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Waterfront Land Assessment Report

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: 03

February 2025

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Document Control

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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

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00	23/10/2024	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys
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Abbreviations

API	Aerial Photography Interpretation
CAA	Controlled Activity Approval
CAAR	Controlled Activity Approval Report
DA	Development Application
DPI	NSW Department of Primary Industries
DPE	NSW Department of Planning and Environment
DPIE	The former NSW Department of Planning, Industry and Environment
LGA	Local Government Area
NRAR	Natural Resource Access Regulator
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
SEED	Sharing and Enabling Environmental Data in NSW
SVTM	State Vegetation Type Mapping
VMP	Vegetation Management Plan
VRZ	Vegetated Riparian Zone
WFL	Waterfront Land
WFLT	Waterfront Land Tool
WM Act	*Water Management Act 2000*
WM Regulations	*Water Management (General) Regulation 2018*

1.0 Introduction

Anderson Environment & Planning was commissioned by Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle c/- Monteath & Powys to undertake a Waterfront Land Assessment Report (WLAR) to determine the presence and management of Waterfront Land within the Site Boundary.

This assessment has been prepared to ensure the objects of the *Water Management Act, 2000,* (WM Act) are met providing a sustainable and integrated management of water within the Site Boundary.

This report been prepared in three parts:

- **Part 1** - **Waterfront Land Assessment (WLA).** The WLA has been prepared to determine the location, type and riparian zones of Waterfront Land within the Site Boundary. AEP has utilised the NSW Department of Planning, Industry and Environment, Natural Resources Access Regulator, 2020, *Waterfront Land Tool* (WLT) and other Department Guidelines to undertake this Assessment.
- **Part 2 – Controlled Activity Approvals Report (CAAR**). The CAA assesses the provisions within the Departments Guidelines for the proposed development and prepare the assessment for integrated assessment. For this report the assessment is a Merit Based assessment.
- **Part 3 - Biodiversity Management Plan (BMP).** The BMP has been prepared to implement a plan for conserving, restoring and enhancing the biodiversity values of the Catchment through actions within the Vegetated Riparian Zones. AEP has utilised the department's Guidelines for Controlled activities – Guidelines for riparian corridors on waterfront land, Guidelines for Outlet Structures; Guidelines for In-stream Works, and the Guidelines for Watercourse Crossings.

For referencing, this document should be referred to as:

> Anderson Environment & Planning (2025). *Waterfront Land Assessment Report for 20 & 20A Cantwell Road and 60 New England Highway, Lochinvar NSW*. Unpublished

AEP has undertaken the desktop and field assessment to prepare WLAR for the proposed residential subdivisions at 20 & 20A Cantwell Road, Lochinvar, and associated road widening on adjoining road reserves and 60 New England Highway, Lochinvar, NSW, refer **Figure 1**.

1.1 Site Particulars

Table 1 – Site Details

Detail	Comments
Client	CDMN
Address	20 & 20A Cantwell Road and 60 New England Highway Lochinvar NSW
Title(s)	Lot 1 DP1299958 Lot 2 DP1299958 Lot 2 DP1214402
Site Boundary	The Site Boundary encompasses the entirety of Lot 1 & 2 DP1299958 and partial Lot 2 DP1214402 and the paper road north of Lot 2 DP 1299958. All upstream tributaries as mapped by *Water Management (General) Regulation 2018* hydroline spatial data 1.0 and associated WFL (**Figure 1**).
Ground-truthed Waterfront Land	The Ground-truthed Waterfront Land consists of a mapped hydroline and associated WFL 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 Site Boundary is a fenced paddock consisting of unmanaged grassland and is currently used as cattle pasture. Other surrounding uses are School, church and residential lands.
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 Site Boundary by State Vegetation Type Mapping (SVTM) (**Figure 2**). Lot 1 & 2 DP1299958 and Lot 2 DP1214402 is mapped "Not classified", with a small fraction of PCT 4089 occurring on south eastern boundary, however, surrounding communities have been mapped: • 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; and • Not classified.
Ground-truthed Plant Community Types AEP SBDAR, 2024)	Within the Site Boundary, two (2) Plant Community Types (PCTs) was identified, with differing conditions: • 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 Site Boundary 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 Site Boundary 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 Site Boundary.
Proposed Development	The proposed development is a Staged Subdivision including a creek road crossing as per Council's DCP requirements for the URA and culvert.

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Figure 1 - Site Location

Date: January 2025

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

Client: CDMN

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Figure 2 - State Vegetation Type Mapping

Date: January 2025

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

Client: CDMN

AEP ref: 4951

2.0 Part 1 – Waterfront Land Assessment

The WLA has been prepared in accordance with NSW Department of Planning, Industry and Environment, Natural Resources Access Regulator, 2020, Waterfront Land Tool (WFLT). The WFLT was developed by the Department to assist applicants determine what is waterfront land under the controlled activity provisions of the Water Management Act 2000 (WM, Act) within a Subject Site.

The WFLT defines '*Waterfront land*' as the bed of any river, lake or estuary, and the land within 40 metres of the river banks, lake shore or estuary mean high-water mark (NSW Department of Planning, Industry and Environment, 2020).

The WFLT identifies waterfront land based on consideration of three key factors:

- The presence of defined bed and banks;
- Evidence of flow and geomorphic features; and
- A change in vegetation indicating a wetland.

The WFLT steps through a series of questions to ensure that the right information is assessed to determine the presence or absence of these features and whether the combination of features is indicative of waterfront land. The results of which allow an applicant to prepare ground-truthed map showing the location of waterfront land to inform CAAR and BMP.

