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Aquatic Ecology Assessment

20 & 20A Cantwell Road and 60 New England Highway, Lochinvar, NSW

Prepared for: Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle c/- Monteath & Powys

AEP Ref: 4951

Revision: 04

February 2025

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Document Control

Document Name	Aquatic Ecology Assessment Report for 20 & 20A Cantwell Road and 60 New England Highway, Lochinvar NSW
Project Number	4951
Client Name	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle
AEP Project Team	Brendon Young Jarod Baxter Natalie Black

Revision

Revision	Date	Author	Reviewed	Approved
00	05/06/2024	Natalie Black	Brendon Young	Natalie Black
01	24/10/2024	Natalie Black	Brendon Young	Natalie Black
02	16/01/2025	Natalie Black	Jarod Baxter	Natalie Black
03	22/01/2025	Natalie Black	Jarod Baxter	Natalie Black
04	17/02/2025	Natalie Black	Jarod Baxter	Natalie Black

Distribution

Revision	Date	Name	Organisation
00	05/06/2024	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys
01	24/10/2024	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys
02	16/01/2025	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys
03	22/01/2025	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys
04	17/02/2025	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys

EXECUTIVE SUMMARY

Anderson Environment & Planning (AEP) has been requested by Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle c/- Monteath & Powys to undertake field investigations and reporting to prepare an Aquatic Ecological Assessment (AEA) to accompany a Permit application under Part 7 of the *Fisheries Management Act 1994*, for the following proposed works within waterland:

- Removal of two (2) blockages to fish passage;
- Installation of a Fish Friendly Box Culvert;
- Vegetated rehabilitation batter; and
- Planting of native vegetation within the aquatic zone and adjoining riparian Lands.

All proposed works have been assessed in accordance with the relevant requirements of the *Fisheries Management Act 1994* (FM Act) and NSW Department of Primary Industry policy and guidelines documents.

The assessment of the unnamed creek and Key Fish Habitat spatial data resulted in the following findings:

- A creek and riparian corridor in a degraded condition with limited native aquatic and terrestrial vegetation used for fish habitat.
- High abundance of exotic fish, dominated by Gambusia (Gambusia holbrooki);
- A single individual native fish species, Carp Gudgeon *(Hypseleotris* spp.); and
- No threatened species listed under the FM Act were identified within the proposed area of works.

This data was used to inform the assessment for both the direct and indirect impacts associated with the development of a proposed subdivision, including creek crossing. This assessment showed that the creek has been significantly modified, most likely from vegetation clearing and extensive agricultural use such as grazing. Which has caused:

- A creek in a highly degraded, polluted and modified condition with limited to no native aquatic vegetation;
- Limited to no native terrestrial vegetation;
- No aquatic habitat;
- High erosion points from domestic stock access, and slumping in higher flow events;
- Pools have been used for dumping of vegetation and other materials;
- Limited to no key features of a creek such as meanders, pools, riffles and snags; and
- No threatened species were identified.

Modifications to the structure and form of the creek reduces if not eliminates the function of the creek within the catchment. The river is located in the upper tributaries of the Hunter River and if functioning would provide refugee habitat aquatic and semi aquatic species particularly during high flow events, breeding and foraging habitat for aquatic and semi aquatic species.

The proposed works to rehabilitate the severely eroded banks in the north east and remove all blockages to fish passage with the installation of a culvert crossing will have a direct impact on the creek during construction only. Post construction there will be no direct impact due to the long-term benefits of restoring the natural creek that will restore the key features, improving the flow and quality, reducing weed seed loads, increasing aquatic habitat within the Lochinvar area.

All proposed works have been assessed in accordance with the relevant requirements of the *Fisheries Management Act 1994* (FM Act), *Water Management Act, 2000* (WM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act).

These changes have allowed for stormwater management activities, however, the driver for these works was restoration of the unnamed creek.

AEP is recommending restoration of the channel; the proposed crossing will have a direct impact to during construction only by diverting flow and reducing the limited habitat. Post construction there will be no direct impacts as the proposed regeneration works and adjoining Biodiversity Management Plan (BMP) are likely to significantly improve the water quality, flows, availability of fish habitat, and riparian and instream vegetation. Rehabilitation under the proposed BMP focuses on achieving a naturally regenerating ecosystem through the removal of weeds and plantings of native vegetation, removal of two (2) instream obstructions to fish passage and the installation of instream snags, which will assist in improving the habitat for both native terrestrial and aquatic flora and fauna.

The construction of the culverts and rehabilitation of the severely eroded banks are proposed to be undertaken when the waterway is under stagnant conditions, however a sudden flow of the creek may require a temporary diversion channel be put in place as a contingency to allow natural water movement.

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List of Acronyms

AEA	Aquatic Ecology Assessment
API	Aerial Photography Interpretation
BC Act	*Biodiversity Conservation Act 2016*
BMP	Biodiversity Management Plan
CAA	Controlled Activity Approval
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DCP	Development Control Plan
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
EEC	Endangered Ecological Communities
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
HEVAE	High Ecological Value Aquatic Ecosystem
KFH	Key Fish Habitat
LEP	Local Environment Plan
LGA	Local Government Area
NRAR	Natural Resource Access Regulator
SEED	Sharing and Enabling Environmental Data in NSW
SVTM	State Vegetation Type Mapping
TEC	Threatened Ecological Communities
VMP	Vegetation Management Plan
VRZ	Vegetated Riparian Zone
WFL	Waterfront Land
WFLT	NRAR Waterfront Land Tool
WM Act	*Water Management Act 2000*

Study Certification and Licencing

Fieldwork was undertaken by Brendon Young BAppSc (Fisheries), Master Env. Management and Jarod Baxter B.Sc (Marine Sys. & Mgmt). This report was drafted by Brendon Young, with contributions from Jarod Baxter, and reviewed and approved by Natalie Black B.Sc (Hons), Master Planning, BAAS: 19076) of Anderson Environment & Planning.

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL101313;
- Animal Research Authority (Trim File No: 14/600(2)) issued by NSW Agriculture; and
- Animal Research Establishment Accreditation Number 53724.

Certification:

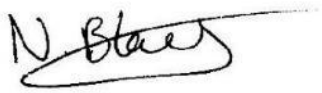
As the principal author, I, Natalie Black, make the following certification:

The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the subject site.

Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, unless specified departures from industry standard guidelines are justified for scientific and/or animal ethics reasons.

All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the Animal Research Act 1995, BC Act and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Principal Author and Certifier:



Natalie Black

Senior Environmental Manager

Anderson Environment & Planning

21/01/2024

1.0 Introduction

At the request of Monteath & Powys on behalf of Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle (the client), Anderson Environment & Planning (AEP) has undertaken the necessary investigations within 20 & 20A Cantwell Road and 60 New England Highway, Lochinvar NSW to inform the production of an Aquatic Ecology Assessment (AEA) as part of:

- A Streamlined Biodiversity Development Assessment Report (SBDAR) in accordance with the BC Act; and
- Permit application for dredge, reclamation and obstructing fish passage works in a waterway, in accordance with Part 7 of the *Fisheries Management Act, 1994,* (FM Act).

In this regard, the report aims to recognise the relevant requirements of the *FM Act* and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. This report has also considered the results of the Waterfront Land Assessment Report (WLAR), prepared in accordance with Natural Resources Access Regulator (NRAR) *Waterfront Land Tool* (2020). The Waterfront Land Tool (WFLT) was developed by the NSW Department of Planning, Industry and Environment to assist applicants in determining waterfront land under the controlled activity provisions of the *Water Management Act 2000* (WM Act) within a Subject Site.

The proposal involves the development of a Staged Subdivision, including watercourse crossings within R1 and C3 zoned lands.

The assessment of waterland within the Study Area, showed that waterland is only located within 20 & 20A Cantwell Road, Lochinvar NSW. This report considers the overall development; however, the assessment applies only to 20 & 20A Cantwell Road Lochinvar NSW.

The culvert has been designed to ensure minimal impact on Fish Passage, ensuring it complies with the requirements of the NSW Department of Primary Industries DPI Fisheries (2013), *Why do Fish Need to Cross a Road?* The creek is in a highly degraded condition due to past and current land uses. The design has also utilised Waterfront Land Tool (NRAR, 2020) and applicable Controlled Activity Approval (CAA) guidelines for riparian corridors on waterfront land released by the NSW Department of Climate Change, Energy, the Environment and Water – Office of Water (NSW Water) to ensure all works comply with *Section 91* of the WM Act.

In this regard, the report aims to recognise the relevant requirements of the WM Act, FM Act, and the Commonwealth EPBC Act.

This report is informed by, and should be read in conjunction with the following documents:

> Anderson Environment & Planning (2025). Waterfront Land Assessment Report *for 20, 20A and 60 New England Highway, Lochinvar NSW*. Unpublished.
>
> Anderson Environment & Planning (2025). *Streamlined Biodiversity Development Assessment Report for 20, 20A and 60 New England Highway, Lochinvar NSW*. Unpublished.
>
> Anderson Environment & Planning (2025). *Biodiversity Management Plan for 20, 20A and 60 New England Highway, Lochinvar NSW*. Unpublished.

2.0 Scope and Purpose

This AEA is being prepared to assess waterland within 20 & 20A Cantwell Road, Lochinvar NSW and determine direct and indirect impacts of the proposed subdivision and creek crossing.

This AEA has been informed by background research, literature review, database searches, consultation with NSW Fisheries, targeted ecological fieldwork, mapping, detailed habitat assessment, and ultimately, impact assessment consideration against the type and form of the proposal.

Specifically, the production of the AEA will be in accordance with the *Fisheries Management Act 1994* and assessed against DPI *Fisheries Policy and Guidelines for Fish Habitat Conservation and Management (2013 Update)*, to:

- Identify Key Fish Habitat (KFH) within the Subject Site;
- Determine KFH sensitivity type;
- Determine KFH waterway classification;
- Assess the direct and indirect impacts of the proposal on Key Fish Habitat;
- Identify aquatic species within the extent of works, including any threatened species listed under the FM Act and EPBC Act;
- Assess the condition of the aquatic habitat and adjoining riparian lands;
- Assess the potential for the proposal to have a significant impact on any threatened species, populations or EEC (or their habitats) listed under the FM Act as identified within the Subject Site;
- Assess the proposal to block fish passage, either in design or during construction; and
- Recommend measures to be implemented to identify, minimise, mitigate and ameliorate potential environmental impacts of the proposal.

3.0 Site Particulars

Table 1 below provides a summary of the site particulars.

Table 1 – Site Particulars

Detail	Comments
Client	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle
Address	20 & 20A Cantwell Road and 60 New England Highway, Lochinvar NSW
Title(s)	Lot 1 DP1299958 Lot 2 DP1299958 Lot 2 DP1214402
Study Area	The Study Area encompasses the entirety of Lot 1 & 2 DP1299958 and partial Lot 2 DP1214402 and all upstream tributaries as mapped by *Water Management (General) Regulation 2018* hydroline spatial data 1.0 and associated water land (**Figure 1**).
Subject Site	The Subject Site consists of a mapped KFH and associated water land within Lot 1 & 2 DP1299958.
LGA	Maitland City Council
Zoning	C3 - Environmental Management: (pub. 21-4-2023) R1 - General Residential: (pub. 21-4-2023)
Current Land Use	The Study Area is a fenced paddock consisting of unmanaged grassland and is currently used as cattle pasture.
Surrounding Land Use	The surrounding land is predominantly low density residential and rural residential properties to the east and west, and large lot rural property to the north. The St Joseph's College Diocese of Maitland Newcastle is immediately adjacent to the south and east, and the New England Highway (NEH) borders the southernmost boundary.
State Vegetation Type Mapping	The following PCTs have been mapped present within the wider Study Area by State Vegetation Type Mapping (SVTM) (**Figure 2**). • PCT 4023 - Coastal Valleys Riparian Forest • PCT 3433 - Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest • PCT 3442 - Lower Hunter Lowland Ironbark-Paperbark Forest • PCT 3444 - Lower Hunter Spotted Gum-Ironbark Forest • PCT 4089 - Namoi-Upper Hunter River Red Gum Forest • Not classified Lot 1 & 2 DP1299958 and Lot 2 DP1214402 is mapped "Not classified", with a small fraction of PCT 4089 occurring on south eastern boundary.
Ground-truthed Plant Community Types (AEP SBDAR, 2024)	• 0.39ha of PCT 3433 – Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest (highly degraded); and • 0.11ha of PCT 4023 – Coastal Valleys Riparian Forest (Highly degraded & Lower-stratum only). • 15ha of Vegetation determined as "Planted Native" due to the presence of *Cynodon dactylon* was also identified on site and is assessed thereafter. • 1.15ha of Non-Native
NSW River Condition Index	This map describes the riverine condition. It is used to combine a range of indicators into a single condition score. The indicators include riparian vegetation, geomorphic condition, hydrologic stress, biodiversity, catchment disturbance and water quality. The Subject Site is mapped as "Very Poor".

Detail	Comments
NSW River Styles Mapping	This map describes the physical characteristics and diversity of rivers and assesses geomorphic stream condition. It considers their capacity to adjust, sensitivity to change due to disturbance, and the pressures (natural and human) that affect their geomorphic condition. The Geomorphic stream condition of the Subject Site is mapped as “Poor”.
High Ecological Value Aquatic Ecosystem (HEVAE) Mapping	This map describes a range of instream values and their importance for NSW freshwater river reach. This includes values such as diversity, distinctiveness, naturalness and vital habitat. NSW HEVAE Instream Value is “Low” within the Subject Site.
Proposed Development	The proposed development is a Staged Subdivision including a creek road crossing.

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Figure 1 - Site Location

Date: January 2025

Location: 20 & 20A Cantwell Road & 60 New England Highway, Lochinvar NSW

Client: Diocese

AEP ref: 4951

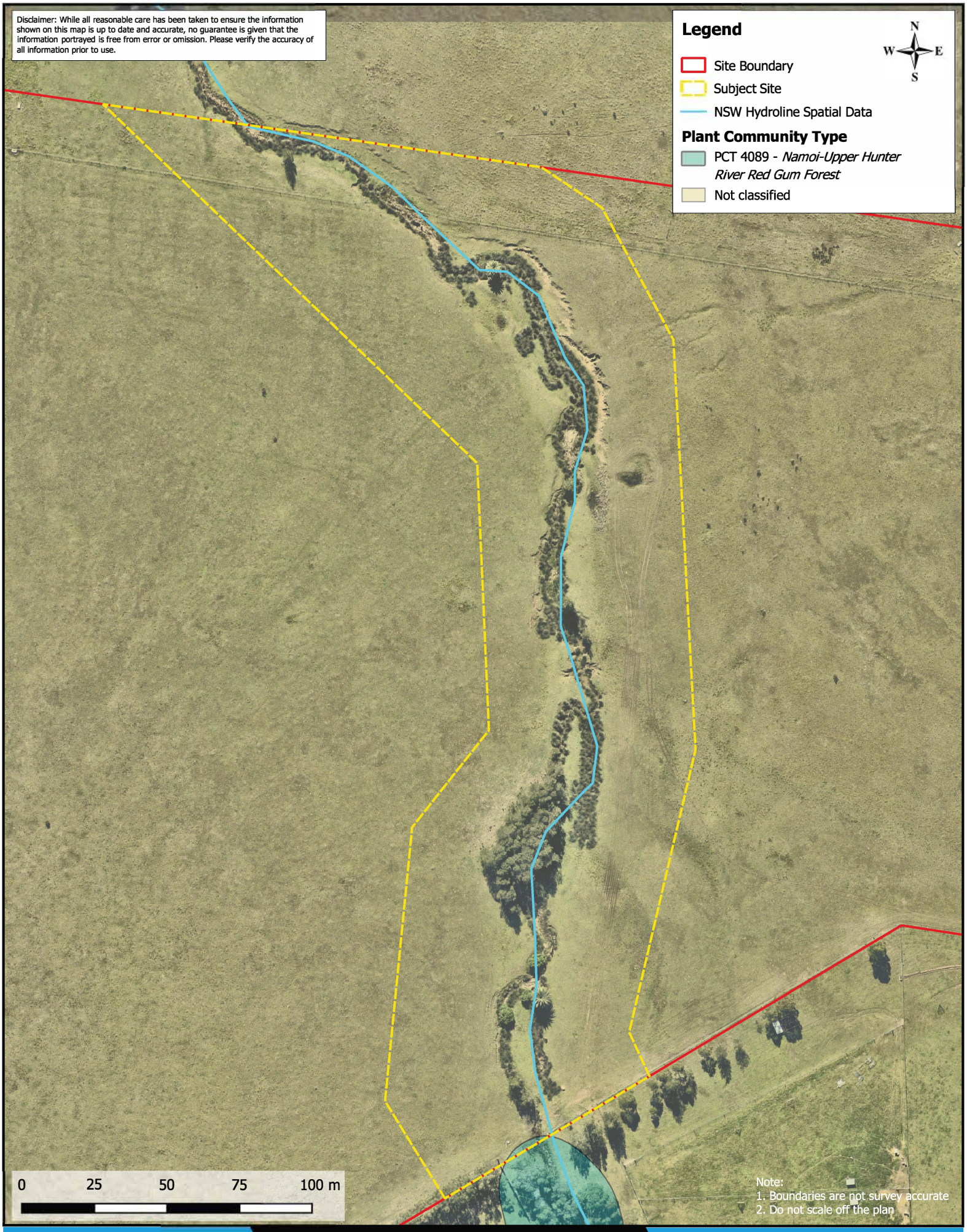

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Figure 2 - State Vegetation Type Mapping Date: January 2025

Location: 20 & 20A Cantwell Road, Lochinvar NSW

Client: Diocese AEP ref: 4951

4.0 Methods

The assessment approach was tailored to undertake sufficient works relating to threatened and native aquatic species, and their habitats, to ensure that legislative requirements were met for the proposal.

