage 2 Drury Metropolitan Centre development will result in the development of existing rural land to urban form.

The ecological values of the site are consistent with those typical to agricultural land use. Vegetation within the site is limited to grazed pasture grasses with interspersed clusters of predominantly exotic woody species along shelter belts and riparian margins. Streams within the site are degraded from unrestricted stock access, lack of riparian margins and resulting degraded watercourses. However, the ultimate receiving environment is Drury Creek – a marine SEA. Several seepage wetlands of low to moderate value are present across the site.

The proposed works have the potential to impact the remaining ecological values of the site. Measures to manage the effects of the proposed works on the ecological values are summarised below:

- Implementation of appropriate erosion and sediment controls in accordance with best practice methods to reduce effects on receiving freshwater and marine environments.
- Implementation of a Native Fish Relocation Plan to reduce the risk of injury or mortality of freshwater fauna during instream works.
- Removal of existing fish passage barriers within Stream A (culverts, piped stream network) to improve fish passage and construction of an arch culvert to maintain fish passage within Stream A (will be detailed in the Stream Enhancement Plan).
- Creation of new stream length comprising realigned and daylighted open channel with improved ecological value including riparian planting and instream habitat features.
- Riparian planting and addition of instream habitat features in 97 m of realigned stream channel within Stream A.
- Development of a Stream Enhancement Plan, prepared by a suitably qualified and experienced freshwater ecologist with input from stormwater engineers and geomorphologists, the purpose of which is to provide the detailed and finalised design for the enhancement of Stream A.
- Implementation of stormwater management devices in accordance with best practice guidelines to manage water quantity into receiving freshwater environments.
- Management of flows during and following construction to ensure hydrology of existing wetlands remains unchanged.
- Implementation of a Bat Management Plan, Avifauna Management Plan and Lizard Management Plan to manage effects on terrestrial fauna during vegetation clearance.

Through implementation of the above management measures, it is considered that the majority of the potential effects of the proposed works can be avoided, minimised or mitigated to an overall low level of effect. Where possible, activities and ecological values with remaining residual adverse effects (that could not be avoided, remedied or mitigated) have been addressed through offset measures on site.

Residual adverse effects remain in respect of loss of 2,172 m^2 natural inland wetland, in the order of 48 m^2 open stream channel and 56 m^2 piped stream which are not addressed through effects management measures. There is therefore a net loss in ecological value of natural inland wetland and open stream channel, and a net loss in extent of natural inland wetland and piped stream.

7 Applicability

This report has been prepared for the exclusive use of our client Kiwi Property Holding No. 2 Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that the Environmental Protection Agency as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:

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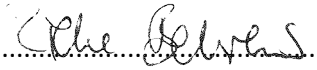
Danielle Cairns
Freshwater Ecologist

Report prepared by:



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Rieke Behrens
Terrestrial Ecologist

Authorised for Tonkin & Taylor Ltd by:

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Lisa Dowson
Project Director