2.1 Methodology

The WFLT requires assessment of both desktop and field components to determine the status of waterfront land.

2.1.1 Information Sources

Information and spatial data provided within this WLAR has been compiled from various sources including:

- Department of Planning, Industry and Environment (2020), Natural Resources Access Regulator Waterfront Land Tool;
- Aerial Photograph Interpretation (API) of the site and surrounding locality using the latest NSW Spatial Services (SIX Maps) and NearMap imagery, accessed May 2024;
- NSW Government (2018) *Determining Stream Order* Fact Sheet;
- *Water Management (General) Regulation 2018 Hydroline spatial data 1.0*, accessed May 2024 (refer **Appendix A**);
- SVTM v2.0 for native vegetation of southeast NSW; and
- Collective knowledge gained from previous ecological survey and assessment in the area over the past 30 years.

2.2 Desktop Assessment

The desktop assessment consists of a historical assessment and State mapping review to inform the report and established data for field assessment.

2.2.1 Historical Assessment

Review of historical API revealed a number of impacts to the mapped reach, upstream of the Subject Site, likely to influence the presence of waterfront land:

- The New England Highway was constructed bisecting the Site Boundary and channels water along road side swales where flow traverses the highway via a series of culverts.
- Larger urban developments on the southern side of the NEH have resulted in the construction of significant stormwater infrastructure including stormwater drainage systems, on-site detention systems and detention basins. Two (2) detention basins collect water and discharge through culverts under the NEH within the Site Boundary.
- Numerous farm dams have been historically constructed on mapped hydrolines throughout the reach Site Boundary.

2.2.2 State Mapping Review

AEP undertook a detailed assessment of the current State mapping programs where the following was determined and used to establish the field proforma for the investigations:

- STVM v2.0 accessed via the SEED Portal (May 2024) was utilised to identify vegetation communities occurring within the (**Figure 2**);
- *Water Management (General) Regulation 2018 Hydroline spatial data 1.0* was used to show Strahler Stream Order in accordance with Schedule 2 of the *Water Management (General) Regulation 2018* (**Figure 3**); and
- The literature review, historical assessment and the Strahler Stream ordering is used to establish the survey sites and allocate segments for assessment in the field (**Figure 4**).

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Figure 3 - Water Management (General) Regulation 2018 Hydroline Spatial Data 1.0

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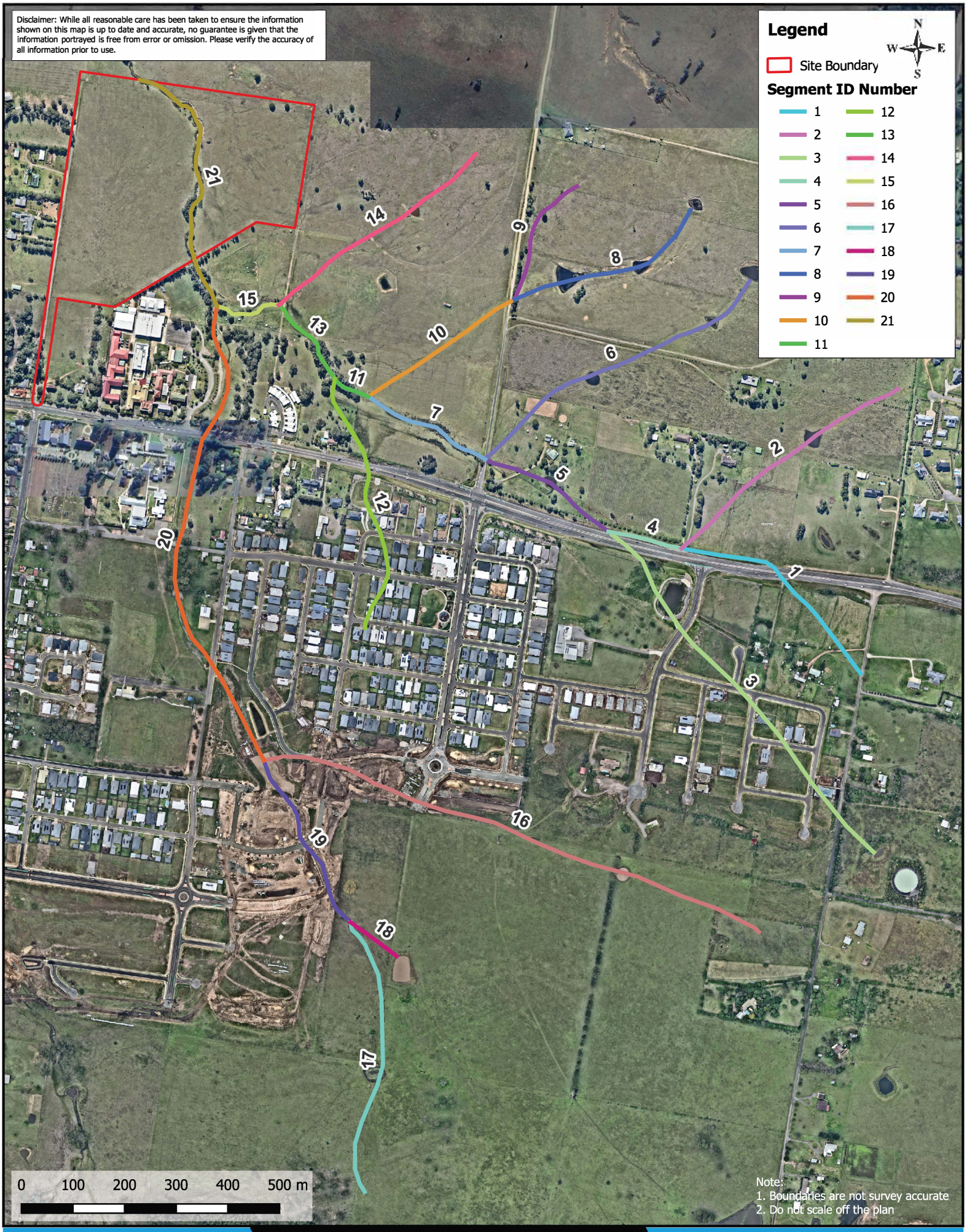