To ensure a robust impact assessment approach, where any potential doubt remained over species impact, presence within the Study Area was assumed to ensure a precautionary approach was employed.

Consideration of other matters such as downstream and catchment effects are included.

4.1 Literature Review

Primary information sources reviewed included:

- Aerial Photograph Interpretation (API) of the site and surrounding locality;
- Review of spatial data presented by the Fisheries NSW Spatial Data Portal;
- Review of Department of Primary Industries Threatened Species Lists and distribution maps;
- Note that any records considered erroneous, historic (records before 1999), or obviously of no relevance to the site in regards to habitat have been omitted from assessment;
- Other reports produced by AEP for the Subject Site; and
- Collective knowledge gained from previous aquatic ecological survey and assessment in the Maitland area over more than 25 years has also been relied upon.

4.1.1 SBDAR Summary

This report has been prepared to meet the requirements of the *Biodiversity Assessment Method 2020* (BAM) established under Section 6.7 of the *Biodiversity Conservation Act 2016* (NSW). This assessment utilises methods applicable to the 'Small Areas' module, detailed within the BAM Order 2020 to identify biodiversity values inherent within the site, including known and potentially occurring threatened species and ecological communities, and quantifies impacts of the proposal upon these values.

The Client is proposing a subdivision of subdivision of Lots 1 and 2 DP 1299958 including infrastructure and a creek crossing, along with road widening affecting Lot 2 DP 1214402. Lots are zoned R1 General Residential and C3 Environmental Management. The land is not Biodiversity Values (BV) mapped, however the clearing of 0.5ha of native vegetation triggering entry into the Biodiversity Offset Scheme (BOS).

The Subject Site is currently vacant with no existing infrastructure and has been impacted by historical and current agricultural usage.

Within the boarder Study Area, two (2) Plant Community Types (PCTs) were identified:

- 0.39ha of PCT 3433 – *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* (highly degraded); and
- 0.11ha of PCT 4023 – *Coastal Valleys Riparian Forest* (Highly degraded & Lower-stratum only).
- 15ha of Vegetation determined as "Planted Native" due to the presence of *Cynodon dactylon* was also identified on site and is assessed thereafter.
- 0.15ha of Non-Native.

It is noted that the only native vegetation observed within the Subject Site (as identified above 20 & 20A Cantwell Rd Lochinvar, NSW) is PCT 4023 – *Coastal Valleys Riparian Forest* and the Planted Native (*Cynodon dactylon*).

The proposal will regenerate approximately 2.33ha of native vegetation. As part of this proposal to avoid impacts, the proposal has been designed to utilise where possible the areas of lowest biodiversity values and avoid and minimise impacts to the areas of higher value and surrounding vegetation whilst retaining higher valued habitat and connectivity.

Fauna species recorded were typical of those expected in this locality and in this type of remnant habitat with existing connection to larger patches of habitat offsite (>500ha). The SAII listed species Swift Parrot was identified via Important Areas habitat mapping within the Study Area, and therefore presence and impact is assumed and an SAII impact assessment undertaken.

Biodiversity values were assessed for the Development footprint, resulting in the calculation of Biodiversity Offsets being determined for the Subject Site.

It is noted that the PCTs identified on site are not associated with a Commonwealth Listed Threatened Ecological Community (TECs) and no additional assessments were required for TECs at a Commonwealth level. It is not anticipated that a Commonwealth referral would be required as part of this proposal.

4.1.2 WLAR

The Waterfront Land Assessment Report, 2025, included both a desktop and field-based assessment of the system within the Subject Site and surrounding lands. The desktop assessment indicated the presence of a single 3rd order stream mapped within the Subject Site and an additional eleven (11) 1st order streams, three (3) 2nd order streams and one (1) 3rd order stream mapped within the Study Area.

However, field surveys identified no Waterfront Land (WFL) features in Segments 1, 2, 3, 4, 5, 6, 10. 12, 14 and 20. API and historical review identified urban development has likely resulted in the modification of Segment 16-19, which was confirmed at Survey point 20.1. Segments 16-19 are not considered WFL or tributaries as defined under the WM Act.

WFL features were observed in Segments 11, 15 and 21, and these Segments were determined to be WFL.

Under **Schedule 2** of the WM Act, a Merit Based 20m VRZ (either side total of 40m) was allocated to Segment 21 for the purpose of a CAA given the severely declined state of the waterfront land within the Subject Site.

4.2 Legislation Review

4.2.1 Fisheries Management Act 1994

Under *Part 4* of the *Environmental Planning and Assessment Act, 1979*, (EP&A Act), NSW DPI is a 'determining authority' for local development that requires one or more of the following permits under the FM Act:

- The proposed culvert and vegetated rehabilitation batter trigger ***Section 201*** requiring a permit to carry out works of dredging or reclamation (i.e. any excavation within, or filling or draining of, water land or the removal of woody debris, snags, rocks or freshwater native aquatic vegetation or the removal of any other material from water land that disturbs, moves or harms these in-stream habitats);
- The installation of the proposed culvert will require the creek to be diverted during construction temporarily blocking fish passage triggering ***Section 219*** requiring a permit to obstruct the free passage of fish; and
- As the Subject Site is confirmed waterland and mapped Key Fish Habitat there is potential to impact to threatened species listed under the FM Act, therefore assessment under **Section 220** is required to ensure the proposed development will not have a **s**ignificant effect on threatened species, populations or ecological communities, or their habitats.

4.3 Field Survey

Aquatic and riparian vegetation and habitat were surveyed utilising a variety of methods including:

- Visual survey of the low flow channel for presence of aquatic flora / fauna;
- Dip netting targeting threatened species
- Bank and bed assessment;
- Ground-truth top of bank;
- Aquatic and riparian vegetation surveys;
- Detailed condition of stream, including obstructions to fish passage; and
- Identification of habitat features including refuge pools, overhanging vegetation and timber snags.

Table 2 and **Figure 4** outline the survey effort and periods.

Table 2 – Field Survey Effort

Date	Time	AEP Staff	Activity
30/08/2022	9:00 – 12:45	CW, KB	Waterfront Land Assessment – Upper Catchment (Study Area)
20/03/2024	10:30 – 12:00	BYO, JFB	Aquatic Ecology Assessment Upper Catchment (Study Area)
20/05/2024	7:30 – 12:00	BYO, JFB	Waterfront Land Assessment – Subject Site
20/05/2023	13:00 – 17:00	BYO, JFB	Aquatic Ecology Assessment – Subject Site, including; • Dip netting; and • Habitat assessment.
28/05/2024	6:30 -14:30	KB	Habitat Assessment – for SBDAR including watercourse
28/05/2024	6:30 -14:30	YB, OS	BAM Plots and Vegetation Mapping including watercourse

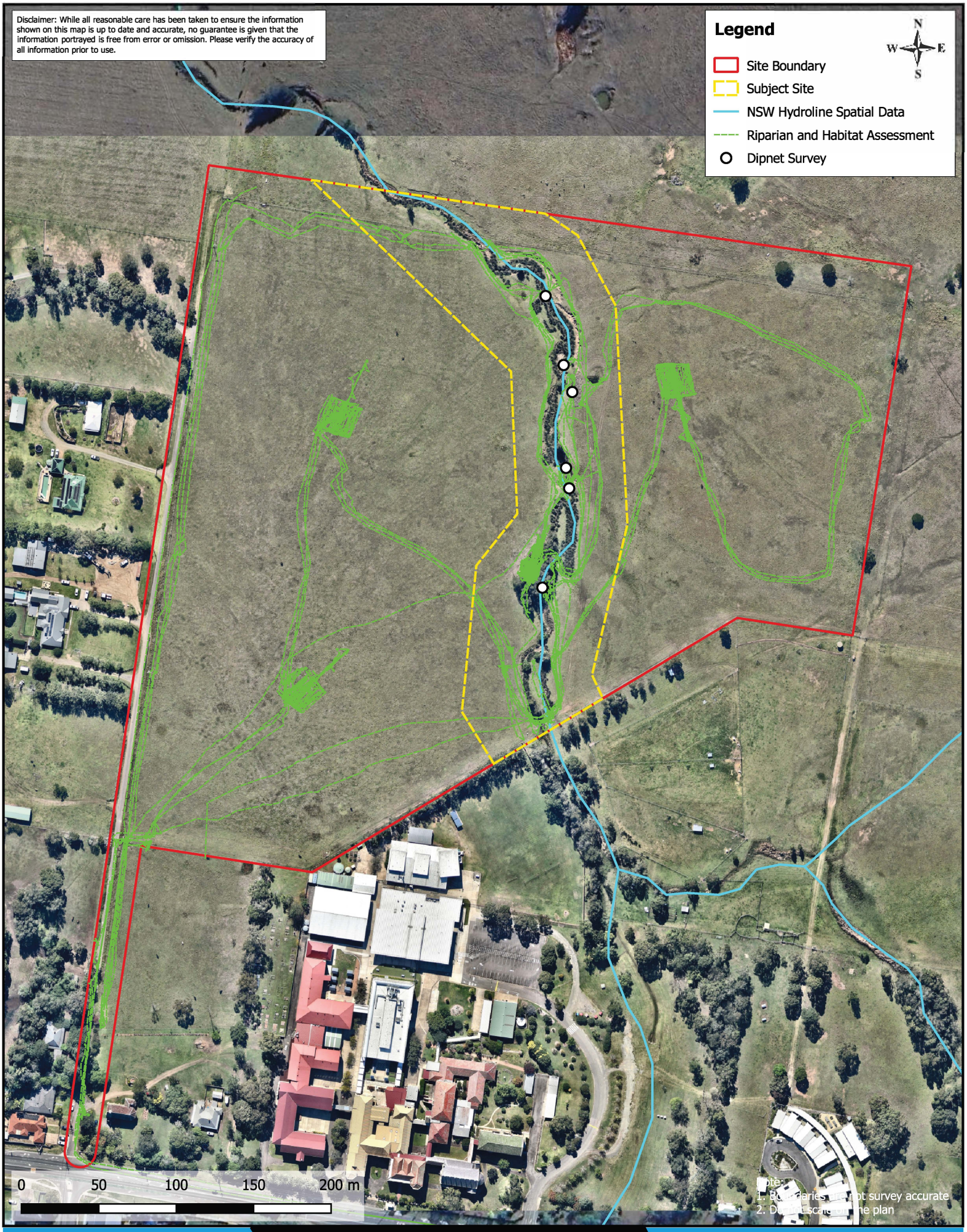

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Figure 3 - Survey Effort

Date: January 2025

Location: 20 & 20A Cantwell Road, Lochinvar NSW

Client: Diocese

AEP ref: 4951

5.0 Aquatic Results

5.1 Waterway Assessment

The watercourse sits in a floodplain between open grassland pasture to the north and a strip of approximately 300m of open pasture / school grounds and the New England Highway (NEH) to the south. The watercourse enters the Subject Site through the adjoining pasture lands to the south east. Two (2) culverts under the NEH allow flow to enter the adjoining site within the greater Study Area. Recent developments on the southern side of the NEH channel stormwater through both culverts, discharging on the north side of the NEH, into the Study Area where flow disperses before entering the creek.

The Subject Site is an unamed tributary of Lochinvar Creek, which in turn is a tributary of the Hunter River; the Subject Site is located approximately 3.5km from the main arm of the Hunter River and has been assessed as a permanent watercourse. The Subject Site is managed agricultural land for the purpose of grazing, currently cattle.

The creek has watercourse features, such as pools, riffles, meanders and aquatic vegetation (noting it is exotic). The past and present land use impacts include land clearing, limited to no regeneration of native vegetation, establishment of exotic aquatic vegetation, severe erosion, removal of snags, changes in formation of the low flow channel and location of banks and deposition bars. These changes along with two (2) blockages to fish passage have resulted in the Subject Site having limited to no fish connectivity with the main arm of Lochinvar Creek and the greater Hunter River Catchment. API of Lochinvar Creek downstream of the Subject Site revealed a number of additional potential barriers to fish passage.

There is significant instream impact and erosion, portions of the creek become very shallow with minimal flow. Water quality is highly disturbed / turbid by cattle in shallow sections. A few deep holes are upstream of the cattle impacted shallow areas and are bound by juncus. The pools have very high turbidity. Aquatic associated vegetation present is exotic juncus, which is proposed to be replaced with native vegetation to restore function within this tributary of the Hunter River.

5.1.1 Waterway classification

NSW DPI Fisheries has provided a waterway classification scheme (**Table 3**) for assessment of watercourses (primarily freshwater and brackish) and classifies these streams using indicators such as (DPI Fisheries, 2013):

- hydraulic geometry (stream shape and size),
- frequency of stream flows (perennial, intermittent or ephemeral),
- presence of aquatic habitat units (pools, riffles, vegetation, snags),
- presence of threatened or protected fish species and other native fish, and
- connection to adjacent habitats (e.g. floodplain wetlands).

Waterway **CLASS** can be used to assess the impacts of certain activities on fish habitats in conjunction with the habitat sensitivity **TYPE** (described below in **Section 6.2**). The waterway **CLASS** scheme can also be used to assess impacts on different fish habitats, such as waterway crossings, and make recommendations to minimise impact.

Table 3 – Classification of waterways for fish passage

Classification	Characteristics of waterway class
CLASS 1 **Major key fish habitat**	Marine or estuarine waterway or permanently flowing or flooded freshwater waterway (e.g. river or major creek), habitat of a threatened or protected fish species or 'critical habitat'.
CLASS 2 **Moderate key fish habitat**	Non-permanently flowing (intermittent) stream, creek or waterway (generally named) with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Freshwater aquatic vegetation is present. TYPE 1 and 2 habitats present.
CLASS 3 **Minimal key fish habitat**	Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other CLASS 1-3 fish habitats.
CLASS 4 **Unlikely key fish habitat**	Waterway (generally unnamed) with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free standing water or pools post rain events (e.g. dry gullies or shallow floodplain depressions with no aquatic flora present).

Source: DPI Fisheries, 2013.

The waterbody within the Subject Site has been modified for agricultural use including road crossing and disposal of vegetation material. During the surveys in 2024 the water levels were high with minimal to no native vegetation was present within the creek and within the riparian zone.

As defined by Department of Climate Change, Energy, the Environment and Water, 2024, *When healthy, watercourses have a rich natural diversity of plants and animals they can act as filtering systems, removing sediment, nutrients and pollutants from water.*

This system with only one native aquatic species is not defined as healthy.

It is well researched for both terrestrial and aquatic habitats that native endemic plants are the ecological basis upon which life depends, including birds, fish, mammals, etc. Without them and the insects that co-evolved with them, local animals such as fish, birds etc cannot survive. Unfortunately, one native aquatic species Typha does not provide the variety of habitat required to support our native fish, macroinvertebrates and other aquatic / semi aquatic species.

AEP surveys did not result in any macroinvertebrates and only one species of native fish, while gambusia was recorded in high numbers. It is likely that the Gambuisa are preying on native fauna, however other reasons for the high population of pest species is due to the limited habitat within the system.