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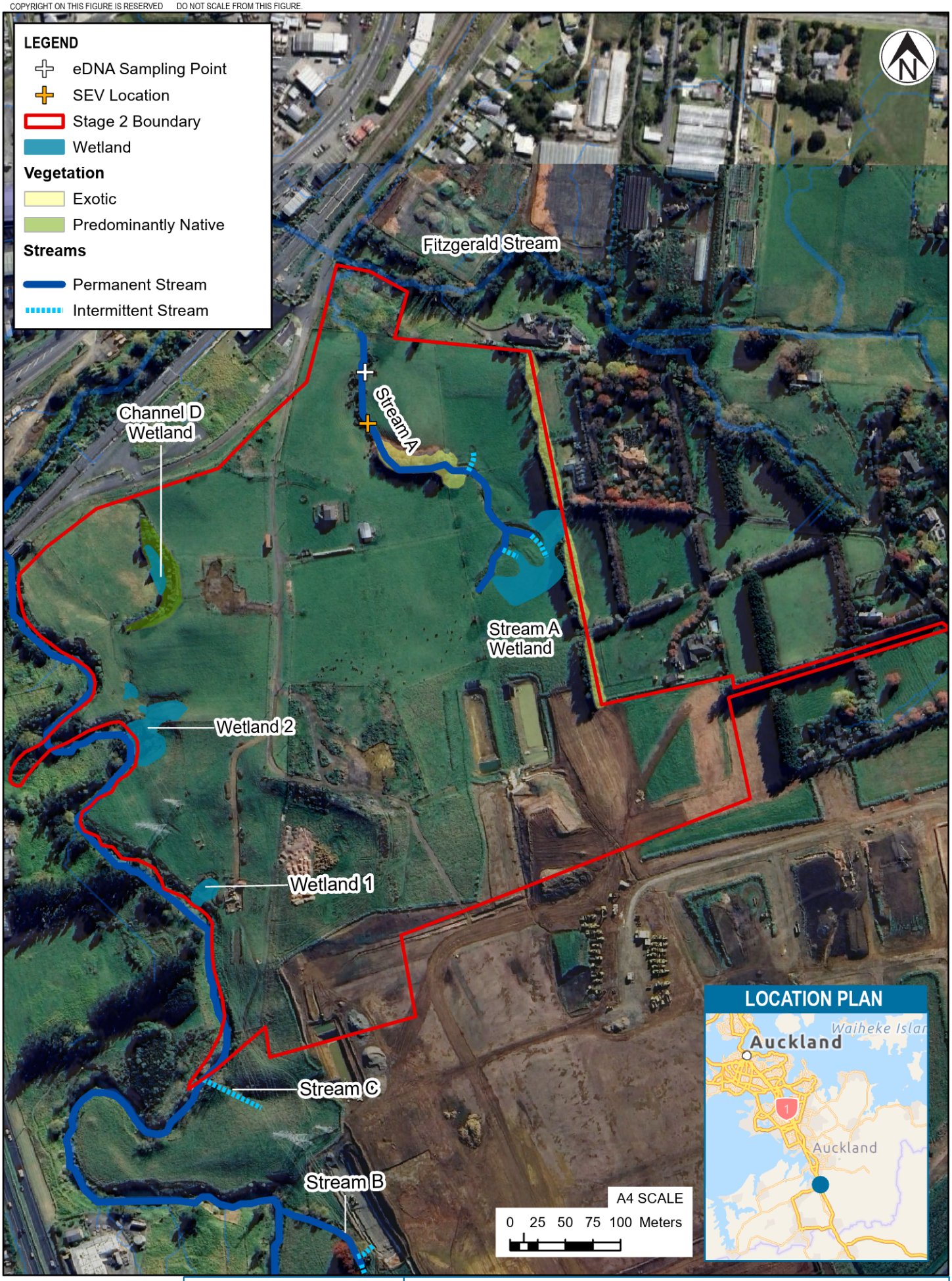
Appendix A Ecological features map



PROJECT No.	1003297.6004		
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DRAWN	DACA	FEB.25	
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APPROVED		DATE	

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PROJECT **DRURY TOWN CENTRE STAGE 2**
TITLE ECOLOGICAL FEATURES
SCALE (A4) 1:4,500 FIG No. FIGURE 1. REV 0

Appendix B Ecological Impact Assessment Guidelines

Appendix B Table 1: Ecological values assigned to freshwater ecology to supplement the EcIA process.

Value	Explanation	Characteristics
Very High	A reference quality watercourse in condition close to its pre-human condition with the expected assemblages of flora and fauna and no contributions of contaminants from human induced activities including agriculture. Negligible degradation e.g. stream within a native forest catchment.	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 120 or greater. EPT richness and proportion of overall benthic invertebrate community typically high. SEV scores high, typically >0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat natural and unmodified.
High	A watercourse with high ecological or conservation value but which has been modified through loss of riparian vegetation, fish barriers, and stock access or similar, to the extent it is no longer reference quality. Slight to moderate degradation e.g. exotic forest or mixed forest/agriculture catchment.	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 80-100 or greater. EPT richness and proportion of overall benthic invertebrate community typically moderate to high. SEV scores moderate to high, typically 0.6-0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy. No pest or invasive fish (excluding trout and salmon) species present. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat largely unmodified.
Moderate	A watercourse which contains fragments of its former values but has a high proportion of tolerant fauna, obvious water quality issues and/or sedimentation issues. Moderate to high degradation e.g. high-intensity agriculture catchment.	Benthic invertebrate community typically has low diversity, species richness and abundance. Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments. Benthic community typically with dominant species or group of species. MCI scores typically 40-80. EPT richness and proportion of overall benthic invertebrate community typically low. SEV scores moderate, typically 0.4-0.6.

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

Appendix B Table 2: Factors to consider in scoring sites values in relation to species representativeness, rarity, diversity and pattern, and ecological context

Value	Species Values	Vegetation/Habitat Values
Very High	Nationally Threatened - Endangered, Critical or Vulnerable	Supporting more than one national priority type. Nationally Threatened species found or likely to occur there, either permanently or occasionally.
High	Nationally At Risk - Declining	Supporting one national priority type or naturally uncommon ecosystem and/or a designated significant ecological area in a regional or district Plan. At Risk - Declining species found or likely to occur there, either permanently or occasionally.