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Figure 4 - Survey Segment ID Numbers

Date: January 2025

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

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2.3 Field Survey

Field surveys were undertaken on 23rd and 30th August 2022 and the 20th May 2024 within multiple Lots in Lochinvar (refer **Figure 1**). The mapped hydrolines within the Site Boundary were assessed in order to determine the presence of one or more of the following features:

- Defined bed and banks;
- Evidence of flow and geomorphic features (pools, riffles, meanders, erosion, deposition bars, oxbows, high bank, low flow channel, etc); and
- The presence of aquatic/riparian vegetation within the tributaries.

Survey Points were assessed at various locations along each identified Segment ID. General observations outside of the Site Boundary were undertaken to assess the hydrolines in the broader locality (refer **Figures 5 & 6** for survey effort).

Additional field surveys were undertaken with surveyors to accurately determine the top of bank (refer **Figures 8, 9 and 10**).

The following data was collected to ground-truth desktop level assessments:

- Assessing each mapped hydroline to determine if defined bed and banks (including locating high bank) are present;
- Identifying what type of watercourse is present (in accordance with NRAR Guide – Watercourse types);
- Determine and notate watercourse features;
- Determine presence of any Lakes or Wetlands; and
- Determine and notate any changes in vegetation communities.

2.4 Waterfront Land Assessment Results

Fieldwork was conducted on the 23rd and 30th August 2022 and the 20th May 2024 to ground-truth the stream order of the watercourses within the Site Boundary and in the surrounding locality is mapped in the New South Wales Hydroline Data Set. Desktop investigations determined that there were;

- eleven (11) mapped 1st order;
- three (3) 2nd mapped order; and
- one (1) 3rd mapped order stream located within the Site Boundary.

Site investigations to ground-truth the waterfront land to determine the appropriate Vegetation Riparian Zones (VRZs) based on existing hydrology identified some variation from the mapped hydrolines and stream order, as such, twenty-one (21) segments were identified and twenty-two (22) survey points were investigated (refer to **Tables 3-17**).

Table 2 – Assignment of survey identification numbers to potential watercourses

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Preparation			
Prepare map allocating survey identification numbers	Yes	A desktop assessment indicated that there are twenty-one (21) segments identified for individual targeted assessments.	4