The lack of native riparian vegetation, shows the watercourse is in a highly degraded state. **Appendix B** provides a flora species list for the Study area. **Appendix C** shows the Ground-truthed vegetation for Study Area extracted from the Biodiversity Development Assessment Report. The Typha species recorded is not able to be classified as they were flowering at the time of survey the distinguishing feature required is the female Inflorescence was not present.

The vegetation within the degraded floodplain has been assessed in the SBDAR as being a stand of *Casuarina glauca* and planted native vegetation with the dominant species being *Cynodon dactylon*.

The Cynodon dactylon has been assessed under the Planted module of the BDAR. This species is targeted for removal in the BMP to increase diversity within the Floodplain. The Species is known for a thick carpet matting in the roots system, prohibiting other groundcovers, shrubs and trees to grow.

Overall, this creek and floodplain are considered **Class 3** given there highly degraded condition and minimal native vegetation and habitat features like snags, roots and rocks etc.

5.2 Key Fish Habitat

One of the objectives of the FM Act is to 'conserve key fish habitats'. To achieve the objectives of DPI - Fisheries have mapped 'Key Fish Habitats' throughout NSW. The mapped habitats are those aquatic habitats that are important to the sustainability of the recreational and commercial fishing industries,

the maintenance of fish populations generally, and the survival and recovery of threatened aquatic species.

'Key Fish Habitat' (KFH) includes

- All marine and estuarine habitats up to highest astronomical tide level (that reached by 'king' tides); and
- Most permanent and semipermanent freshwater habitats including rivers, creeks, lakes, lagoons, billabongs, weir pools and impoundments up to the top of the bank.

Exclusion from KFH are:

- Small headwater creeks and gullies (known as first and second order streams), that only flow for a short period after rain are generally excluded;
- Farm dams constructed on such systems;
- Wholly artificial waterbodies such as irrigation channels, urban drains and ponds; and
- Salt and evaporation ponds are also excluded except where they are known to support populations of threatened fish or invertebrates.

To assess KFH DPI Fisheries developed assessment criteria based of both desktop and field surveys. The assessment considers the 'sensitivity' of the affected fish habitat. In this context, 'sensitivity' is defined by the importance of the habitat to the survival of fish (noting that 'fish' under the FM Act includes all aquatic invertebrates) and its robustness (ability to withstand disturbance). **Table 4** defines those habitats that are considered 'key fish habitats' for the purposes of the application of the FM Act, and also includes a fish habitat sensitivity ranking which is used to differentiate between permissible and prohibited activities or developments related to the importance of the 'TYPE' of key fish habitat. **Figure 4** shows current KFH spatial data provided by DPI Fisheries.

This data was used to inform the assessment for both the direct and indirect impacts associated with the development of a proposed subdivision, on the mapped Key Fish Habitat. This assessment showed that the proposed crossing and restoration works will have limited to no impact on the highly degraded Type 3 fish habitat. Post construction there will be no direct impacts as the proposed regeneration works (all proposed works are outside of the KFH) and adjoining Biodiversity Management Plan (BMP) is likely to significantly improve the water quality, flows, availability of fish habitat, and riparian and instream vegetation. Rehabilitation under the proposed BMP focuses on achieving a naturally regenerating ecosystem through the removal of weeds and plantings of native vegetation.

The construction of the natural channel design is proposed to be undertaken when the waterway is under stagnant conditions, however a sudden flow of the creek may require a temporary diversion channel be put in place as a contingency to allow natural water movement.

AEP

Figure 4 - Key Fish Habitat Mapping

Date: January 2025

Location: 20 & 20A Cantwell Road, Lochinvar NSW

Client: Diocese

AEP ref: 4951

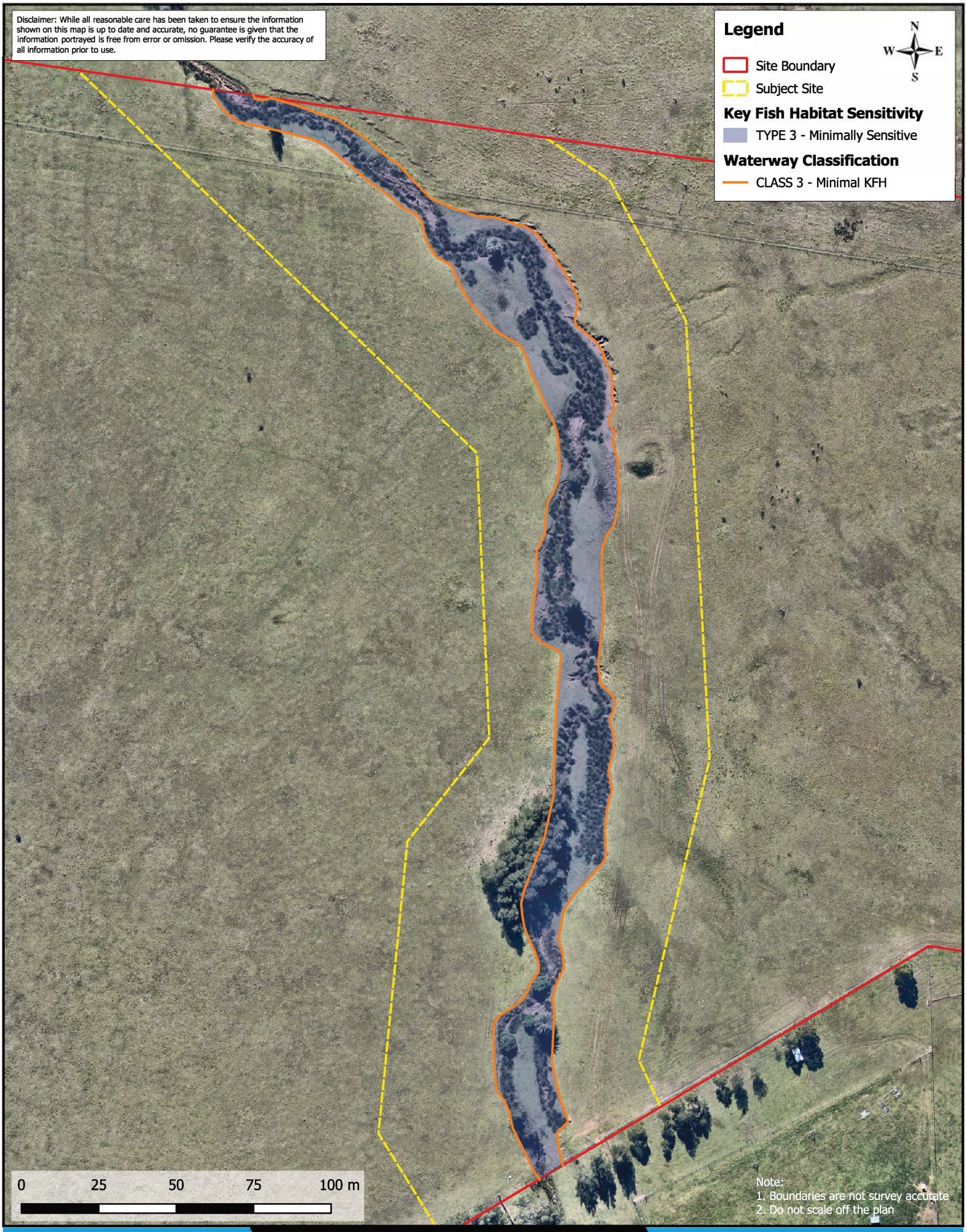
Table 4 – KFH Sensitivity Classification Assessment

Habitats	TYPE 1 - Highly sensitive key fish habitat	TYPE 2 – Moderately sensitive key fish habitat:	TYPE 3 – Minimally sensitive key fish habitat	Assessment
Marine Attributes	• *Posidonia australis* (strapweed) • *Zostera, Heterozostera, Halophila* and *Ruppia* species of seagrass beds >5m^2 in area • Coastal saltmarsh >5m^2 in area • Coral communities • Coastal lakes and lagoons that have a natural opening and closing regime (i.e. are not permanently open or artificially opened or are subject to one off unauthorised openings) • Marine Park, an aquatic reserve or intertidal protected area.	• *Zostera*, *Heterozostera, Halophila* and *Ruppia* species of seagrass beds <5m^2 in area • Mangroves • Coastal saltmarsh <5m^2 in area • Marine macroalgae such as *Ecklonia* and *Sargassum* species • Estuarine and marine rocky reefs • Coastal lakes and lagoons that are permanently open or subject to artificial opening via agreed management arrangements (e.g. managed in line with an entrance management plan) • Aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area • Stable intertidal sand/mud flats, coastal and estuarine sandy beaches with large populations of in-fauna	• Unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna • Coastal and freshwater habitats not included in TYPES 1 or 2.	The Subject Site does not occur in the marine environment.
Freshwater Attributes	• Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants • Mound Spings	• Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1 • Weir pools and dams up to full supply level where the weir or dam is across a natural waterway.	• Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation	Due to lack of riparian vegetation and native aquatic vegetation the Creek is in a highly degraded state with severe erosion within the low flow channel and the rills/gully erosion within the floodplain.

Habitats	TYPE 1 - Highly sensitive key fish habitat	TYPE 2 – Moderately sensitive key fish habitat:	TYPE 3 – Minimally sensitive key fish habitat	Assessment
				No aquatic vegetation or wetland vegetation was identified during field surveys within water land. As defined by Department of Climate Change, Energy, the Environment and Water, 2024, *When healthy, wetlands have a rich natural diversity of plants and animals. These can act as filtering systems, removing sediment, nutrients and pollutants from water.* This system with only one native aquatic species is not defined as healthy. It is well researched for both terrestrial and aquatic habitats native endemic plants are the ecological basis upon which life depends, including birds, fish, mammals, etc. Without them and the insects that co-evolved with them, local animals such as fish, birds etc cannot survive.

Habitats	TYPE 1 - Highly sensitive key fish habitat	TYPE 2 – Moderately sensitive key fish habitat:	TYPE 3 – Minimally sensitive key fish habitat	Assessment
				Unfortunately, one native aquatic species does not provide the variety of habitat required to support our native fish, macroinvertebrates and other aquatic / semi aquatic species. AEP surveys did not result in any macroinvertebrates and only one species of native fish, while exotic species were observed in high numbers. It is likely that some of the exotic species are preying on native fauna, however other reasons for the high population of pest species is due to the limited habitat within the system. The lack of native riparian and aquatic vegetation, shows the watercourse is in a highly degraded state. **Appendix B** provides a flora species list for the Study area. **Appendix C** shows the Ground-truthed vegetation for Study Area extracted from the Biodiversity

Habitats	TYPE 1 - Highly sensitive key fish habitat	TYPE 2 – Moderately sensitive key fish habitat:	TYPE 3 – Minimally sensitive key fish habitat	Assessment
				Development Assessment Report. The Typha species is not able to be classified as they were not flowering at the time of survey the distinguishing featured required is the female Inflorescence was not present.
Wetland Attributes	• SEPP 14 coastal wetlands, wetlands recognised under international agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA wetlands), wetlands listed in the Directory of Important Wetlands of Australia[2]	N/A	N/A	No wetlands occur within the Subject Site.
Threatened Species	• Any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act	N/A	N/A	No threatened species or communities listed under the FM Act were identified during field surveys.
Results	**TYPE 3 – Minimally sensitive key fish habitat**			
Recommendations	• Buffer requirements for the creek are 10m to 50m. The proposed development should implement Vegetated Riparian Zone (VRZ) buffers (20m) as determined by the Waterfront Land Assessment Report (AEP, 2025). • Biodiversity Management Plan will be required to regenerate the aquatic and riparian zones within the retained lands. • Waterway crossing should avoid the native riparian vegetation, specifically the Casuarina stand (refer **Figure 7**) • Waterway crossing design should allow for fish passage in accordance DPI Fisheries guidelines.			



AEP

Figure 5 - Habitat Sensitivity and Waterway Classification

Date: January 2025

Location: 20 & 20A Cantwell Road, Lochinvar NSW

Client: Diocese

AEP ref: 4951

5.2.1 KFH Results

As discussed above, the section of Lochinvar creek to the east and with Subject Site is highly degraded and modified, limiting its function to support fish communities or native aquatic flora. The Field surveys identified the following features (**Figure 6**):

- Immature wetland conditions were observed within the Study Area in the south east (adjoining lands, not within the Subject Site).
- Floodplain – a flood plain channel approx. 20m wide was observed, limited to no native riparian vegetation with the exception of one (1) stand of Casuarina**.**
- In-stream Vegetation, one species of aquatic vegetation were recorded being Typha spp.
- Stream channels and Substrates – sandy erosive soils with rills and gullies within erosion gullies in the flood plain

5.3 Snags Assessment

Large woody debris, or 'snags', refers to the large woody debris from trees and shrubs, including whole fallen trees, broken branches and exposed roots that have fallen or washed into a waterway and are now wholly or partially submerged by water. Snags also include submerged large rocks (of greater than 50cm in two dimensions).

Snags tend to accumulate in freshwater and upper estuarine areas and form one of the most important habitat components for fish within streams by:

- providing places to rest out of the main current flow;
- providing sites to hide from predators or avoid direct sunlight;
- providing ‘markers’ to designate territorial boundaries for species that move or migrate within the river system (e.g. Murray cod and golden perch);
- providing breeding sites for species such as river blackfish and Murray cod which lay adhesive eggs onto hard substrates;
- providing a surface for algal, fungal, bacterial, plants and insects to colonise;
- stabilising sediments and protecting the stream bed and banks, thereby preventing stream erosion; and

The removal of woody debris and snags or work that involves the removal of any other material from water land that disturbs, moves or harms woody debris and snags is considered “dredging” under the FM Act.

“Removal of large woody debris from NSW rivers and streams” is listed as a key threatening process under Part 7A of the FM Act. This imposes certain requirements upon authorities when authorising an activity or development that may involve in-stream woody habitat removal.

5.3.1.1 Results

One snag, less than 300mm in diameter and less than 3m in length was identified in the Creek. Hence it has been determined that this habitat is not present within the Creek. Refer **Figure 6** to show the location.

5.4 Fish Passage

Australian native fish require unimpeded access along waterways in order to survive and reproduce. Both fresh and saltwater fish move within waters at different times to access food and shelter, to avoid predators, pest management, and to seek out mates. Of the 83 species of freshwater fish in south eastern Australia, over half migrate at least once as part of their life cycle, migrating hundreds of meters to thousands of kilometres.

Barriers to fish passage prevent movement of native fish species, which can have severe implications for these populations. In extreme cases, barriers can result in localised extinctions. This has occurred for golden perch populations above several large weirs and dams.

Barriers can be:

- physical structures (e.g. dams, floodgates, causeways and weirs);
- hydraulic (e.g. areas of high velocity flow or turbulence);
- chemical (e.g. pollution plumes, acid sulfate soil discharge and low dissolved oxygen slugs); and
- behavioural obstructions (e.g. dark tunnels or unnatural substrates created by pipes).