Value	Species Values	Vegetation/Habitat Values
Moderate-high	Nationally At Risk - Recovering, Relict or Naturally Uncommon	A site that meets ecological significance criteria as set out the relevant regional or district policies and plans.
Moderate	Not Nationally Threatened or At Risk, but locally uncommon or rare	A site that does not meet ecological significance criteria but that contributes to local ecosystem services (e.g. water quality or erosion control).
Low	Not Threatened Nationally, common locally	Nationally or locally common with a low or negligible contribution to local ecosystem services.

Appendix B Table 3: Summary of the criteria for describing the magnitude of effect

Magnitude	Description
Very high	Total loss of, or very major alteration to, key elements/features/ of the existing baseline[1] conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature.
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature.

[1]Baseline conditions are defined as 'the conditions that would pertain in the absence of a proposed action' (Roper-Lindsay *et al*., 2018).

Appendix B Table 4: Timescale for duration of effect

Timescale	Description
Permanent	Effects continuing for an undefined time beyond the span of one human generation (taken as approximately 25 years).
Long-term	Where there is likely to be substantial improvement after a 25 year period (e.g. the replacement of mature trees by young trees that need > 25 years to reach maturity, or restoration of ground after removal of a development) the effect can be termed 'long term'.
Temporary[1]	Long term (15-25 years or longer – see above). Medium term (5-15 years). Short term (up to 5 years). Construction phase (days or months).

[1] Note that in the context of some planning documents, 'temporary' can have a defined timeframe.

Appendix B Table 5: Criteria for describing overall levels of ecological effects

Magnitude of effect	Ecological Value				
	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Appendix C eDNA Data

Scientific Name	Rank	Taxa ID	Common Name	Group	Present (number of replicates)
Anguilla australis	species	7940	Shortfin eel; tuna; hao; aopori; hikumutu	Fish	Y (3/3)

Appendix D Stream A Wetland – Wetland delineation results

	Rapid test	Dominance test		Prevalence test		Hydric soils test	Hydrology test	Threatened sp. test	Pasture test	
Site	Pass/Fail	Index	Pass/Fail	Index	Pass/Fail	Pass/Fail	Pass/Fail		Pass/Fail	Classification
T1 P1	Fail	33%	Fail	3.6	Fail	Fail	Fail	Fail	Pass (77%)	Non-wetland
T1 P2	Pass	100%	Pass	2.4	Pass	Fail	Fail	Fail	Fail (13%)	Wetland
T1 P3	Fail	67%	Pass	2.8	Pass	Pass	Fail	Fail	Fail (36%)	Wetland
T1 P4	Fail	100%	Pass	2.5	Pass	Fail	Fail	Fail	Fail (7%)	Wetland
T1 P5	Pass	100%	Pass	2.6	Pass	Fail	Fail	Fail	Fail (26%)	Wetland
T1 P6	Pass	100%	Pass	2.5	Pass	Pass	Fail	Fail	Fail (22%)	Wetland
T2 P1	Fail	100%	Pass	2.9	Pass	Pass	Fail	Fail	Fail (28%)	Wetland
T2 P2	Pass	100%	Pass	2.5	Pass	Pass	Fail	Fail	Fail (25%)	Wetland

Add wetland plot map from here: \\ttgroup.local\corporate\Tauranga\Projects\1003297\1003297.6004\WorkingMaterial\04 - GIS\Outputs\Appendix D_StreamA_Wetland plots.pdf

Appendix E SEV Modelling Assumptions

Function Category	Variable	***ID: Stream A potential riparian planting*** ***SEV: SEVi-P*** ***Offset: 10 m riparian margin enhancement on both banks + weed control and stock exclusion (20 years post planting). Under Precinct Plan existing farmland will be developed to urban land use.***	***ID: Stream A daylighted/realigned stream*** ***SEV: SEVm-P*** ***Offset: ~8 m riparian margin enhancement on both banks + weed control and stock exclusion (20 years post planting). Remaining outer margin impervious/urban areas (e.g. boardwalk, roads, buildings), grassed areas and stormwater wetland/raingardens.***
Hydraulic	**Vchann**	Assumes some improvement due to increase in woody debris	Assumes incision present in existing channel is not present in created channel due to increased bank and bed stability from riparian planting and filtering of contributing flows.
	Vlining	Assumes reduction in silt loading due to increased bank stability and filtering capacity from riparian planting.	Assumes reduction in silt loading due to increased bank stability and filtering capacity from riparian planting.
	Vpipe	Assumes no change from observations on site (no pipes).	Assumes no change from observations on site (no pipes).
	Vbank	Assumes less incision and increased connectivity in created channel with floodplain/riparian margin, limited by urban development outside of 10 m riparian margin.	Assumes less incision and increased connectivity in created channel with floodplain/riparian margin, limited by urban development outside of ~8 m riparian margin.
	Vrough	Assumes 10 m planted margin of low diversity regenerating bush and mature flax/sedge/grasses with stock exclusion. Exotic trees retained. Outer 10 m to be grassed areas and urban development under Precinct plan.	Assumes ~8 m planted margin of low diversity regenerating bush and mature flax/sedge/grasses (no stock access due to urban development). Constructed wetland, grassed areas and urban development in outer 12 m margin.
	Vbarr	Assumes no change from observations on site (no barriers).	Assumes no barriers within reach.
	Vchanshape	*Autopopulated*	*Autopopulated*
Biogeochemical	**Vshade**	Assumes increase in moderate and high shading due to 10 m riparian planting.	Assumes moderate and high shading due to ~8 m riparian planting.
	Vdod	Assumes increase to sub optimal due to increased shading, increased bank stability and filtering capacity and stormwater treatment devices. Limited by urban development (e.g. increased runoff temperatures).	Assumes increase to sub optimal due to increased shading, increased bank stability and filtering capacity and stormwater treatment devices. Limited by urban development (e.g. increased runoff temperatures).
	Vveloc	Assumes no change from observations on site.	Assumes no change from observations on site.
	Vdepth	Assumes no change from observations on site.	Assumes no change from observations on site.