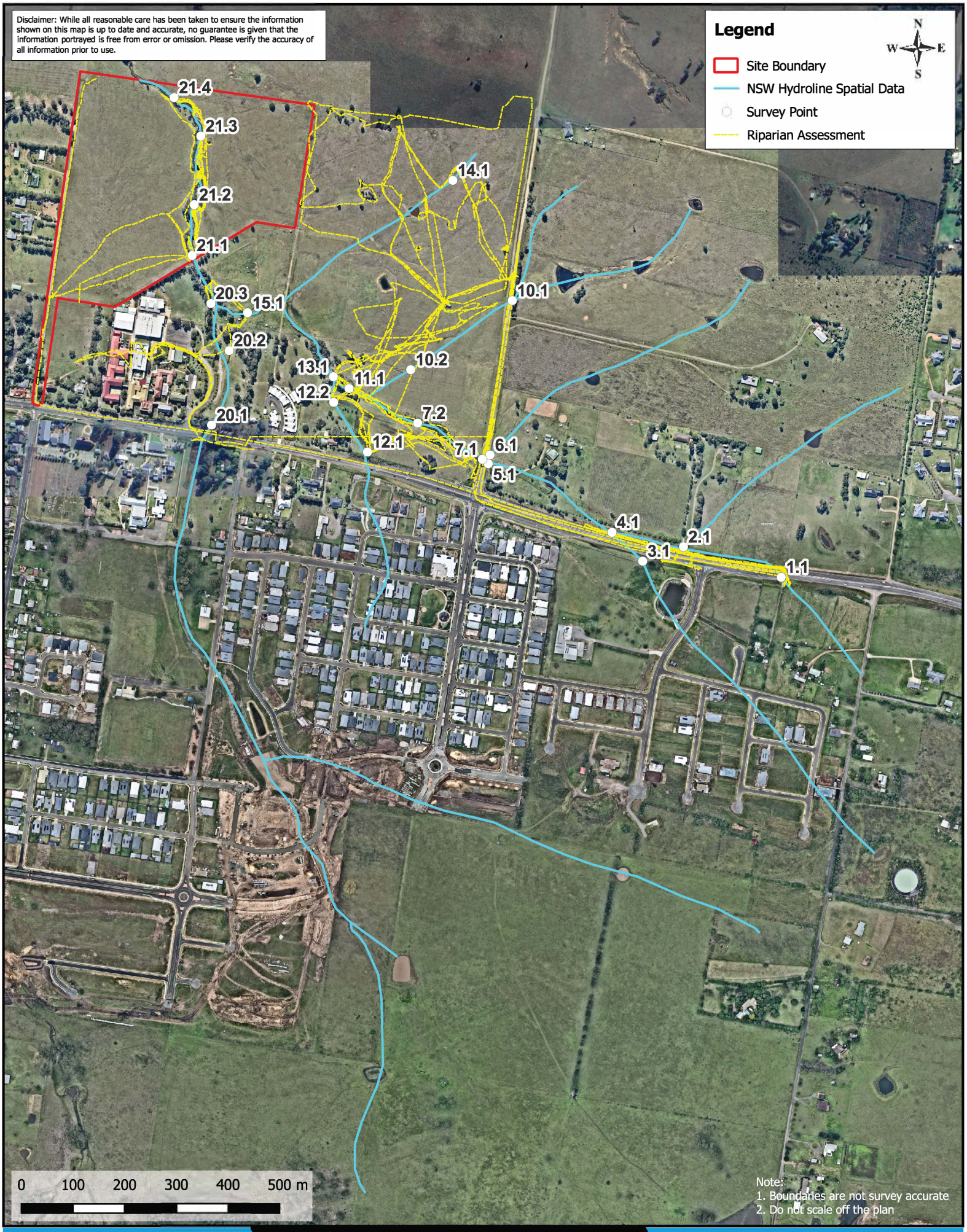

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Figure 5 - Survey Effort

Date: January 2025

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

Client: CDMN

AEP ref: 4951

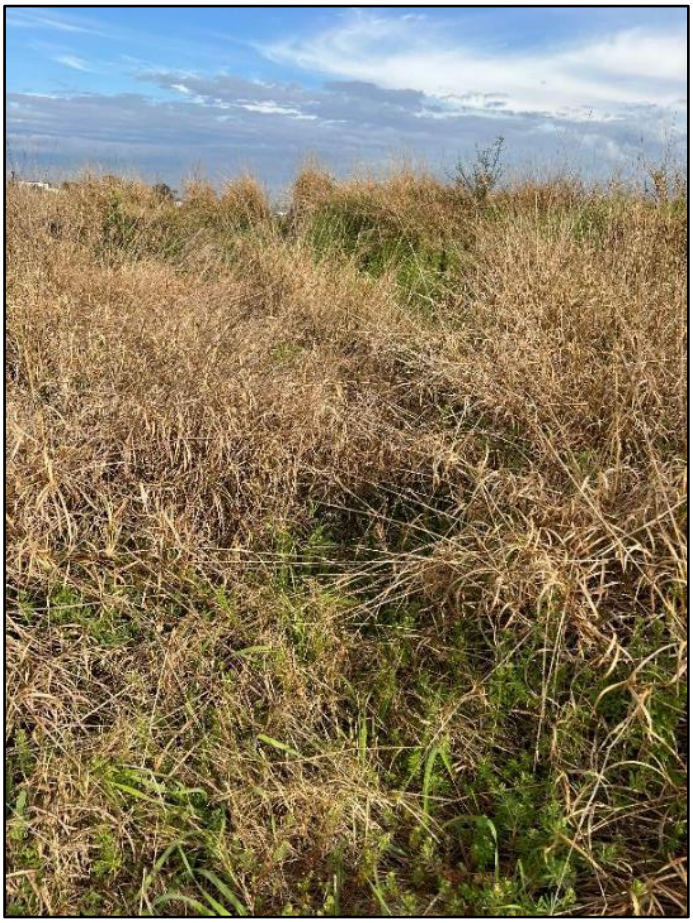
3.0 Site Assessment Results

Table 3 – Segment ID 1 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 1.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 1 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 1.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and Outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	None Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	No native vegetation Present		
Riparian Vegetation (high bank to 40m)	No native vegetation Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	Segment 1 is mapped as a 1st order stream and the location is now occupied by a swale along the NEH. Urban development has altered the hydrological and geomorphological characteristics of the landscape. The inspection showed stormwater infrastructure through an urban environment. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were identified. Survey Point 1.1 does not constitute waterfront land.		