Habitats where food and shelter are degraded may also impact upon the migration of native fish species. Fish passage barriers can adversely impact native fish by:

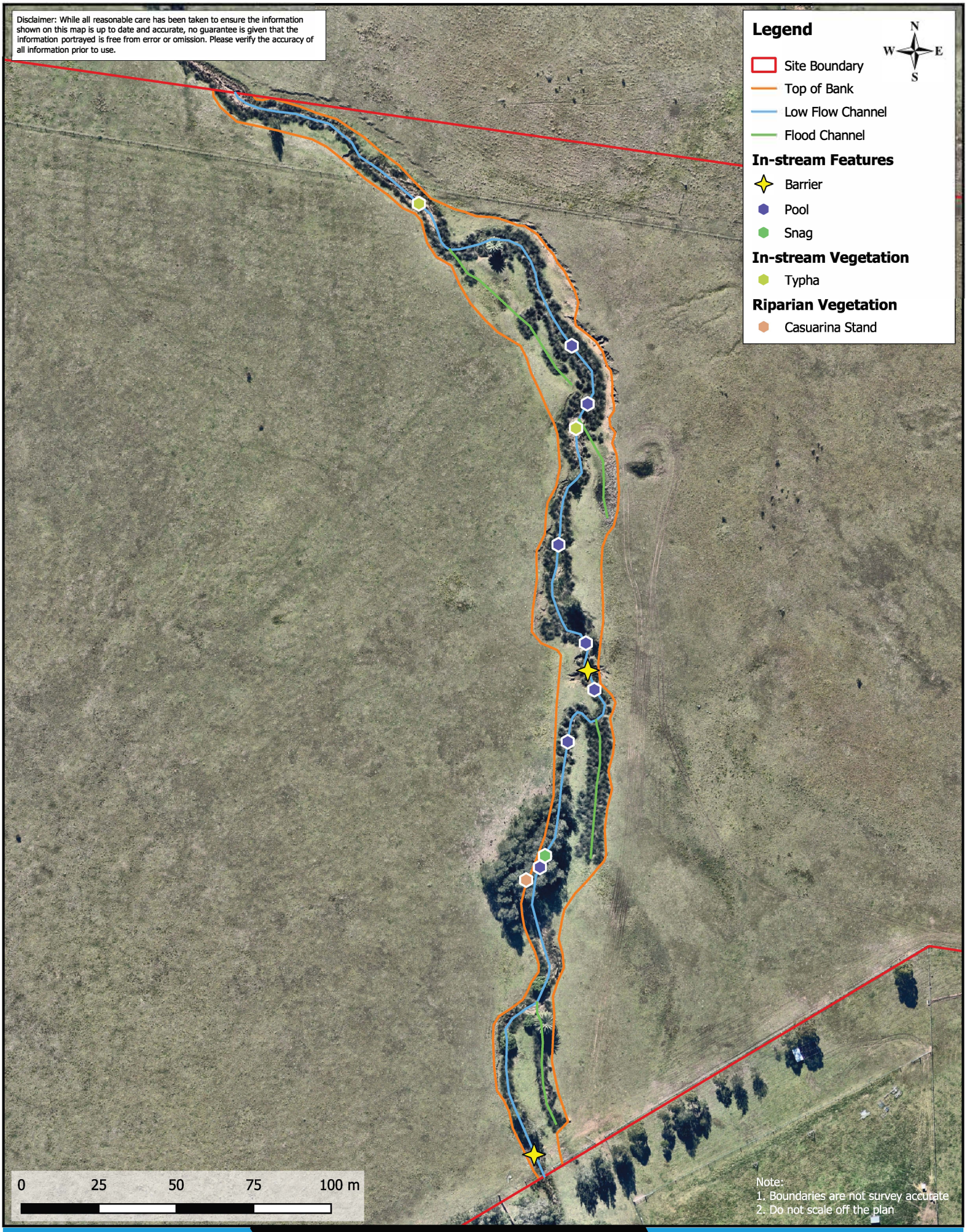
- interrupting spawning or seasonal migrations;
- restricting access to preferred habitat and food resources;
- increasing the chance of predation and disease; and
- reducing genetic flow between populations through population fragmentation.

Assessment of barrier includes assessment of cumulative effect of barriers to fish passage, as this is listed as a Key Threatening Process to the continuing survival of several species of native fish in Australia.

Under *Section 219* of the FM Act, fish passage is not to be blocked without a permit from NSW DPI Fisheries:

5.4.1.1 Results

As stated above and shown in **Figure 6** there are two (2) blockages to fish passage, both man-made structures for crossings. The blockages have resulted in the Creek having limited to no fish connectivity with the main arm of Lochinvar Creek and the greater Hunter River Catchment.



AEP

Figure 6 - Ground-truthed Key Fish Habitat

Date: January 2025

Location: 20 & 20A Cantwell Road, Lochinvar NSW, Lochinvar

Client: Diocese

AEP ref: 4951

5.5 Flora

The plants growing on the water's edge, the banks of rivers and creeks and along the edges of wetlands are referred to as 'riparian vegetation'. Riparian vegetation constitutes all stratum and when native forms an important part of a healthy functioning ecosystem and has many important ecological benefits.

Aquatic vegetation may include trees, sedges and rushes, submerged macrophytes and algae. Some trees such as Melaleucas and Casuarina species, these species can grow within channels and provide fish habitat by creating bars, islands and pools along the bed of the stream. Some sedges grow directly in the aquatic zone and provide excellent bank protection and capture nutrients. The tree roots of both aquatic and riparian vegetation stabilise sediments and the exposed vegetation increases channel roughness. This slows water flow, creating backwaters and eddies where fish can rest.

Macrophytes (including submerged and semi-submerged species) act as a nutrient sink and source, stabilise sediments, and provide habitat for fish and other aquatic organisms. Freshwater and brackish species provide small fish with feeding opportunities and shelter. Macrophytes function as migration corridors for fish species that migrate between saltwater and freshwater throughout their lifecycle, and are therefore critical to the recruitment success of some fish species such as Australian bass.

5.5.1 Flora Results

The Subject Site is currently vacant with no existing infrastructure and has been impacted by historical and current agricultural usage.

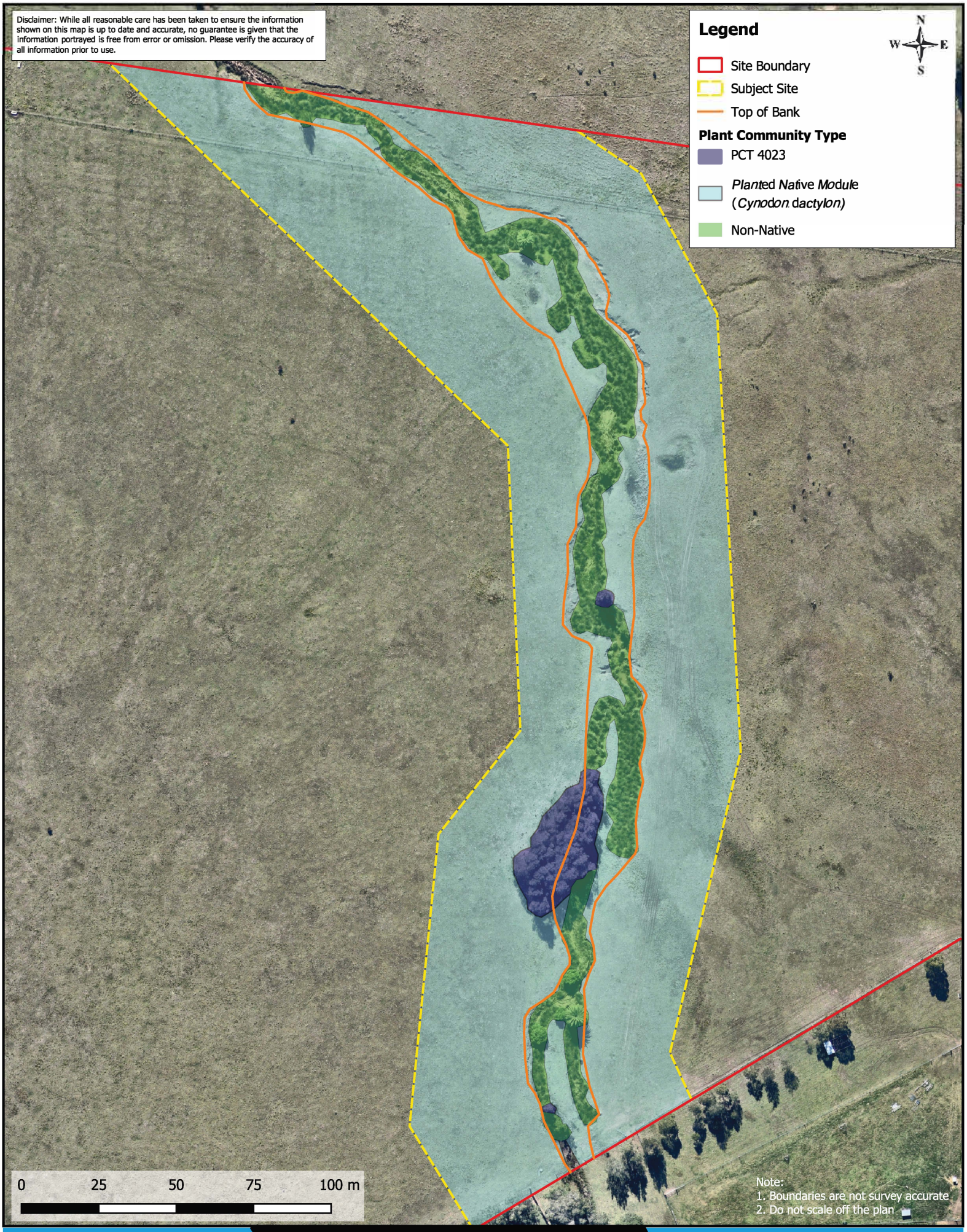
Within the Subject Site, one (1) Plant Community Types (PCTs) and one Planted Native - *Cynodon dactylon* was identified.

As shown in **Figure 3** the aquatic vegetation is exotic with limited native riparian vegetation present.

The Casuarina trees and Typha sp. shown within **Appendix B** occur on the banks of unnamed creek a tributary of the Hunter River. The proposed development and stormwater overflow area will not impact the vegetation within the unnamed creek.

As shown in **Figure 3** the aquatic vegetation is exotic with limited native riparian vegetation present.

Appendix B provides a flora species list for the Study area. **Appendix C** shows the Ground-truthed vegetation for Study Area extracted from the Biodiversity Development Assessment Report.



AEP

Figure 7 - Riparian Corridor Vegetation

Date: January 2025

Location: 20 & 20A Cantwell Road, Lochinvar NSW

Client: Diocese

AEP ref: 4951

5.6 Fauna

Fish communities are co-occurring populations of individual fish species within habitats. Changes in fish communities are driven by a range of interactions within the ecosystem such as:

- Species health;
- Waterway health;
- Habitat availability;
- Access / movement through a system (obstructions);
- Foraging availability;
- Predation;
- Natural events (fire, drought, flood); and
- Disturbance, both natural and human induced.

The combined effects of each of these processes governs the species composition and relative abundances of species within the community. Given the large catchment area of the Hunter River and the extensive altitudinal range and underlying geological features, consequent range of habitats, and spatial variation in the level and type of human disturbance, the composition of fish communities occurring at sites are unlikely to be consistent with healthy section of the catchment.

Fish identified by Howell and Creese, 2010, found that in the upland tributaries of the Hunter the following native fish are likely to be present:

- *Anguilla* spp;
- Australian bass;
- Australian smelt;
- Cox's gudgeon;
- *Hypseleotris* spp;
- Short-finned eel; and
- Flat head gudgeon.

5.6.1 Fauna Results

Two fish species were observed during field surveys; one (1) native species, Carp Gudgeon *(Hypseleotris* spp.) (**Plate 1**) and one (1) exotic species, Gambusia (*Gambusia holbrooki*). The native fish was caught between the two instream obstructions, therefore is not likely to breed outside of extreme high flow events. Over 100 Gambusia were collected throughout the entire Creek.

Plate 1: *Hypseleotris* spp. (Carp Gudgeon)

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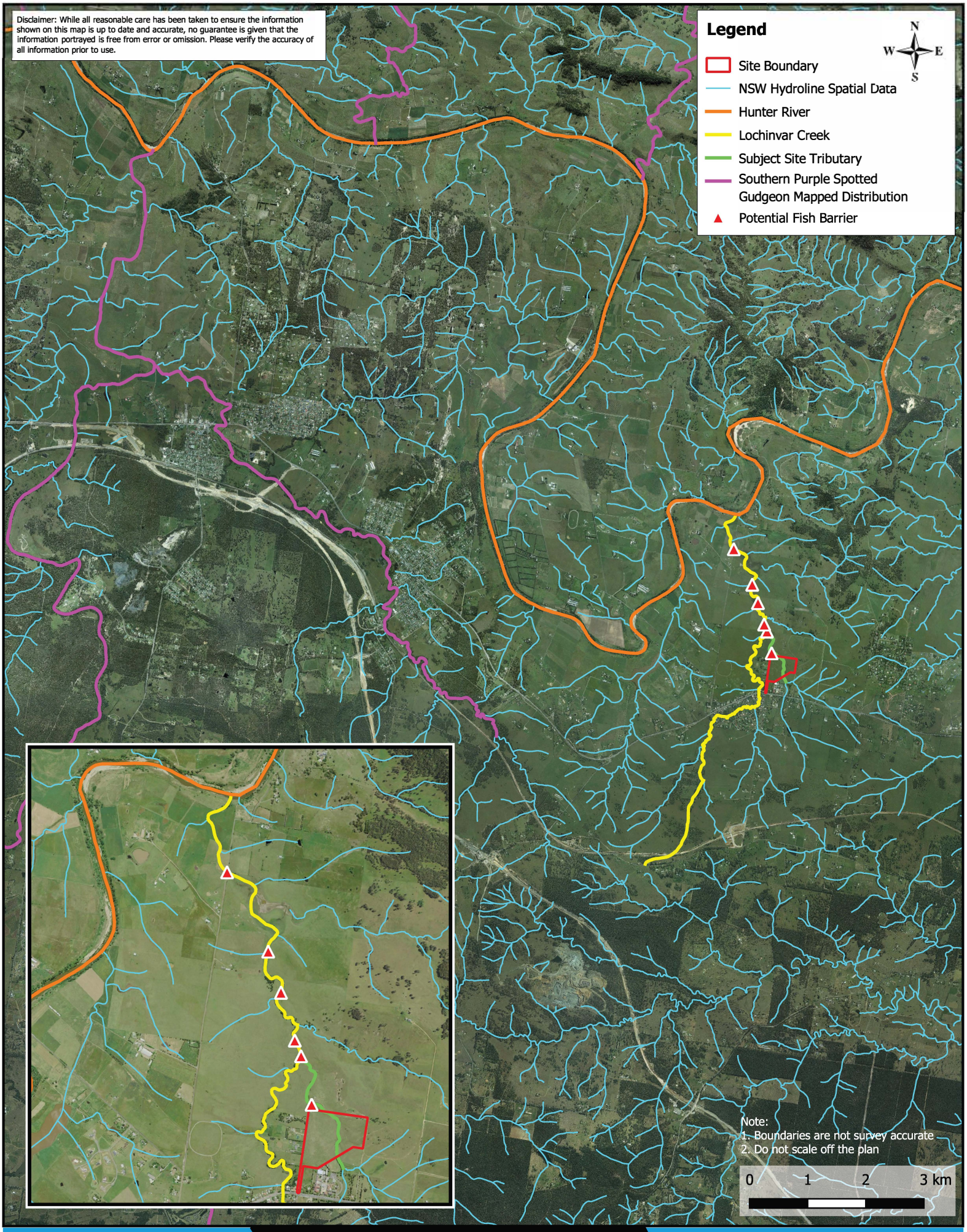
5.6.2 Results

Table 5 provides an assessment of the listed species and endangered communities.

Table 5 – Listed Species Appraisal

Scientific Name	Common Name	Status	Distribution	Habitat	Likelihood of Occurrence	Key Subject Species
Archaeophya adamsi	Adams Emerald Dragonfly -	E	Adam's Emerald Dragonfly is one of the rarest dragonflies in the country. It breeds in rivers and streams in coastal areas. In the past 35 years it has been collected from only four sites in the Greater Sydney region.	Adam's Emerald Dragonfly larvae occur in narrow shaded riffle zones with moss and abundant river bank vegetation in small to moderate sized creeks with gravel or sandy bottoms.	The species has been recorded in upper reaches of the Hunter River Catchment. However, the habitat required for the species being shaded narrow riffle sections with gravel beds is not present within the Subject Sie or greater Study are, due to past and present land uses.	Not considered due to habitat being highly degraded and not present within the Subject Site.
Mogurnda adspersa	Southern Purple Spotted Gudgeon	E	The Southern Purple Spotted Gudgeon occurs in the Murray-Darling basin as well as parts of coastal northern NSW and Queensland.	The species can be found in a variety of habitats such as rivers, creeks, streams and billabongs with slow-flowing or still waters. Cover in the form of aquatic vegetation, overhanging vegetation from river banks, leaf litter, rocks or snags are important for the species.	Species distribution data indicates Southern Purple Spotted Gudgeon habitat is connected approximately 19km downstream of the Subject Site and the species has the potential to occur within the Study Area (**Figure 7**). However, the habitat required for the species being aquatic vegetation, overhanging vegetation from river banks, leaf litter, rocks or snags is limited and when present is highly degraded consisting mostly of exotic species. Additionally, API revealed multiple potential natural and constructed	**Subject Species** – additional assessment is required, refer **Section 7.1**.

Scientific Name	Common Name	Status	Distribution	Habitat	Likelihood of Occurrence	Key Subject Species
					obstruction to fish passage along Lochinvar Creek, downstream of the Subject Site (**Figure 7**). Given the mapped results for the species in the Hunter Catchment AEP has used the precautionary principle and will undertake further assessment.	