Function Category	Variable	***ID: Stream A potential riparian planting*** ***SEV: SEVi-P*** ***Offset: 10 m riparian margin enhancement on both banks + weed control and stock exclusion (20 years post planting). Under Precinct Plan existing farmland will be developed to urban land use.***	***ID: Stream A daylighted/realigned stream*** ***SEV: SEVm-P*** ***Offset: ~8 m riparian margin enhancement on both banks + weed control and stock exclusion (20 years post planting). Remaining outer margin impervious/urban areas (e.g. boardwalk, roads, buildings), grassed areas and stormwater wetland/raingardens.***
	Vripar	Assumes outer 5 m of 10 m riparian planting is planted with woody species.	Assumes outer 4 m of ~8 m riparian planting is planted with woody species.
	Vdecid	Assumes all planting aside from existing exotic trees are evergreen species.	Assumes all planting is with native evergreen species.
	Vmacro	Assumes no change from observations on site.	Assumes no change from observations on site.
	Vretain	*Autopopulated*	*Autopopulated*
	Vsurf	Assumes increase in woody debris and leaf litter from riparian planting.	Assumes increase in woody debris and leaf litter from riparian planting.
	Vripfilt	Assumes high riparian filtering activity due to riparian planting, limited by urban development and grassed areas.	Assumes high riparian filtering activity due to riparian planting, limited by urban development and grassed areas.
Habitat Provision	**Vgalspwn**	Assumes no change from observations on site (no suitable bank slopes).	Assumes created channel will show no change from observations on site (no suitable bank slopes).
	Vgalqual	Assumes no suitable habitat due to steep bank slopes.	Assumes no suitable habitat due to steeper bank slopes.
	Vgobspawn	*Autopopulated*	*Autopopulated*
	Vphyshab	Assumes increase in habitat diversity and abundance, hydrologic heterogeneity, channel shading and riparian vegetation integrity due to riparian planting and increased bank stability (e.g. woody debris input, prevention of further incision). Shading and vegetation integrity limited by 10 m riparian planting width and urban development.	Assumes increase in habitat diversity and abundance, hydrologic heterogeneity, channel shading and riparian vegetation integrity due to riparian planting, increased bank stability and addition of habitat features in the created channel (e.g. woody debris input, riffle section, large boulders, prevention of further incision). Shading and vegetation integrity limited by ~8 m riparian planting width and urban development.
	Vwatqual	Assumes improvement due to planting of channel length upstream.	Assumes improvement due to planting of channel length upstream.
	Vimperv	Assumes increase in upstream imperviousness due to urban	Assumes increase in upstream imperviousness due to urban

Function Category	Variable	***ID: Stream A potential riparian planting*** ***SEV: SEVi-P*** ***Offset: 10 m riparian margin enhancement on both banks + weed control and stock exclusion (20 years post planting). Under Precinct Plan existing farmland will be developed to urban land use.***	***ID: Stream A daylighted/realigned stream*** ***SEV: SEVm-P*** ***Offset: ~8 m riparian margin enhancement on both banks + weed control and stock exclusion (20 years post planting). Remaining outer margin impervious/urban areas (e.g. boardwalk, roads, buildings), grassed areas and stormwater wetland/raingardens.***
		development and increased stormwater treatment devices.	development and increased stormwater treatment devices.
Biodiversity	**Vfish**	-	-
	Vmci	-	-
	Vept	-	-
	Vinvert	-	-
	Vripcond	*Autopopulated.*	*Autopopulated.*
	Vripconn	Assumes slight increase from riparian planting.	Assumes less incision and increased connectivity in created channel with floodplain/riparian margin.

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