Site Photos – Survey Point 1.1



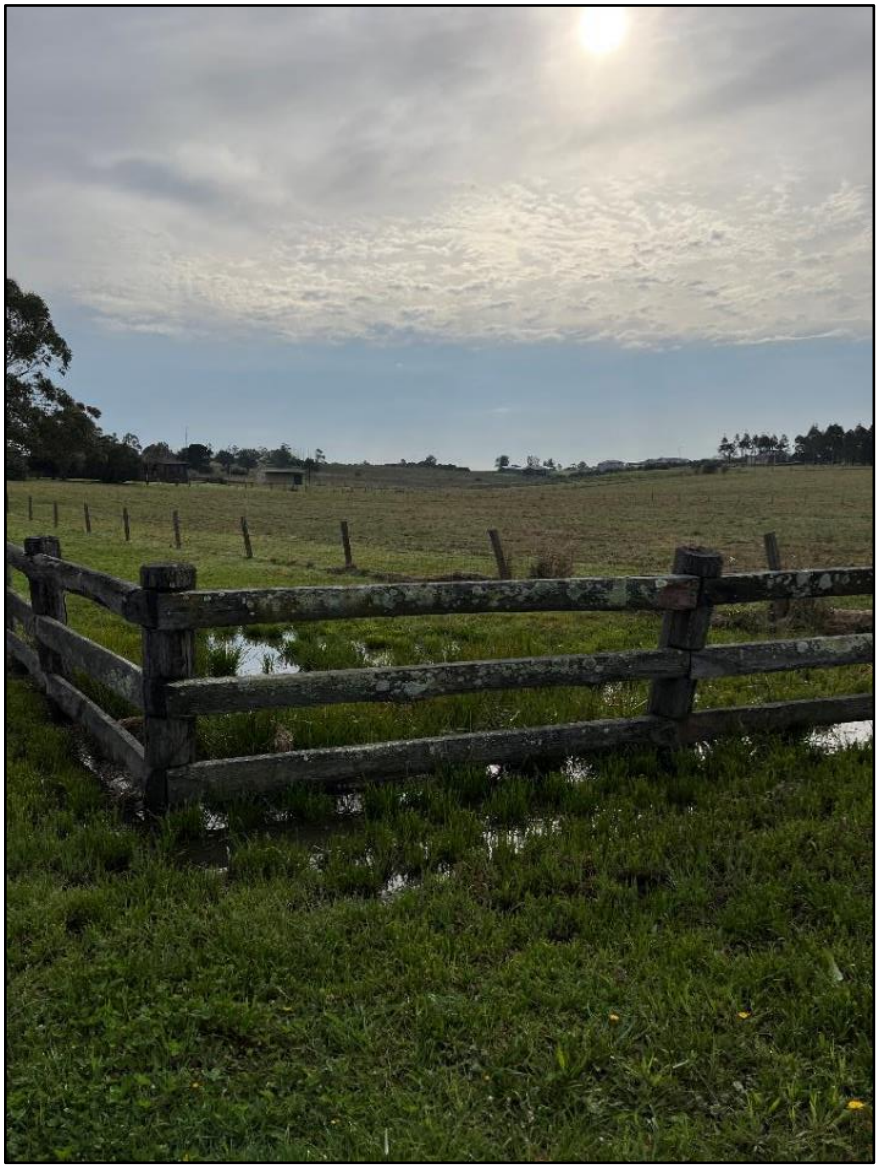
Survey Point 1.1

Table 4 - Segment ID 2 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 2.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 2 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 2.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	No native vegetation Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	No native vegetation Present		
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	Segment 2 is mapped as a 1st order stream. No WFL features, such as a defined bed and bank, or a change in vegetation indicating a wetland were identified. A farm dam is visible on aerial photography north east of Survey Point 2.1, and likely historical land use for agriculture has altered the surface hydrology and geomorphology of the mapped hydroline. Survey Point 2.1 does not constitute waterfront land.		

Site Photos – Survey Point 2.1



Survey Point 2.1 - mapped upstream

Table 5 – Segment ID 3 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 3.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 3 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 3.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	No native vegetation Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	No native vegetation Present		
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	Segment 3 is mapped as a 1st order stream. A roadside swale along the NEH and recently constructed detention Basin for a subdivision development on the southern side of the NEH have likely altered the hydrological and geomorphological characteristics of the landscape. The inspection showed stormwater infrastructure through an urban environment (swales, culverts and detention basin). No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were identified. Survey Point 3.1 does not constitute waterfront land.		

Site Photos – Survey Point 3.1

Survey Point 3.1 mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 3.1 mapped downstream

Table 6 – Segment ID 4 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 4.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 4 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 4.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	No native vegetation Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	No native vegetation Present		
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	Segment 4 is mapped as a 2nd order stream and the location is now occupied by a swale along the NEH. Urban development has altered the hydrological and geomorphological characteristics of the landscape. The previously mapped hydroline is not present. The inspection showed stormwater infrastructure through an urban environment. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were identified. Survey Point 4.1 does not constitute waterfront land.		

Site Photos – Survey Point 4.1

Survey Point 4.1 – mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 4.1 – mapped downstream

Table 7 – Segment ID 5 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 5.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 5 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 5.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	No native vegetation Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	No native vegetation Present		
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	Segment 5 is mapped as a 2nd order stream. Urban development has altered the hydrological and geomorphological characteristics of the landscape. The adjacent rural property is occupied by a farm dam and dam overflow flows under an internal access road culvert and along a straight drainage channel to an existing culvert under Wyndella Road. The inspection showed farm and stormwater infrastructure through a modified environment. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were observed. Survey Point 5.1 does not constitute waterfront land.		