AEP

Figure 8 - Threatened Species Distribution and Fish Barriers Date: January 2025

Location: 20 & 20A Cantwell Road, Lochinvar NSW

Client: Diocese AEP ref: 4951

6.0 Fisheries Management Act 1994 Assessment

Using the above information AEP has undertaken the required assessment in accordance with the FM Act and NSW DPI Fisheries guidelines *Policy and guidelines for fish habitat conservation and management (2013).*

The process for the following permits require assessment under the following sections of the FM Act:

- Threatened Species, Populations and Ecological Communities (Section 220ZA-220ZE);
- Dredge and Reclamation (Section 201);
    - Riparian and Freshwater Aquatic Vegetation Assessment;
    - Snag assessment; and
    - Environmental Risk Assessment (Aquatic).
- Blockage to Fish Passage (*Section 219*).

6.1 Threatened Species, Populations and Ecological Communities

Detailed analysis of NSW DPI (Fisheries) Threatened Species List and Spatial Data Portal were undertaken in June 2024. Species distribution data indicates *Mogurnda adspersa* (Southern Purple Spotted Gudgeon) habitat is connected approximately 19km downstream of the Subject Site and the species has the potential to occur within the Study Area. Following the precautionary principle, targeted field surveys were undertaken and given the mapped data further assessment is considered below for this species.

Table 6 provides a comprehensive threatened species assessment in accordance with Department of Primary Industries (2008) *Threatened species assessment guidelines: The Assessment of Significance*.

Table 6 – Threatened Species Impact Assessment

No.	Clause	Assessment
a)	*In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*	*Mogurnda adspersa (Southern Purple Spotted Gudgeon)* was not identified during field surveys. Given the poor water quality, numerous downstream barriers and limited habitat it is considered unlikely this species would utilise the Subject Site.
b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.*	No endangered populations are currently mapped within the Study Area or surrounds. No species belonging to an endangered population was observed during field surveys. The proposal is considered unlikely to impact a listed endangered population.
c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:* *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	There were no endangered ecological communities or critically endangered ecological communities within the aquatic environment identified within the Subject Site.

No.	Clause	Assessment
d)	*in relation to the habitat of a threatened species, population or ecological community:* *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*	The watercourse within the Subject Site will be reconstructed incorporating watercourse features to improve the quality and quantity of available riparian and riverine Key Fish habitat. This will include the construction of in-stream pools, riffles, meanders and snags, reducing erosion. The Riparian Corridor will be managed under a 5-year Biodiversity Management Plan to ensure benchmark riparian condition is achieved.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	The removal of the existing blockages to fish passage and the installation of a fish passage friendly culvert will significantly improve connectivity within the Lochinvar Creek and greater Hunter River Catchment.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	The Subject Site is currently in poor condition from historical and surrounding land uses. Development of the culvert is likely to improve site ecological condition.
e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*	No critical habitat was listed as occurring within the Study Area.
f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*	DPI Fisheries Priority Action Statement lists a number of habitat Regeneration objectives. While the Subject Site is unlikely to support *Mogurnda adspersa (Southern Purple Spotted Gudegon),* improvements to water and riparian quality from the culvert and associated BMP would align with these objectives.
g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*	***Degradation of native riparian vegetation along New South Wales water course****s.* Sections of native riparian vegetation are proposed to be cleared for installation of culverts and associated waterway crossing infrastructure. These impacts are to be offset within the associated BMP. Given the small area of impact and the much larger area to be managed and regenerated under the BMP, it is considered likely the overall ecological and biodiversity conditions of the site will be improved. ***Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams*** The proposed crossing will be designed to ensure natural flow as are maintained fish passage is achieved. ***Removal of large woody debris from New South Wales rivers and streams*** No large debris was recorded, the BMP will ensure installation of large woody debris.

6.2 Dredge and Reclamation

Under *Section 201* of the FM Act, a permit is required to carry out works of dredging or reclamation. This includes any excavation within, or filling or draining of, water land or the removal of woody debris, snags, rocks or freshwater native aquatic vegetation or the removal of any other material from water land that disturbs, moves or harms these in-stream habitats.

6.2.1 Environmental Risk Assessment

A Dredge and Reclamation application requires evaluation of risk of environmental impacts from the proposed works as per **Section 228** of the *Environmental Planning and Assessment Regulation 2000*. The EP&A Regulation 2000 has subsequently been superseded by the *Environmental Planning and Assessment Regulation 2021*. Therefore, evaluation has been undertaken against the criteria listed in **Section 171** of the EP&A Regulation 2021 (**Table 5**).

Table 7 – Environmental Risk Assessment

Risk	Level (High, Moderate, Low, Nil)	AEP Assessment
The environmental impact on the community,	Nil	The aquatic assessment above show that within the Subject Site Upper tributary of Lochinvar Creek is highly degraded and not able to naturally regenerate, regulate water quality or provide habitat for fish communities. The proposed development will aim to provide these features within the BMP Lands.
The transformation of the locality,	Nil	The aquatic assessment above show that within the Subject Site upper tributary of Lochinvar Creek is highly degraded and not able to natural regenerate, regulate water quality or provide habitat for fish communities. The proposed development will aim to provide these features within the BMP Lands.
The environmental impact on the ecosystems of the locality,	Low	Due to the infrequent flow of water along Upper tributary of Lochinvar Creek and temporary nature of the disturbance from the proposed installation of the culvert and regeneration works, it is unlikely that there will be any impacts to downstream ecosystems; as a contingency to potential rainfall and increased flow of aquifers, a temporary stream diversion is recommended to ameliorate impacts of water blockages during such an event.
Reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality,	Low	Given the degraded condition and proposed BMP works, the environmental value contained within the site will be improved post construction.
The effects on any locality, place or building that has— (i) aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance, or (ii) other special value for present or future generations,	Low	Refer to SBDAR for detailed assessment.

Risk	Level (High, Moderate, Low, Nil)	AEP Assessment
The impact on the habitat of protected animals, within the meaning of the Biodiversity Conservation Act 2016,	Low	The aquatic assessment above show that within the Subject Site upper tributary of Lochinvar Creek is highly degraded and not able to natural regenerate, regulate water quality or provide habitat for fish communities. The proposed development will aim to provide these features within the BMP Lands.
The endangering of a species of animal, plant or other form of life, whether living on land, in water or in the air,	Low	Due to the infrequent flow of water and contingent diversion of Lochinvar Creek during construction works, it is unlikely that there will be any impacts that will result endangering the lives of listed species.
Long-term effects on the environment,	Low	The environmental effects associated with the proposal are expected to be temporary.
Degradation of the quality of the environment,	Low	With appropriate sediment and erosion controls the culvert installation will result in little negative impact on the quality of the environment
Risk to the safety of the environment,	Low	As stated above the proposed work is not likely to pose an environmental risk with appropriate sediment and erosion controls.
Reduction in the range of beneficial uses of the environment,	Low	The proposed culverts are to be designed to meet DPI (Fisheries) guidelines and the riparian areas are to be regenerated and managed under a BMP.
Pollution of the environment,	Low	The portion of Lochinvar Creek within the development footprint exists in an already-polluted state due to proximity to agricultural land. Development of a Sediment Control Plan associated with the proposed works is recommended before construction activities commence.
Environmental problems associated with the disposal of waste,	Moderate	There is unlikely to be an impact as a result of the culverts construction providing an appropriate waste management procedure has been put into effect by contractors undertaking works.
Increased demands on natural or other resources that are, or are likely to become, in short supply,	Low	It is unlikely that the installation of two prefabricated culverts will have any major effect on natural resource supplies.
The cumulative environmental effect with other existing or likely future activities,	Low	It is unlikely that cumulative environmental effects with other existing or likely future activities will occur as a result of construction activities due to the temporary nature of works; furthermore, a temporary diversion of upper tributary of Lochinvar Creek will act as a contingency to ameliorate any short-term effects during culvert construction works.
The impact on coastal processes and coastal hazards, including those under projected climate change conditions,	Low	Due to the temporary nature of the proposed works and infrequent flow of upper tributary of Lochinvar Creek it is unlikely that the installation will have any major effect on coastal processes and hazards.

Risk	Level (High, Moderate, Low, Nil)	AEP Assessment
Other relevant environmental factors.	Low	No other environmental factors are likely to be impacted by the proposed culverts.

6.2.2 Riparian and Freshwater Aquatic Vegetation Assessment

Table 8 outlines the DPI assessment criteria and AEP assessment for this proposal.

Table 8 – Riparian and Freshwater Vegetation Policy and Guidelines

Assessment Criteria	AEP Assessment
NSW DPI will generally not approve or support works that may harm freshwater aquatic vegetation (TYPE 1 and 2 habitats – see Table 1), unless adequate mitigation, Regeneration and/or demonstrated compensation measures are in place (see section 3.3).	There is no native aquatic vegetation, therefore no harm, however it is noted that the BMP will be prepared to regenerate the aquatic and riparian communities.
NSW DPI will generally require riparian buffer zones to be established and maintained for developments or activities in or adjacent to TYPE 1 or 2 habitats or CLASS 1-3 waterways (see guidelines below). Riparian buffer zones shall be measured from the top of the bank/drainage depression along CLASS 1 to 3 waterways (see Table 2). Please note that this policy does not apply to developments involving maintenance to existing, or construction of new roads or bridges crossing a waterway, but may apply to developments involving roads that are adjacent to, but not crossing a waterway (e.g. new subdivisions, rezoning proposals involving new access roads, new road developments along a new alignment).	The stream is classed as a Type 3 and the BMP will be regenerated aiming for Type 1 to 2.
NSW DPI will require the design of riparian buffer zones to incorporate the maintenance of lateral connectivity between aquatic and riparian habitat. Installation of infrastructure, terraces, retaining walls, cycle ways, pathways and grass verges within the riparian buffer zone shall be avoided or minimised.	BMP will incorporate approx. 20m either side of the creek for regeneration of both aquatic and riparian lands.
NSW DPI will generally support proposals that aim to remove willows or other exotic trees or other weeds from the watercourse, followed by Regeneration with native species. Willows and other exotic trees should only be removed from the stream where stream stability is not unduly compromised.	The BMP proposes to remove and manage all weeds and exotic species.
NSW DPI will assess the width of the riparian buffer zone based on the habitat TYPE and waterway CLASS (see Tables 1 and 2), the possible extent of the disturbance and the susceptibility of the riverbank to erosion. As a guide the following are recommended: • TYPE 1, CLASS 1: 100 metres • TYPE 2, CLASS 2-3: 50 metres • TYPE 3, CLASS 3-4: 10-50 metres For guidelines on designing filter strips for this purpose (including appropriate widths) please refer to Prosser and Karssies (2001) (see Appendix 2). Advice on	The proposed BMP will manage approx. 20m either of the Type 3 Creek with an aim to regenerate to a Type 1 -2.

Assessment Criteria	AEP Assessment
protecting aquatic macrophytes in wetlands and shallow lakes can be obtained from Bailey et al. (2002) (see Appendix 2).	
Riparian buffer zones should be clearly delineated (e.g. fences or other markers) and well managed to avoid degradation (e.g. weed and stock access management).	The BMP will provide these measures to provide protection of water quality and aquatic ecosystem.
Developments should ensure that existing native riparian vegetation is retained to the greatest extent possible in an undamaged and unaltered condition. Revegetation of disturbed areas with local native species should also be considered as part of development controls (e.g. stabilisation of sediment, sediment filters during and post-construction) and mitigation measures. Monitoring should be undertaken to ensure successful establishment of vegetation in these areas.	The stand of Casuarina will be removed for the installation of the road crossing, the entire BMP lands is proposed to be regenerated.
Where establishment or Regeneration of a riparian zone is required, the Regeneration strategy should include native in-stream vegetation (macrophytes) and snags where appropriate.	The BMP Lands will include full aquatic planting as a Management Zone.
Mitigation or Regeneration measures for developments should include weed control.	The BMP will provide a detailed approach to management of weeds within entire BMP lands.
Willow control guidelines can be accessed at www.environment.gov.au/biodiversity/invasive/weeds /index.html or www.weeds.org.au/WoNS/willows/	N/A

6.2.3 Snags Assessment

Table 9 outlines the assessment that AEP have undertaken in accordance with the assessment criteria for Snags

Table 9 – Snag Assessment

Assessment Criteria	AEP Assessment
NSW DPI supports the retention of snags within streams (i.e. CLASS 1-3 in Table 2) to the greatest extent possible and will generally not support or approve snag management proposals that do not demonstrate a significant public benefit. In particular, NSW DPI will generally not support or approve the removal of snags purely for aesthetic purposes.	The only snag is below 15cm in diameter; hence retention is not deemed significant as the habitat provided is minimal. The BMP requires installation of snags to provide high quality fish habitat.
NSW DPI will generally not support or approve snag management proposals aimed at improving or enhancing navigability of streams. NSW DPI may, however, agree to proposals which aim to maintain (not enhance) navigability in those areas where there is a long history of boating use, providing the habitat of a threatened species will not be adversely affected and it is not contrary to a recovery or threat abatement plan.	N/A
NSW DPI will generally not support or approve snag management proposals aimed at improving or enhancing the hydraulic capacity of streams or reducing flood risk.	Noted

Assessment Criteria	AEP Assessment
NSW DPI may support or approve snag management proposals which are part of a larger strategy or program to rehabilitate and stabilise degraded streams, providing the proposal aims to minimise the level of disturbance. In particular, NSW DPI will support proposals that aim to remove willows or other exotic trees from the watercourse, and replace them with native vegetation, except in cases where stream stability is likely to be unduly compromised.	As there are no recorded snags required for removal within the Subject Site this clause does not apply, it is noted that additional snags are to be installed within the BMP.
NSW DPI will adopt a conservative approach to snag management proposals in TYPE 1 habitat areas (i.e. habitats for threatened fish species, populations, or ecological communities) (see Table 1) and will evaluate the environmental benefits of the works versus the potential short-term negative impacts of the works on such habitat areas.	As there are no recorded snags required for removal within the Subject Site this clause does not apply, it is noted that additional snags are to be installed within the BMP.
NSW DPI will support proposals for reintroduction of snags to waterways where: • it can be shown that snags have been removed in the past and are now depleted and it can be done without significant adverse impacts upon other waterway uses, users or waterway stability, or • riparian vegetation has been cleared and no new source of large woody debris is readily available.	As there are no recorded snags required for removal within the Subject Site this clause does not apply, it is noted that additional snags are to be installed within the BMP.
Proposals for snag management should: • clearly outline the objectives to be achieved, • document the action to be taken for each individual snag, • detail the methods and machinery to be used, and • specify the season or time period over which the works will be carried out.	The BMP will include these management aims.
As a general principle for timber snags, **lopping** should be considered as the first priority for the management of snags. Where lopping will not solve the immediate problem, **re-alignment** should be considered as the next possibility, followed by **relocation**. **Removal** of a snag is the least desirable option and should only be adopted as a last resort. Proposals for snag removal should be accompanied by a 7-part test and/or Species Impact Statement where proposed in areas that are TYPE 1 aquatic habitats (see Table 1 and section 2.6.9).	As there are no recorded snags required for removal within the Subject Site this clause does not apply, it is noted that additional snags are to be installed within the BMP.
In general, snags that extend for a distance of less than 25% of the total stream width from the bank towards the stream centre should not be interfered with. Exceptions may be made for those snags which are causing deflection of water onto the riverbank and causing accelerated erosion. In these cases the snag should be realigned or relocated in preference to being removed.	The BMP will include these management aims.
Where snag management is part of a wider stream restoration project, snag removal should be kept to a minimum and if possible re-snagging should be undertaken to enhance the in-stream habitat.	The BMP will include these management aims.

Assessment Criteria	AEP Assessment
Where snags are pointing upstream or at right angles to the bank and are deflecting water towards the bank, they should be realigned to point downstream so that water is deflected towards the centre of the stream. The base (or root wad) of the snag should be placed closely against the bank. However, in areas that are known habitat for Trout Cod, research has found that this species has a demonstrated preference for snags pointing upstream and therefore this guideline does not apply in these areas.	The BMP will include these management aims.

6.2.4 Blockage to Fish Passage

The current proposed design culverts will not block fish passage. To ensure passage is not blocked during construction a temporary flow diversion channel is proposed, with a planned 72hr period to construct the diversion. Proposed culverts will provide a low flow depth as per NSW DPI guidelines (Fairfull, 2003) (refer **Appendix C**). It is considered unlikely this design would significantly impact volumetric flow rates; however hydrological testing would be required to confirm. Consequently, it is deemed unlikely the proposed culverts will provide a barrier to fish passage.

Table 10 – Fish Passage Policy and Guidelines

Assessment Criteria	AEP Assessment
NSW DPI will consider habitat TYPE (sensitivity) and waterway CLASS when assessing development proposals that may create barriers to fish passage (see Tables 1 and 2). Permanent or temporary barriers on CLASS 1 or 2 waterways will not be approved unless adequate fish passage is provided. Please note that a temporary barrier to fish passage (including a temporary waterway crossing), is considered to be one that is used for a short time only (generally less than 6-12 months) while the construction of a permanent barrier or waterway crossing is constructed. Once the permanent barrier or crossing is completed, the temporary barrier is then removed.	All current blockages to fish passage will be removed and the installation of the culverts will be undertaken in accordance with DPI Fisheries design guidelines and ensure fish passage, within the entire Subject Site.
A permit is required for all works that may obstruct the free passage of fish whether permanently or temporarily in TYPE 1-3 habitats (see Table 1).	To be lodged with the Development Application
Developments that include one or more of the following aspects will require assessment by NSW DPI to ascertain whether they may create an obstruction to fish passage: • any development across the full width of a waterway that creates discontinuity in the flow including dams, weirs, regulators, waterway crossings, pipeline crossings and in-stream Regeneration measures. • any development which increases the mean stream velocity for a given cross-section through the constriction of flow (through pipes, culverts or channelised waterways) or leads to significant reductions in water depth (at wet crossings and causeways) (refer to section 4.2).	The design will ensure compliance with these measures and the BMP will provide regeneration of the highly degraded system.

Assessment Criteria	AEP Assessment
• any development which prevents or impedes tidal inundation of a given area (e.g. through the installation or modification of a floodgate or similar structure) (refer to section 4.4). • any development which will result in the release of water into a waterway at a temperature that differs more than two degrees Celsius from receiving waters.	
NSW DPI requires that the environmental assessment for all in-stream works address potential impacts on lateral and longitudinal fish habitat connectivity and consideration must be given to potential impacts of barriers (including the construction phase) on threatened species, populations, ecological communities or their habitat (including 'critical habitat') listed under Part 7A of the FM Act.	The proposed culverts are to be designed to meet DPI (Fisheries) guidelines and the riparian areas are to be regenerated and managed under a BMP.
The timing of any works should be planned so as not to interfere with the possible migration of fish within the waterway. Temporary blockages should not be placed within a waterway during the months of September to March, which are the key months when the majority of native fish are moving to spawn or recruit within NSW waters.	These measures will be incorporated into the BMP and CEMP.
The timing of works should coincide with low flow periods within the respective catchment.	These measures will be incorporated into the BMP and CEMP.
In-stream works (e.g. pads, coffer dams, sediment controls) should be designed and staged to avoid blocking the entire waterway. If the entire waterway is to be blocked, measures need to be implemented to maintain historic base flow conditions within the waterway (e.g. diversion channel) for the duration of the proposed works.	All current blockages to fish passage will be removed and the installation of culverts will be undertaken in accordance with DPI Fisheries design guidelines and ensure fish passage, within the entire Subject Site.

7.0 Standard Precaution and Mitigation Measures

To ensure protection of aquatic environments Tables 11 - 13 provide comprehensive assessment in accordance the *Fisheries Management Regulations 2019* and Department of Primary Industries (Fisheries) Policies and Guidelines:

- Precaution and Mitigation Measures;
- Regeneration Measures; and
- Waterway Management.

Table 11 – Precaution and Mitigation Measures

Assessment Criteria	AEP Assessment
Deployment of environmental safeguards (silt curtains, booms, etc) before, during and as long as necessary after construction of works to ensure there is no escape of turbid water into the aquatic environment. NSW DPI strongly recommends the use of The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom 2004) (see www.landcom.nsw.gov.au/news/publications-and-programs/the-blue-book.aspx) when planning sediment and erosion controls in or adjacent to aquatic environments.	A sediment and erosion plan will be prepared in accordance with The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom 2004) and will ensure there is limited to impact on the water quality, especially during fish migration.
Programming of work to ensure that it takes place during low flow periods (freshwater habitats) or during the lower half of the tidal cycle (tidal waterways).	Timing will be incorporated into the BMP to ensure compliance.
Directions on the use of sediment and erosion controls for in-stream works to avoid impacts on water quality and fish passage. For example, where it is not possible to work in the dry (out of the water), a sediment or silt screen may be required around the entire work area, but should not extend across the waterway (as it may obstruct fish passage). Silt screens should be placed to isolate the works area and be attached to the same bank upstream and downstream of the work site. Sediment or silt screens should be inspected daily and maintained to prevent the escape of suspended sediments. Sediment control devices should not be removed until the risk of sedimentation and erosion is negligible and the site has been stabilised or revegetated following construction. Screens or other guards should be carefully removed after the work is completed. Silt screens should generally only be used in still water conditions. When placed in higher flows, water either spills over the top or lifts the curtains.	A sediment and erosion plan will be prepared in accordance with The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom 2004) and will ensure there is limited to impact on the water quality, especially during fish migration.
Directions on the use of coffer dams or temporary access tracks to keep disturbance to the substrate and blockages to fish passage to a minimum. The use of temporary dam materials such as sheet piling will reduce impacts on the substrate. Coarse rock confined by gabion baskets or mattresses should be used in preference to sand or soil.	These measures will only be used where other methods are not able to achieved due the scale of the culvert designs or the removal of existing structures.
Provisions to protect fish during the dewatering process of any coffer dams or the clearing of screens. These should include:	These measures will be incorporated in the BMP.

Assessment Criteria	AEP Assessment
• discharging water into a bunded or screened site to allow fish to be rescued, • any fish caught in the dewatering process must be immediately released upstream (fish will want to continue migrating upstream) of the site, • pumps and screens must be of a suitable capacity and size, and pump velocities slow enough, to allow fish to escape during the dewatering process.	
Ensuring that foreshore works in estuaries are restricted to calm weather conditions. This helps prevent the suspension of fine sediment particles into the water column and ensures the silt screen is not disturbed by wave action.	N/A
Ensuring that river works in freshwater environments are restricted to periods of low flow.	These measures will be incorporated in the BMP.
Providing direction on the stockpiling of fill or excavated materials on flood prone lands to avoid sedimentation. Particular care should be made in siting stockpiles and dumps. Preferred sites should be situated either above the highest astronomical tide, or be secure from a 1 in 10 year flood and have effective sediment control measures in place to contain any runoff.	These measures will be incorporated in the BMP.
Ensuring that only natural material is used as fill during reclamation works. Contaminated material, tyres, building and demolition rubble or acid sulfate soils (ASS) should not be used as fill in any aquatic environment.	These measures will be incorporated in the BMP.
Directions on the use and maintenance of buffer zones around the immediate area of the proposed works to ensure that sediment is controlled off site and impacts on the surrounding ecosystem are kept to a minimum.	These measures will be incorporated in the BMP.
Ensuring that the area is rehabilitated after completion of works in accordance with a NSW DPI approved method or plan. This may involve establishment of native riparian vegetation.	These measures will be incorporated in the BMP.

Table 12 – Regeneration Measures

Assessment Criteria	Assessment
As noted in general policy 7 in section 3.1, NSW DPI enforces a 'no net loss' habitat policy as a permit condition or condition of consent. This may require proponents to conduct habitat Regeneration and/or provide environmental compensation. A monetary bond or payment may be required to be lodged with NSW DPI to ensure the works are completed in accordance with the permit conditions (see section 3.3.4 below for further information on bonds).	Given the high level of degradation within Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.
NSW DPI calculates habitat compensation on a minimum 2:1 basis for all key fish habitat (TYPE 1-3 in Table 1) to help redress other indirect impacts of development. A greater compensation ratio may be	Given the high level of degradation within Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.

Assessment Criteria	Assessment
considered if opportunities for compensation are not available in the vicinity of, or of the type of, habitat that has been lost. Please note that compensation for disturbances to SEPP 14 coastal wetlands (which may include TYPE 1 and 2 habitats) requires approval from the Department of Planning and Infrastructure and a ratio of 10:1 generally applies. This is calculated at the rate of $51/m26 for marine and freshwater vegetation which equates to $102/m2 to meet the 2:1 habitat offset requirement.	
NSW DPI does not support seagrass transplanting as an impact compensation measure as the viability of transplanting methods is yet to be scientifically proven for all species (see Ganassin and Gibbs 2008). Transplanting may be allowed in future for those species where viability is scientifically proven. In circumstances where seagrass is likely to be negatively impacted and cannot be avoided or mitigated, environmental compensation will be required and calculated in line with the rate outlined in point 2 above.	N/A
In the case of mangroves and saltmarsh, transplanting the vegetation from the impact site to the compensation site may be required.	N/A
NSW DPI requires a management plan be developed for any compensatory area of habitat that ensures: • replanting, transplanting and monitoring methods are documented in accordance with the permit conditions; • the site is suitable for habitat creation (e.g. is of suitable substrate and depth, not exposed to excessive pollution); • in the case of revegetation, species used must be endemic to the area and suitable for the site; • performance indicators are set to adequately measure success of the project over time and to identify where responses are not being achieved.	These measures will be incorporated within the BMP.
Opportunities to enhance and/or protect existing key fish habitat, and to avoid direct or indirect impacts on such habitats is preferred and should always be explored as a first option.	Given the high level of degradation within Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.
NSW DPI supports strategic resource investment such that Regeneration efforts should primarily be invested in areas where there is likelihood of Regeneration success (key fish habitats with high recovery potential).	Given the high level of degradation within Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.
Subject to point b above, habitat Regeneration and compensation should take place as close as possible to the site of the impact to achieve 'no net loss' of habitat within the area affected and the catchment as a whole.	Given the high level of degradation within Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.

Assessment Criteria	Assessment
Pre-development habitat compensation (i.e. prior to disturbance) is recommended over post-development compensation (i.e. after the habitat is lost).	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.
Repair of degraded habitat is recommended over habitat creation and should be conducted as close to the site of proposed 'habitat loss' as possible.	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.
Transplanting of aquatic vegetation should only be undertaken if an appropriate donor site is available or where re-establishment is likely to be successful (e.g. plants with vegetative growth and fairly shallow roots – e.g. sedges and rushes). NSW DPI recommends that donor sites are selected in consultation with the local Aquatic Habitat Protection Unit staff (see Appendix 5 for contact details). Mangrove Regeneration projects/activities should be undertaken in accordance with the NSW DPI "Mangroves" Primefact (Primefact No. 746) available on the NSW DPI website at www.dpi.nsw.gov.au.	N/A
Where affected habitat is less sensitive, secondary compensation may be more appropriate than implementing a 'like for like' habitat replacement policy. For example, in catchments and/or estuaries where the habitat being replaced is not sensitive or under threat, alternative environmental measures may achieve greater environmental gain (e.g. removal of 1 ha of river mangrove might require the transplanting of 2 ha of endangered saltmarsh).	N/A
Habitat Regeneration efforts should be directed at achieving the maximum benefits for fish habitat and fisheries. Local councils, government departments, community groups or individuals who wish to rehabilitate degraded marine, estuarine or freshwater aquatic habitats should discuss their proposals with NSW DPI. This will ensure that efforts are directed at key fish habitat areas as a priority, methods used are appropriate and relevant approvals are obtained prior to the commencement of works.	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.

Table 13 – Urban Streams Policy Assessment

Maintaining fish passage in urban streams	
Assessment Criteria	**Assessment**
NSW DPI must be consulted in regard to urban stream works that will obstruct fish passage as they may require a permit under the FM Act.	Integrated development approvals will be sought as part of the development application.
NSW DPI will treat artificial habitats that are linked to natural habitats upstream as 'on-line systems'. As such, NSW DPI will generally require that the created lands provide for connectivity between habitats including continuous fish passage.	Fish passage will be restored to this section of the upper tributary of Lochinvar Creek, through the proposed development.
NSW DPI requires that off-line artificial habitats be designed to have minimal impact on adjacent natural systems or receiving waters. Diversion of flows from	All stormwater management systems will be designed to ensure compliance with WSUD.

Maintaining fish passage in urban streams	
Assessment Criteria	**Assessment**
natural habitats into off-line artificial wetlands will generally not be approved.	
NSW DPI requires that detention ponds and other stormwater treatment devices should be located off-stream and at-source to ensure they do not interfere with fish passage.	All proposed offline.
NSW DPI will generally only support the creation of artificial wetlands when they are not at the expense of existing natural habitat.	N/A
Water Management in Urban Areas	
NSW DPI will generally not support proposals that damage, destroy or alienate existing key fish habitats in the process of creating new development in urban areas.	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.
NSW DPI will require water quality controls used to treat run-off to be located in areas where treatment can occur prior to discharge into the riparian zone and stream channel.	All stormwater management systems will be designed to ensure compliance with WSUD.
NSW DPI will generally not approve proposals to construct new sewage outfalls, stormwater drains and outlet structures that will discharge within 100 m of TYPE 1 and 50 m of TYPE 2 marine vegetation (see Table 1) unless effective compensation is provided.	All stormwater management systems will be designed to ensure compliance with WSUD.
NSW DPI will require the environmental assessment of development proposals in urban areas to address the cumulative impacts on water quality and quantity including the management of stormwater, potential Acid Sulfate Soil and salinity issues, groundwater and land contamination, water volumes and flow velocities.	All stormwater management systems will be designed to ensure compliance with WSUD.
NSW DPI will require new urban development proposals to achieve 'no net impact' upon the receiving waterway from water quality and quantity and flow velocity. NSW DPI therefore requires the environmental assessment of any development proposals to take account of the existing water quality and flow conditions of the receiving waterway.	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.
There are many tools used to achieve water-sensitive urban design, the appropriateness of each being dictated by site characteristics. In general, the objective is to reduce the volume and improve the quality of water leaving a site. OEH has several useful technical documents on water sensitive urban design and stormwater management which can be accessed via www.environment.nsw.gov.au under "stormwater".	All stormwater management systems will be designed to ensure compliance with WSUD.
Development Control Plans developed for urban catchments should include provisions to ensure that there is no net increase in runoff and no reduction in water quality of receiving waters from urban areas.	All stormwater management systems will be designed to ensure compliance with WSUD.
Stormwater treatment devices should be checked and maintained regularly. Management and maintenance plans should be developed and implemented.	All stormwater management systems will be designed to ensure compliance with WSUD.