Site Photos – Survey Point 5.1

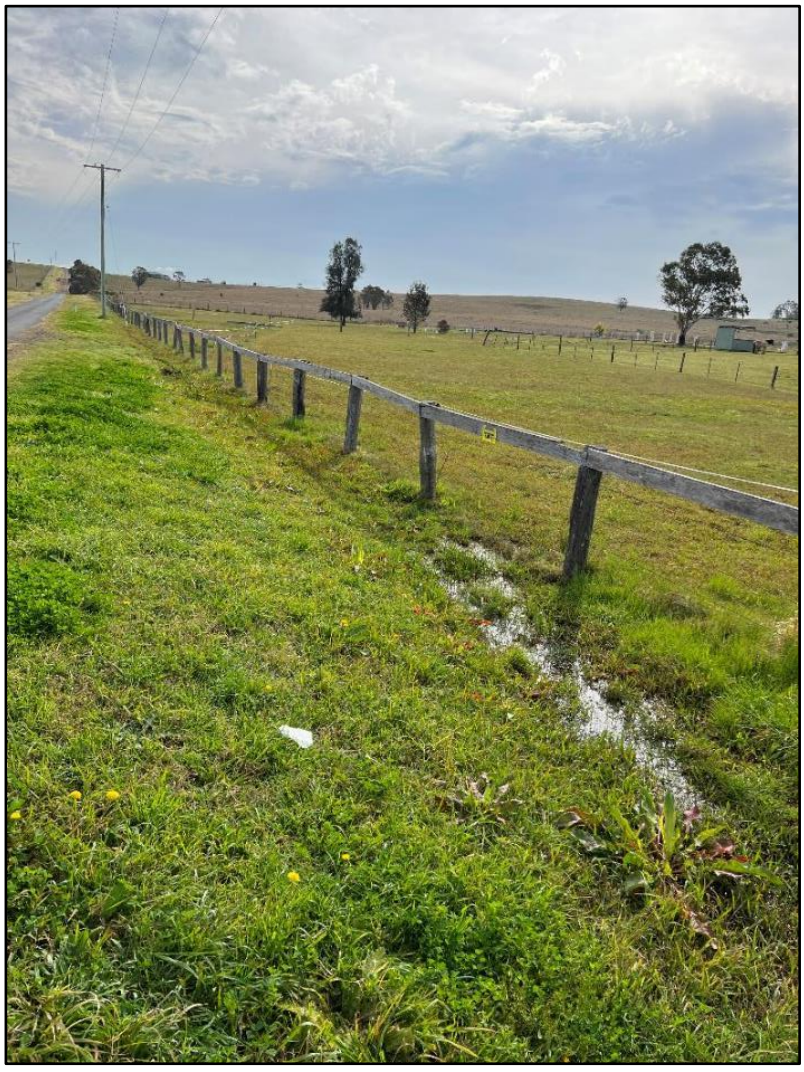
Survey Point 5.1 – mapped upstream

Table 8 – Segment ID 6 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 6.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 6 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 6.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	None Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	No native vegetation Present		
Riparian Vegetation (high bank to 40m)	No native vegetation Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	Segment 6 is mapped as a 1st order stream. Rural development has altered the hydrological and geomorphological characteristics of the landscape. Multiple farm dams and a horse training yard occupy the upstream area mapped as Segment 6. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland. Survey Point 6.1 does not constitute waterfront land.		

Site Photos – Survey Point 6.1



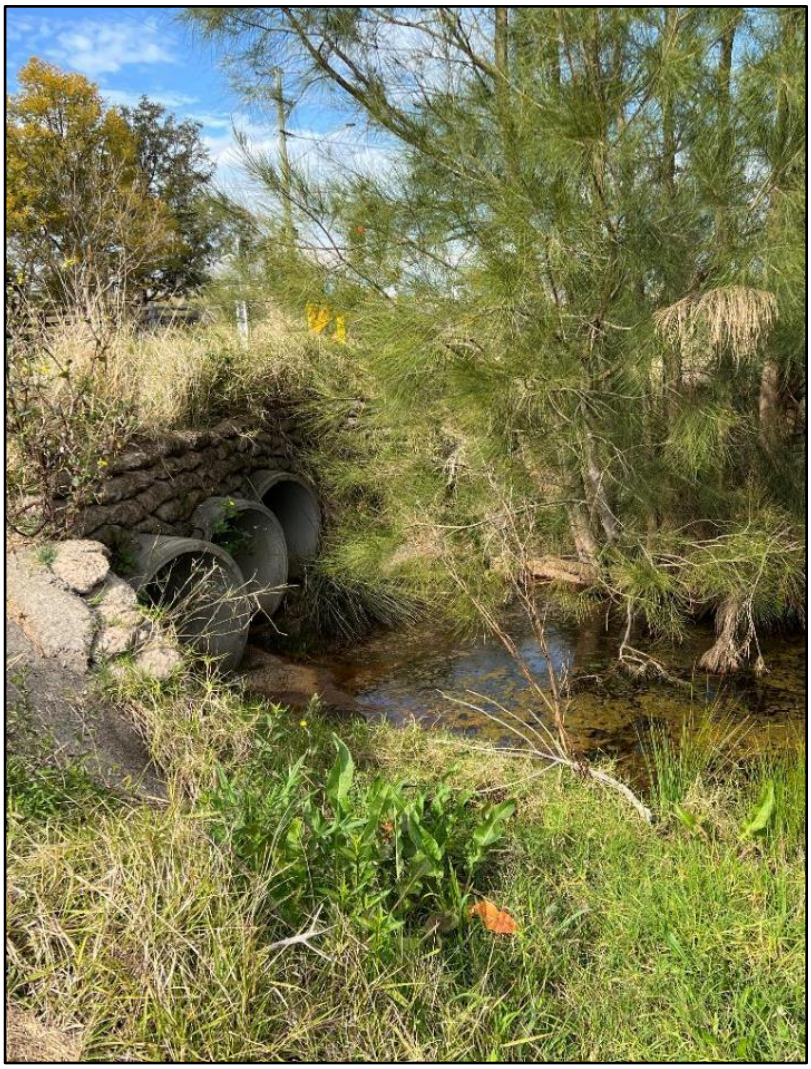
Survey Point 6.1

Table 9 – Segment ID 7 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 7.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 7 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 7.1			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3b	Laterally Unconfined Continuous – Low Sinuosity	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Pools, Erosion, Deposition	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	Riparian vegetation is present, such as Casuarina and *Juncus usitatus,* however a wetland is not present.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		7
Ground-truthed Waterfront Land present?	Yes	The survey identified a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	7
Aquatic Vegetation Present	No native vegetation Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	*Casuarina glauca* present		
Riparian Vegetation (high bank to 40m)	*Casuarina glauca* present		
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Comments	Survey Point 7.1 occurs at a culvert on the western side of Wyndella, Road. Discharge from the culvert has resulted in WFL and includes watercourse features such as a defined bed and bank, pools and a change in vegetation indicating a wetland. Survey Point 7.1 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		