Maintaining fish passage in urban streams	
Assessment Criteria	**Assessment**
SEPP 62 (Sustainable Aquaculture) requires the referral to NSW DPI of any proposal that might impact on water quality in an oyster growing area. SEPP 62 can be viewed at www.legislation.nsw.gov.au	N/A
Minimising habitat alteration	
NSW DPI will generally not support or approve the permanent piping or channelising of CLASS 1 2 or 3 waterways (see Table 2).	Culverts will be designed to comply with Fisheries Guidelines.
NSW DPI will generally not support or approve permanent realignment works in TYPE 1 and 2 habitats (see Table 1).	N/A
Temporary piping, channelizing or realignment works may be considered for public infrastructure projects (e.g. public road projects) where the works are short time only (generally less than 6-12 months) and the final construction of permanent works will result in the achievement of NSW DPI's no net loss policy (see section 3.3.3).	These measures will be incorporated into the BMP.
If proposed stream works in a given area achieve clear environmental improvements (including fish passage, habitat and water quality outcomes), certain channel modifications may be approved on a case-by-case basis. For example, major stream works may be approved in heavily degraded urban streams that are isolated from key fish habitat upstream and downstream.	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.
Where channel modification is approved (e.g. in degraded areas), streams should remain as open channel systems.	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat. The unnamed creek will remain an open channel.
Channel modification designs should include natural stream features including meanders, pools, riffles, bars and riparian and in-stream vegetation.	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in Aquatic and riparian habitat.
Regeneration of existing streams is recommended as opposed to construction of new channels.	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in Aquatic and riparian habitat.
Regeneration efforts, including the removal of concrete and other artificial stream linings and restoration of stream morphology and vegetation, are supported, particularly in CLASS 1-3 waterways where fish communities and opportunities for fish passage are greater. Such efforts should focus on enhancing the connectivity of the Regeneration works with other sections of key fish habitat (see Table 1).	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in Aquatic and riparian habitat.
Protecting urban riparian vegetation	
NSW DPI requires that developments within urban areas be designed in a manner that protects the	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed

Maintaining fish passage in urban streams	
Assessment Criteria	**Assessment**
natural values of the existing riparian zone and ensures that the protected zone functions as a 'natural' system.	regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat. This will be achieved through the regeneration of the riparian land and aquatic zone with extensive planting of native species to improve ecological values and function.
NSW DPI will assess urban development proposals on a case-by-case basis but with due regard to the cumulative impacts of development on riparian vegetation and key fish habitat (see Table 1).	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat.
NSW DPI will require riparian buffer zones to be established and maintained for developments in or adjacent to TYPE 1 or 2 habitats (see guidelines below). Please note that this policy does not apply to developments involving maintenance to existing, or construction of new roads or bridges crossing a waterway, but may apply to developments involving roads that are adjacent to, but not crossing a waterway (e.g. new subdivisions, rezoning proposals involving new access roads, new road developments along a new alignment). Riparian buffer zones shall be measured from: • the highest astronomical tide level in tidal areas (generally 1.0 m AHD), or • from the top of the bank/drainage depression along CLASS 1 to 3 waterways (see Table 2). NSW DPI will require the design of riparian buffer zones to incorporate the maintenance of lateral connectivity between aquatic and riparian habitat. Installation of infrastructure, terraces, retaining walls, cycle ways, pathways and grass verges within the riparian buffer zone shall be avoided or minimised.	N/A
NSW DPI will assess the width of the riparian buffer zone based on the habitat TYPE and waterway CLASS (see Tables 1 and 2), the possible extent of the disturbance and the susceptibility of the riverbank to erosion. As a guide the following are recommended: • TYPE 1, CLASS 1: 100 metres • TYPE 2, CLASS 2-3: 50 metres • TYPE 3, CLASS 3-4: 10-50 metres For guidelines on designing filter strips for this purpose (including appropriate widths) please refer to Prosser and Karssies (2001) (see Appendix 2). Advice on protecting aquatic macrophytes in wetlands and shallow lakes can be obtained from Bailey *et al.* (2002) (see Appendix 2).	Given the high level of degradation within upper tributary of Lochinvar Creek the proposed regeneration, under the management of a BMP, will provide a net gain in aquatic and riparian habitat. The BMP Lands will include a minimum of 20m regeneration either side of the creek providing totalling 2.33ha of regeneration compared with the 0.39ha of native riparian vegetation currently present within the defined waterland of the Subject Site. It is noted that an additional 0.5ha of native vegetation is mapped within the development footprint, however not considered within the assessment for creek class as it is not located within waterland. Therefore, it has been determined that the proposed regeneration is a will be nature positive.
Riparian buffer zones should be clearly delineated (e.g. fences or other markers) and well managed to avoid degradation (e.g. weed and public access management).	This measure will be incorporated into the BMP.

8.0 Recommendations

The following general recommendations are made for consideration to minimise localised impacts on biodiversity in general, and to ensure overall improved environmental outcomes for aquatic flora and fauna habitat in the locality, as a result of the proposal:

- Detailed design by suitable qualified engineer and aquatic ecologist to restore the creek, implementing natural channel design. These works should increase bank stabilisation, and installation of watercourse features to support native aquatic flora and fauna such as: pools, riffles, meanders.

  This will include localised reshaping of the incised bank, installation of ground stabilising matting and/or terracing, and revegetation using suitably dense planting of groundcovers, trees, and shrubs;

- Diversion measures need to be created during any works within the waterland if stagnant conditions are not present on commencement of construction;
- Implementation of the BMP;
- Prior to construction, a suitably experienced and qualified Project Ecologist should be appointed to oversee ecological works to mitigate construction impacts on native biota welfare;
- Prior to construction commencing, temporary construction fencing and signage will be installed to delineate construction zone from retained riparian vegetation;
- No machinery or material should be stored within retained vegetation or within the dripline of retained trees;
- Equipment should be cleaned thoroughly and disinfected before entering and exiting site to prevent weed and disease introduction such as *Phytophthora cinnamomi* (Root-rot fungus), *Puccinia psidii* (Myrtle Rust) and others;
- Culvert design should incorporate recommendations in DPE guidelines: *Controlled activities – Guidelines for watercourse crossings on waterfront land* and DPI Fisheries guidelines: *Policy and Guidelines for Fish Friendly Waterway Crossings* and *Why do fish need to cross the road?;*
- Installation of in-stream woody debris where possible;
- Construction should occur in stages to ensure continual flow of the river;
- Aquatic floating screening should be utilised around the extent of the works area to ensure that mobilised sediment and debris is not distributed into the wider system;
- Erosion and Sediment plan must be prepared prior to commencement of works; and
- It is recommended approval is conditioned to provide a Construction Environmental Management Plan that specifies the procedure for waste disposal during construction.

9.0 Conclusion

The proponent engaged AEP to prepare an Aquatic Ecology Assessment to determine the presence of Key Fish habitat, its condition, and appropriate management actions to avoid or minimise impacts.

The upper tributary of Lochinvar Creek is present in a highly degraded condition within the Subject Site, with two blockages to Fish Passage present. Field surveys did not identify native aquatic vegetation, and high level of bank, bed and floodplain erosion was observed. The combination of blockages and highly degraded nature of Lochinvar Creek resulted in a classification of Type 3 – minimally sensitive key fish habitat.

The proposed development has prepared a BMP to restore a natural channel, reduce bank and bed erosion and allow for fish passage within the Subject Site and regenerate both the aquatic and riparian land, approx. 20m either side of the Creek. Such works will provide a net gain in catchment health and increase available fish habitat.

10.0 References

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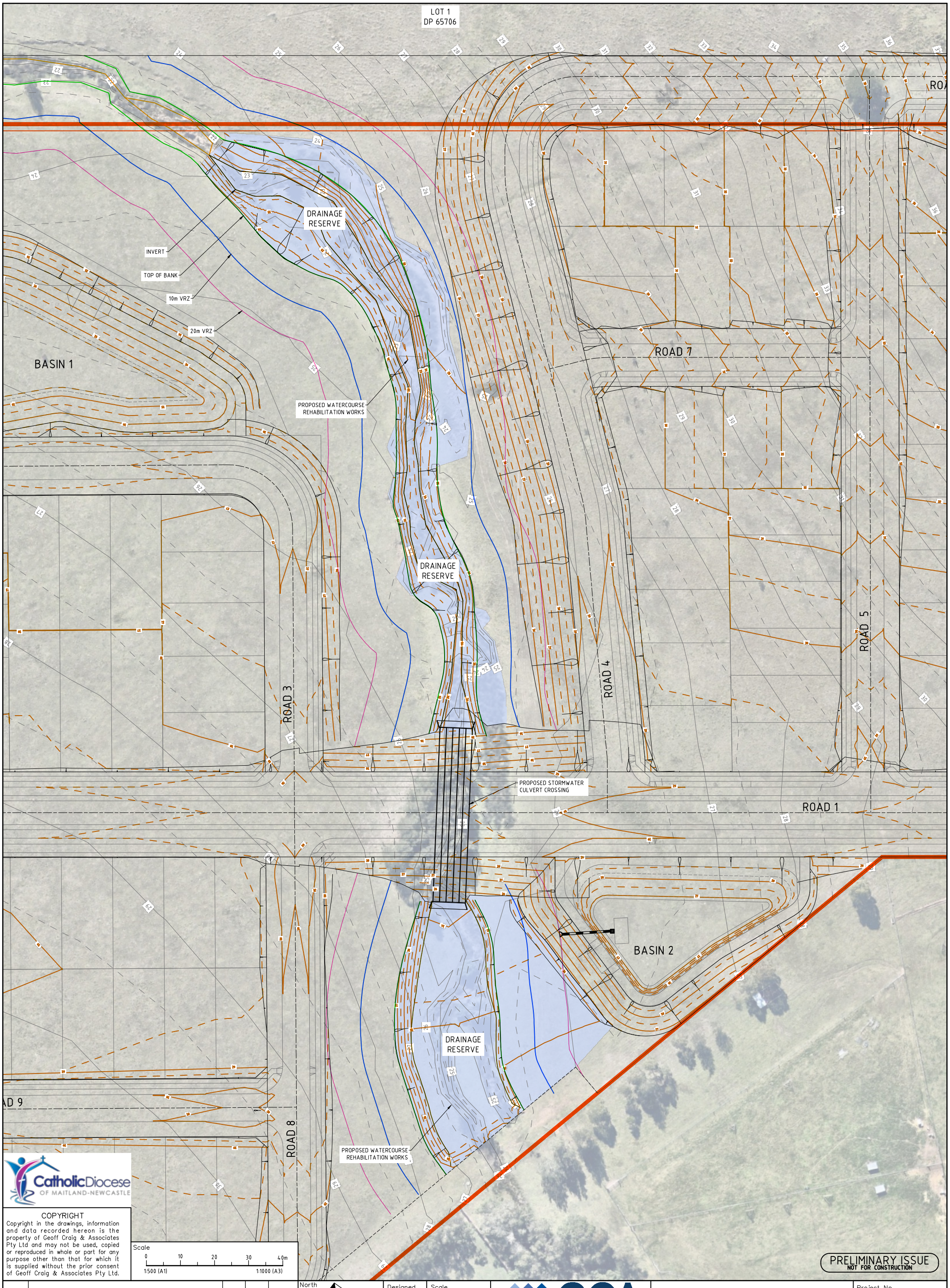
Appendix A – Design Plans



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PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REVISION	Description	Drawn	App'd	Date
2	ADDED INV, TOB, VRZ LINEWORK	AS	AS	09.01.25
1	ORIGINAL ISSUE	DB	AS	17.12.24

North

Designed: DB
Scale: 1:500
Cad Reference: 23290C dSK11 r1
Project Approval: IAN HILL (B.E) Consulting Civil Engineer

GCA ENGINEERING SOLUTIONS
A.B.N. 92 086 017 745
1 HARTLEY DRIVE, THORNTON NSW 2322
PO BOX 3337, THORNTON NSW 2322
PHONE: (02) 4964 1811

PROPOSED RESIDENTIAL SUBDIVISION
20 & 20A CANTWELL ROAD
LOCHINVAR

WATERCOURSE REHABILITATION PLAN

Project No: 23290C
Drawing No: SK11
Revision: 2
A1 SHEET

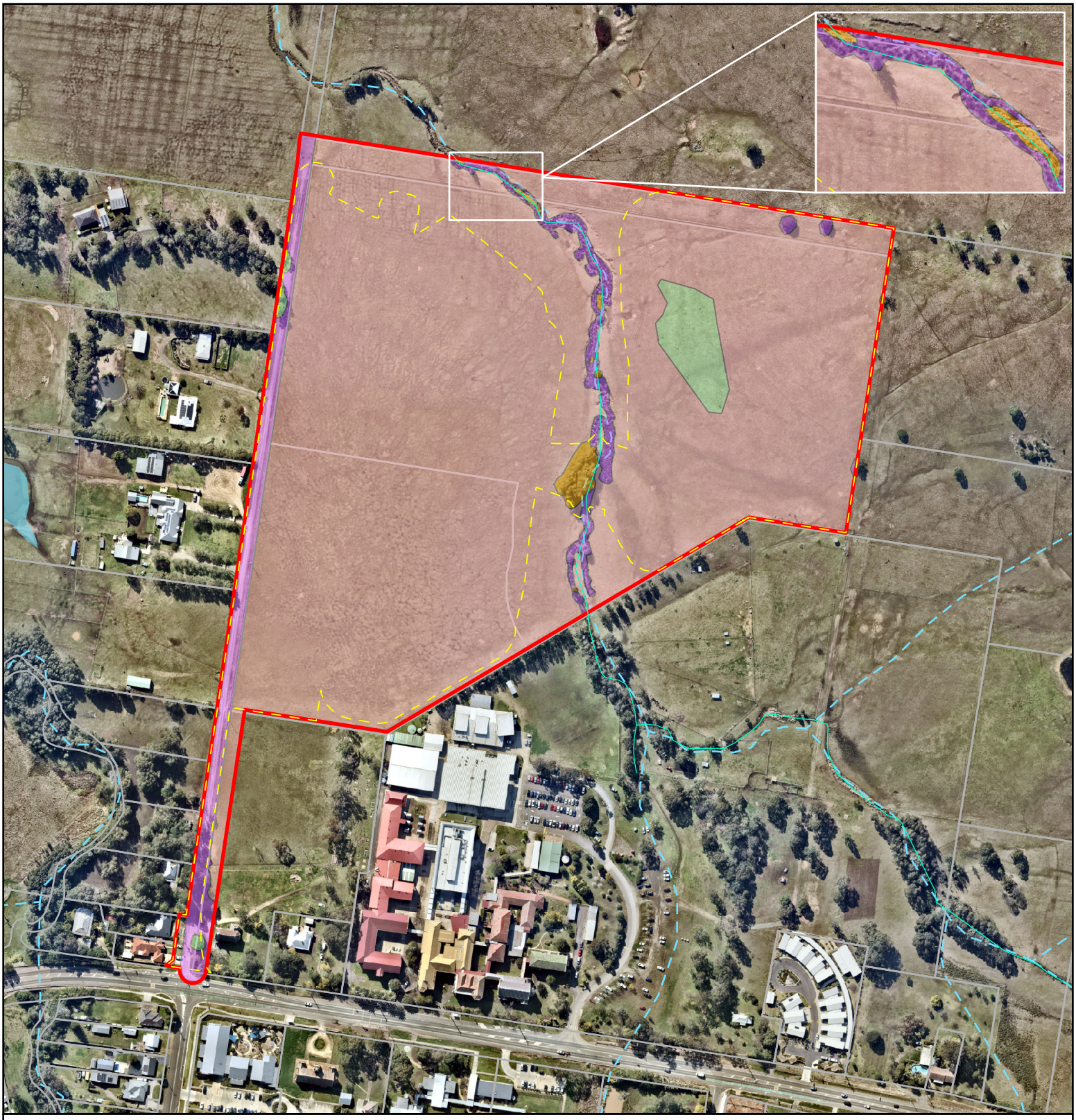
PLOT DATE: 9/01/2025 11:45:21 AM
CAD FILE: Q:\23\23290 60 New England Highway, Lochinvar\02_CAD\AutoCAD\Civil\100 DA Civil\Sketches\23290C dSK11 r1.dwg

Appendix B – Flora List

Family	Scientific Name	Common Name
Amaranthaceae	Amaranthus spp.	Amaranth
Poaceae	Aristida vagans	Threeawn Speargrass
Poaceae	Axonopus fissifolius	Narrow-leafed Carpet Grass
Poaceae	Bothriochloa macra	Red Grass
Brassicaceae	Cardamine hirsuta	Common Bittercress
Casuarinaceae	Casuarina glauca	Swamp Oak
Solanaceae	Cestrum parqui	Green Cestrum
Asteraceae	Cirsium vulgare	Spear Thistle
Commelinaceae	Commelina spp.	
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane
Poaceae	Cymbopogon refractus	Barbed Wire Grass
Poaceae	Cynodon dactylon	Common Couch
Poaceae	Cynodon spp.	
Apiaceae	Daucus carota	Wild Carrot
Poaceae	Dichanthium sericeum subsp. sericeum	Queensland Bluegrass
Poaceae	Ehrharta erecta	Panic Veldtgrass
Chenopodiaceae	Einadia nutans subsp. linifolia	Climbing Saltbush
Poaceae	Eragrostis elongata	Clustered Lovegrass
Cyperaceae	Fimbristylis dichotoma	Common Fringe-sedge
Proteaceae	Hakea teretifolia	Needlebush
Asteraceae	Hypochaeris radicata	Catsear
Juncaceae	Juncus cognatus	
Brassicaceae	Lepidium spp.	
Primulaceae	Lysimachia arvensis	Scarlet Pimpernel
Poaceae	Microlaena stipoides	Weeping Grass
Oleaceae	Olea europaea	Common Olive
Oxalidaceae	Oxalis perennans	
Poaceae	Panicum simile	Two-colour Panic
Poaceae	Paspalum dilatatum	Paspalum
Phyllanthaceae	Phyllanthus virgatus	Wiry Spurge
Plantaginaceae	Plantago lanceolata	Lamb's Tongues
Poaceae	Poa annua	Winter Grass
Polygonaceae	Rumex spp.	Dock
Asteraceae	Senecio madagascariensis	Fireweed
Poaceae	Setaria parviflora	
Malvaceae	Sida rhombifolia	Paddy's Lucerne
Solanaceae	Solanum americanum	Glossy Nightshade
Solanaceae	Solanum nigrum	Black-berry Nightshade
Poaceae	Sporobolus africanus	Parramatta Grass
Poaceae	Sporobolus creber	Slender Rat's Tail Grass
Poaceae	Sporobolus spp.	Rat's Tail Couch
Caryophyllaceae	Stellaria media	Common Chickweed

Family	Scientific Name	Common Name
Verbenaceae	Verbena bonariensis	Purpletop
Verbenaceae	Verbena quadrangularis	
Campanulaceae	Wahlenbergia communis	Tufted Bluebell

Appendix C – Ground-truthed Vegetation (extract from SBDAR, 2024)



Legend

- Study Area
- Development Footprint
- Cadastre
- HydroArea

Ground Truthed Vegetation

- Non-Native
- PCT 3433
- PCT 4023
- Planted Native Module (Cynodon dactylon)

- Ground Truthed Stream Order
- NSW Hydroline

Address: 20 & 20A Cantwell Rd and 60 New England Hwy, Lochinvar NSW
Client: Trustee RCC Diocese M N | AEP Ref: 4951 | Date: January 2025

Imagery: NearMap, downloaded 8/8/2024
Spatial Reference: GDA2020 MGA Zone 56

0 40 80 m
Scale: 1:4,000

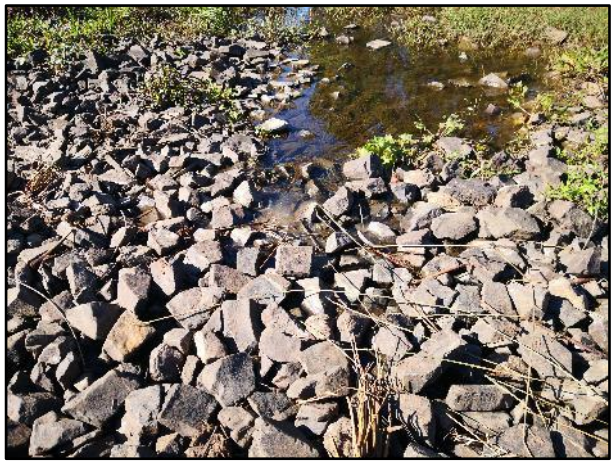
N W E S

Figure 4 - Ground Truthed Vegetation

AEP

Note:
1. Boundaries are not survey accurate
2. Do not scale off this plan

Appendix D – Site Photographs



Appendix E – Glossary of Terms

Activity Approval	A controlled activity approval or an aquifer interference approval.
Alluvial	Deposited by running water.
Alluvium	A general term for detrital deposits made by stream processes on riverbeds, floodplains, and alluvial fans; esp. a deposit of silt or silty clay laid down during times of flood. The term applies to stream deposits of recent time. It does not include subaqueous sediments of seas or lakes.
Anabranch	A diverging branch of a river that re-enters the main stream.
Aquatic Vegetation	A plant characteristically growing wholly or partly submerged in water.
Aquifer	A geological structure or formation, or an artificial landfill, that is permeated with water or is capable of being permeated with water.
Aquifer Interference Activity	means an activity involving any of the following— (a) the penetration of an aquifer, (b) the interference with water in an aquifer, (c) the obstruction of the flow of water in an aquifer, (d) the taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations, (e) the disposal of water taken from an aquifer as referred to in paragraph (d).
Bank	The side slopes of a channel between which the streamflow is normally confined.
Bed	The bottom of a channel.
Channel	An area that contains continuously or periodically flowing water that is confined by banks and a streambed.
Coastal Lake	A large open body of saline or brackish water which has a relatively narrow permanent or intermittent connection to the sea.
Construct a Work	includes install, maintain, repair, alter or extend the work.
Controlled Activity	As defined in the Dictionary of the *Water Management Act, 2000:* (a) the erection of a building or the carrying out of a work (within the meaning of the Environmental Planning and Assessment Act 1979), or (b) the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or (c) the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or (d) the carrying out of any other activity that affects the quantity or flow of water in a water source.
Deposition	The laying down of sediment carried by wind, flowing water, the sea or ice.
Drainage Work	means a work (such as a pump, pipe or channel) for the purpose of draining water from land, including a reticulated system of such works, and includes all associated pipes, sluices, sluicegates, valves, metering equipment and other equipment, but does not include— (a) any sewage work (within the meaning of Part 2 of Chapter 6), or (b) any work declared by the regulations not to be a drainage work.
Environment	includes all aspects of the surroundings of human beings, whether affecting them as individuals or in their social groupings.

Erosion	Wearing away of rock or soil by the gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical, chemical, or biological forces.
Estuary	As defined in the Dictionary of the Water Management Act, 2000 (a) any part of a river whose level is periodically or intermittently affected by coastal tides, or (b) any lake or other partially enclosed body of water that is periodically or intermittently open to the sea, or (c) anything declared by the regulations to be an estuary, but does not include anything declared by the regulations not to be an estuary.
Flood Channel	Low sinuosity subsidiary channel. Entrance height approximates bankfull stage. Commonly observed at valley margins. Floodchannel depth tends to increase down-pocket with the basal section of the floodchannel elevated above the low flow channel
Flood Work	A work (such as a barrage, causeway, cutting or embankment)— (a) that is situated— (i) in or in the vicinity of a river, estuary or lake, or (ii) within a floodplain, and (b) that is of such a size or configuration that, regardless of the purpose for which it is constructed or used, it is likely to have an effect on— (i) the flow of water to or from a river, estuary or lake, or (ii) the distribution or flow of floodwater in times of flood, and includes all associated pipes, valves, metering equipment and other equipment, but does not include any work declared by the regulations not to be a flood work.
Floodplain	an area of low-lying ground adjacent to a river, formed mainly of river sediments and subject to flooding.
Floodplain Pocket	Narrow, discrete floodplain typically on the bank of valley confined channel.
Floodplain Vegetation	Vegetation that is seasonally or irregularly flooded by changes in river level, hence can tolerate inundation for periods of time. It is noted that the tolerance to inundation reduces with the distance from the waterfront land
Flora Stratum	Vertical layering of vegetation in the riparian zone and the classification of its layers and height of growth including trees, heath/shrubs or a ground layer consisting of grasses or sedges.
Gravel Bed	An unconsolidated natural accumulation of rounded rock fragments, mostly of particles larger than sand (diameter greater than 2 mm), such as boulders, cobbles, pebbles, granules, or any combination of these.
Groundwater	Water contained under the ground's surface, located in the spaces between soil particles and in the cracks of sand, gravel, and rock; a natural resource and source of water for drinking, irrigation, recreation, and industry.
Gully	a. is not a 'stream channel' (or watercourse); b. is a persistent erosional feature, with active head or walls on average > 0.5 m deep, and has multiple modes of expansion, but always including headward retreat into an otherwise un-dissected landscape; c. erodes unconsolidated materials and saprolite, but not bedrock; d. must have an active head scarp or head wall at the upslope limit of the gully (which may or may not be a clear nick point): e. sometimes a series of head scarps may occur; • a 'scalded' or desiccated area (i.e. an area stripped of its topsoil with degraded vegetative cover) may often fringe the upslope area of the head scarp and head walls;

Appendix F – CVs

BRENDON YOUNG
Project Manager

Profile Summary

Brendon works with AEP in the role of Project Manager and Ecologist/Aquatic Ecologist. He graduated with a Bachelor of Applied Science (Fisheries w/Honours), a Masters in Environmental Management and Graduate Certificate in Fish Conservation and Management. Brendon has previously worked in large retail operations in staff and budget/data management, reporting and quality assurance which adds to the experience that he currently contributes to the AEP team.

Academic Qualifications

Charles Sturt University

- Master of Environmental Management (Water Resources) 2022
- Graduate Certificate of Fish Conservation and Management

University of Tasmania

- Bachelor of Applied Science (Fisheries) with Honours

Training, Licences and Professional Memberships

- NSW Class C Driver's Licence
- WHS NSW Construction Induction White Card
- First Aid (Provide First Aid HLTAID011)

Professional Experience

Project Manager/Aquatic Ecologist Anderson Environment & Planning Newcastle NSW	Jan 2024 – Present
Project Lead/Ecologist Anderson Environment & Planning Newcastle NSW	Oct 2023 – Jan 2024
Ecologist Anderson Environment & Planning Newcastle NSW	Sept 2022 – Oct 2023
Department Manager Woolworths Pty Ltd	2013 - 2022
Produce Quality Control Officer Woolworths Pty Ltd	Mar 2019 - Oct 2019

Relevant Project Experience

Ecological Surveys

- Watercourse Assessment with the NRAR Waterfront Land Tool in Huner Valley, Central Coast, Midcoast and Dubbo regions.
- Key Fish Habitat surveys at Karuah River Port Stephens, Hunter River Lochinvar and Chisholm, Manning River Tibbuc and Lachlan River Stubbo.
- Dip netting for *Mogurnda adspersa* in Lochinvar, Tibbuc, Chisholm and Stubbo.

- Seagrass and Mangrove surveys in Port Stephens.
- Targeted, systematic transects for threatened flora species.
- Deployment of Camera Traps, Songmeter and Anabats across central Coast and Hunter Valley regions for targeted survey.
- Spot Assessment Technique surveys: Halloran, Windella, Ourimbah, Chisholm.
- Weed mapping: Taree, Ourimbah, Hunter Valley.

University

- Training with aquatic sampling techniques such as seine nets, gill nets and fyke nets.
- Training in the use of mist netting, bat harp traps, Elliot traps, pitfall traps and camera traps.
- Identification of fish, reptiles, insects, and plants to species level through honours research and other projects while studying.

Ecological Assessment

- Riparian and watercourse assessment with the Waterfront Land Tool in the Hunter Valley, Central Coast, Sydney and Hastings regions.
- Preparation of Vegetation Management Plans in the Hunter Valley, Central Coast and Midcoast regions.
- Bushfire Threat Assessment in accordance with PBP 2019 at various sites across the Hunter Valley and Central Coast regions.
- Assist with Arborists assessments in Central Coast, Sydney, Mudgee and Hunter Valley Regions.

Ecological Monitoring

- Primary contributing author for Garden Suburbs Biodiversity Stewardship Site Assessment Report and associated Management Plan.

Publications

- Courtney, A.J., Schemel B.L., Wallace, R., Campbell, M.J., Mayer, D.G. and Young, B. (2005) *Reducing the impact of Queensland's trawl fisheries on protected sea snakes*. FRDC Project No. 2005/053. Queensland Government.

NATALIE BLACK

Senior Ecologist

Profile Summary

Natalie works with AEP in the role of Senior Environmental Manager. She has extensive knowledge in environmental management, environmental planning, fisheries, aquatic and riparian environments, and report writing and assessment. With a detail understanding of planning, catchment management, coastal management and rehabilitation. Natalie has had a successful career with both state and local government in conservation, planning and field investigation roles. Natalie has also gained extensive communication skills and project management through her previous career in lecturing in a range of course with a focus on environmental management and environmental legislation. Her background and experience in the ecological and planning fields is utilised in a diverse array of application in her current role.

Natalie Black is a conservation detection dog handler and is currently working with his purpose breed working English Springer Spaniel "Gus" who is currently trained to detect Koala scat, Forest Owl pellets and Cane Toads.

Academic Qualifications

- B.Sc (Hons) Sustainable Resource Management and Marine Science – University of Newcastle, 2001
- Master Planning – University of Technology Sydney, 2007
- Certificate IV Training and Assessment – TAFE, 2012
- BAM Assessor; accreditation number: BAAS19076

Training, Licences and Professional Memberships

- NSW Class C Driver's Licence
- Provide First Aid HLTAID011
- Evidence Gathering and Legal Process, Australian Institute of Environmental Health
- Conflict Resolution Course (LGSA)
- Report Writing Course (LGSA).
- Powerful Presentation (LGSA)
- NSW Rural Fire Services Bush Fire Assessment
- Relocation of Threatened Species, Botanical Gardens Sydney
- Sustainable Home Assessment Reduction Revolution
- Flora and Fauna Survey Assessments Niche Environment and Heritage

Professional Experience

Senior Environmental Manager / Works Coordinator 2019 – Present

Anderson Environment & Planning

Newcastle NSW

Principal Environmental Planner 2010 - 2019

Black Earth

Newcastle NSW

Senior Lecture 2010 - 2019

Hunter TAFE

Range of Hunter Campuses

Natural Resource Manager and Development Assessment Officer	2003 - 2010
Lismore City Council	
Lismore NSW	
Fish Passage Expert	2002 - 2003
NSW Department of Primary Industries	
Ballina NSW	
Conservation Officer	2000 - 2002
NSW Department of Primary Industries	
Crows Nest, NSW	
Volunteer NSW Fisheries	1998 - 2000
Varied Roles	
Port Stephens, NSW	

Relevant Project Experience

Ecological Survey examples

- Target surveys for *Thelymitra adorata* Halloran; Wyee, Wadalba;
- Target surveys for *Melaleuca biconvexa* Mardi, , Halloran; Wyee, Wadalba
- Target surveys for *Tetratheca juncea* Hillsborough, Mardi, Thornton, Warners Bay;
- Target surveys for *Rhodamnia rubescens* Hillsborough, Mardi, Thornton, Stuarts Point, South West Rocks,
- Target Survesy for Cumberpalin Snail and Dural Snail, Rouse Hill
- Target Search for seagrass and threatened marine fauna, Stuarts Point, South West Rocks, Lake Macquarie, Peat Island,
- Powerful Owl nest locating and monitoring: Salamander Bay
- Spot Analysis Techniques surveys: Lismore, Wallsend, Salamander Bay, North Arm Cove, Warnervale, Hamlyn Terrace, Wyee, Charlestown, Chisholm, Gillieston Heights, Mount Vincent, Hillsborough;
- Surveys for Squirrel Glider (*Petaurus norfolcensis*) Wadalba, Rouse Hill, Claremount Meadows, Wyee, Hillsobourgh, South West Rocks, Stuart Point;
- Frog Surveys: Lismore, Wallsend, Salamander Bay, North Arm Cove, Warnervale, Hamlyn Terrace, Wyee, Charlestown, Chisholm, Hillsborough Rouse Hill, Kariong, Wadalba,

Ecological Assessment examples

- Accredited Assessor for approved Biodiversity Development Assessment Reports:
  - Teraglin Village, Chain Valley Bay;
  - Railway Road, Warnervale;
  - McFarlane's Road, Chisholm;

- Fairlands Road, Medowie;
- Raymond Terrace Road Chishlm,
- Annangrove Road, Rouse Hill
- Richmond Road, Marsden Park,
- Claremount Meadows,
- Newcastle Golf Course, Fern Bay,
- Newell Highway, Gilgandra
- Narromine Road, Dubbo

- Ecological Assessment Report for Proposed Modification to Approved Western Rail Coal Unloader At Pipers Flat;
- Infrastructure Ecology Reports;
  - Wyee Water Main;
  - Mardi Water Main;
  - Wyee Rising Main;
  - Mardi Rising Main;
- Summerhill Waste Facility Recycling Plant

Ecological Offsets and Monitoring

- Biodiversity Stewardship Agreements including:
  - Hillsborough
  - Blueys Beach,
  - Allandale,
  - South-West Rocks.
- Biodiversity Management Plans / Vegetation Management Plan / Wildlife Management Strategies
  - VMP for Proposed Modification to Approved Western Rail Coal Unloader At Pipers Flat;
  - VMP / WMS / Dewatering Plan for Wyee for 23ha Offset lands
  - VMP Rouse Hill Commercial Development.
  - BMP – Claremount Meadows Commercial Development.

Planning – Approved Review of Environmental Factors

- South West Rocks Installation of Seawall,
- Lake Macquarie upgrade of carpark, boat ramp and jetty,
- Demolition of two (2) jetties Peat Island,
- Stuart Point upgrades to caravan park including boat ramp.
- Wyee Rising Main
- Anambah Recycling Facility

Bushfire Threat Assessments

- Kempsey Correctional Facility for upgrade
- Stuarts Point Caravan Park for upgrades
- Claremount Meadows for a Commercial development included Daycare, and service station
- Batlow for a Service Station
- Lovedale for a change of use to Brewery