Site Photos – Survey Point 7.1



Survey Point 7.1 - upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 7.1 - downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 7.2			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 8 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 7.2			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3b	Laterally Unconfined Continuous – Low Sinuosity	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Pools, Erosion, Deposition	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No		-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		7
Ground-truthed Waterfront Land present?	Yes	The survey identified a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	7
Aquatic Vegetation Present	Present	Aquatic vegetation is present, *Juncus usitatus,*	
Bank Vegetation (Toe to top of high Bank)	None Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Comments	Watercourse features are present at Survey Point 7.2. Survey Point 7.2 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 7.2			

Survey Point 7.2 - upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 7.2 - downstream

Table 10 – Segment ID 10 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 10.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 10 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 10.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	Present	Aquatic vegetation is present, such as *Juncus usitatus,*	

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	None Present		
Riparian Vegetation (high bank to 40m)	Present	Scattered Eucalyptus	
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	Segment 10 is mapped as a 2nd order stream and Survey Point 10.1 represents the juncture of Segment 8 and 9. Roadside inspection reveal a lack of bed and bank, and watercourse features, north east in the direction of mapped Segment 8 and 9. A culvert is present under Wyndella Road, with small erosion pools at the entrance and exit points, formed by the convergence of over land flow at the culvert. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were observed. Survey Point 10.1 does not constitute waterfront land.		

Site Photos – Survey Point 10.1

Survey Point 10.1 – mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 10.1 - downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 10.2			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 10 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 10.2			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	None Present		
Bank Vegetation (Toe to top of high Bank)	None Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	Segment 10 is mapped as a 2nd order stream and the location is now occupied by managed grassland. Rural development has likely altered the hydrological and geomorphological characteristics of the landscape through pastural land use and construction of farm dams and drainage lines. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland. Survey Point 10.2 does not constitute waterfront land.		

Site Photos – Survey Point 10.2

Survey Point 10.2

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 10.2 -downstream

Table 11 – Segment ID 11 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 11.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	3	Based on the desktop assessment, Segment ID 11 is mapped as a 3rd order stream.	3
Field Assessment – Survey Point 11.1			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3a	Laterally Unconfined Continuous – Bank Confined	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Erosion, Deposition, Riffle	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	Yes	Yes, there are change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	6
Aquatic Vegetation Present	Present	Aquatic vegetation is present *Juncus usitatus,*	

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	Present	*Casuarina glauca*	
Riparian Vegetation (high bank to 40m)	Present	*Casuarina glauca*	
Controlled Activity Approval Required (Y / N)	Yes	CAA required.	6
Comments	Watercourse features are present at Survey Point 11.1. The bed and bank have been heavily impacted by cattle. Survey Point 11.1 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		

Site Photos – Survey Point 11.1

Survey Point 11.1 – upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 11.1 - downstream

Table 12 – Segment ID 12 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 12.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 12 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 12.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	None Present	No native vegetation - *Juncus spp* not flowering could not be determined if native or exotic	

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	None Present	No native vegetation	
Riparian Vegetation (high bank to 40m)	None Present	No native vegetation	
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	A roadside swale along the NEH and recently constructed detention Basin for a subdivision development on the southern side of the NEH have likely altered the hydrological and geomorphological characteristics of the landscape. The inspection showed stormwater infrastructure through an urban environment (swales, culverts and detention basin). No WFL features, such as a defined bed and bank were observed. Inundation due to discharge from the NEH culvert has resulted in sporadic occurrence of *Juncus spp.* Survey Point 12.1 does not constitute waterfront land.		

Site Photos – Survey Point 12.1

Survey Point 12.1 – mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 12.1 – mapped downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 12.2			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 12 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 12.2			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	None Present		
Bank Vegetation (Toe to top of high Bank)	None Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	A roadside swale along the NEH and recently constructed detention Basin for a subdivision development on the southern side of the NEH have likely altered the hydrological and geomorphological characteristics of the landscape. No WFL features, such as a defined bed and bank were observed. Inundation due to discharge from the NEH culvert has resulted in sporadic occurrence of *Juncus spp.* Survey Point 12.2 does not constitute waterfront land.		

Site Photos – Survey Point 12.2

Survey Point 12.2 – mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 12.2 – mapped downstream

Table 13 – Segment ID 13 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 13.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	3	Based on the desktop assessment, Segment ID 13 is mapped as a 3rd order stream.	3
Field Assessment – Survey Point 13.1			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3a	Laterally Unconfined Continuous – Bank Confined	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Erosion, Deposition, Riffle, Pool	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		-
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	6
Aquatic Vegetation Present	None Present		
Bank Vegetation (Toe to top of high Bank)	None Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	Present	*Casuarina glauca*	
Controlled Activity Approval Required (Y / N)	Yes	CAA required.	6
Comments	Watercourse features are present at Survey Point 13.1. Survey Point 13.1 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 13.1			

Survey Point 13.1

Table 14 – Segment ID 14 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 14.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	1	Based on the desktop assessment, Segment ID 14 is mapped as a 1st order stream.	3
Field Assessment – Survey Point 14.1			
Defined Bed and Banks (Yes / No)	No	No defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	None	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	None Present		
Bank Vegetation (Toe to top of high Bank)	None Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Comments	Survey Point 14.1 is occupied by managed grassland. Rural development has likely altered the hydrological and geomorphological characteristics of the landscape through pastural land use and construction of farm dams and drainage lines. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland. Survey Point 14.1 does not constitute waterfront land.		

Site Photos – Survey Point 14.1

Survey Point 14.1 – mapped downstream

Table 15 – Segment ID 15 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 15.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	3	Based on the desktop assessment, Segment ID 15 is mapped as a 3rd order stream.	3
Field Assessment – Survey Point 15.1			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3a	Laterally Unconfined Continuous – Bank Confined	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Erosion, Deposition, Pool	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		-
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	6
Aquatic Vegetation Present	None Present		
Bank Vegetation (Toe to top of high Bank)	None Present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	Yes	CAA required.	6
Comments	Watercourse features are present at Survey Point 15.1. Survey Point 15.1 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 15.1			

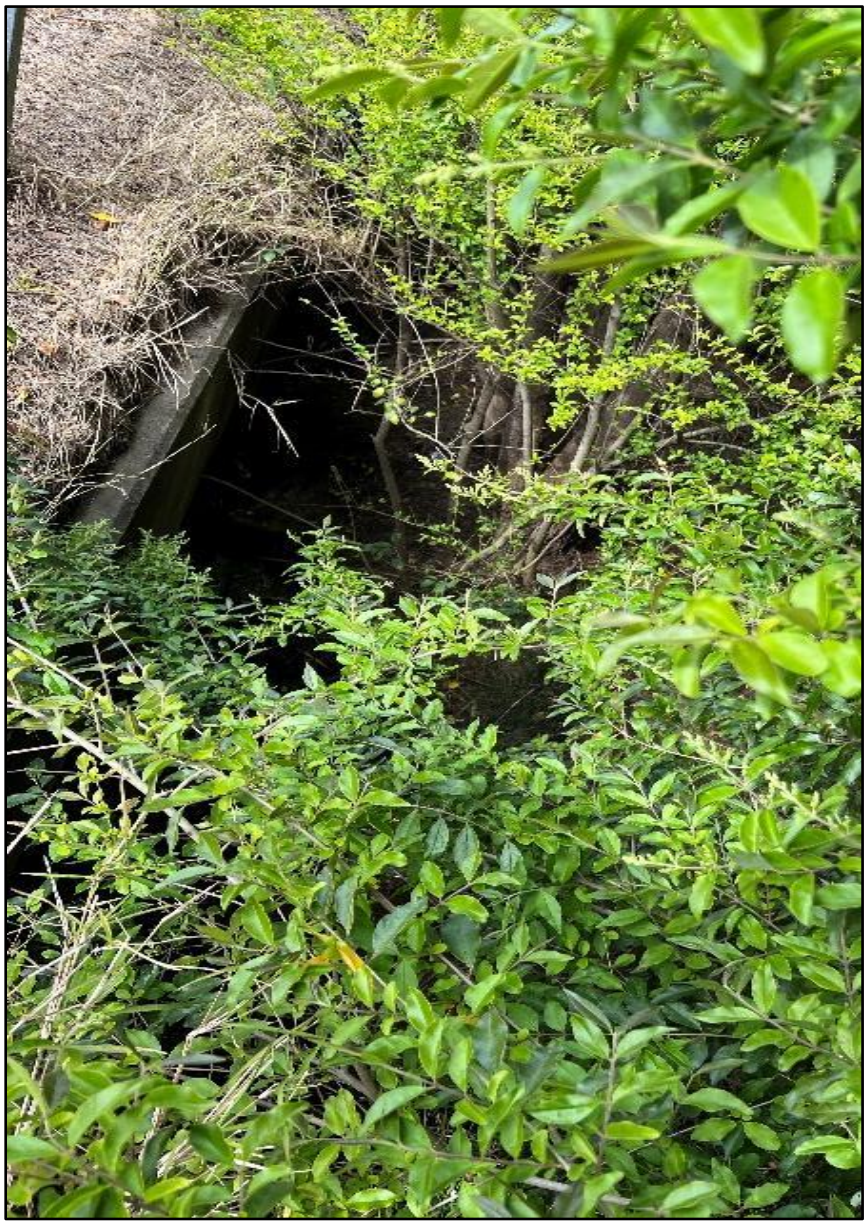
Survey Point 15.1

Table 16 – Segment ID 20 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 20.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 20 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 20.1			
Defined Bed and Banks (Yes / No)	None	No defined bed or bank	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None	No watercourse features present	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	No		-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No		-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	-
Ground-truthed Waterfront Land present?	N/A	Not applicable	6
Aquatic Vegetation Present	None Present	No native vegetation	
Bank Vegetation (Toe to top of high Bank)	None Present	No native vegetation	

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	None Present	Planted Eucalyptus sp.	
Controlled Activity Approval Required (Y / N)	No	Not applicable	6
Comments	Segment 20 is mapped as a 2nd order stream and the location is now occupied by a culvert under the NEH that discharge into a stormwater infrastructure. Urban development has altered the hydrological and geomorphological characteristics of the landscape. The inspection showed stormwater infrastructure through an urban environment. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were identified. Survey Point 20.1 does not constitute waterfront land.		

Site Photos – Survey Point 20.1



Survey Point 20.1 – mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 20.1 – mapped downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 20.2			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	2	Based on the desktop assessment, Segment ID 20 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 20.2			
Defined Bed and Banks (Yes / No)	None	No defined bed or bank	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	None		6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	No	No watercourse features present	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	No		-
Ground-truthed Waterfront Land present?	N/A	The survey did not identify a defined bed and bank, or watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does not constitute waterfront land.	6
Aquatic Vegetation Present	None Present		
Bank Vegetation (Toe to top of high Bank)	None Present		

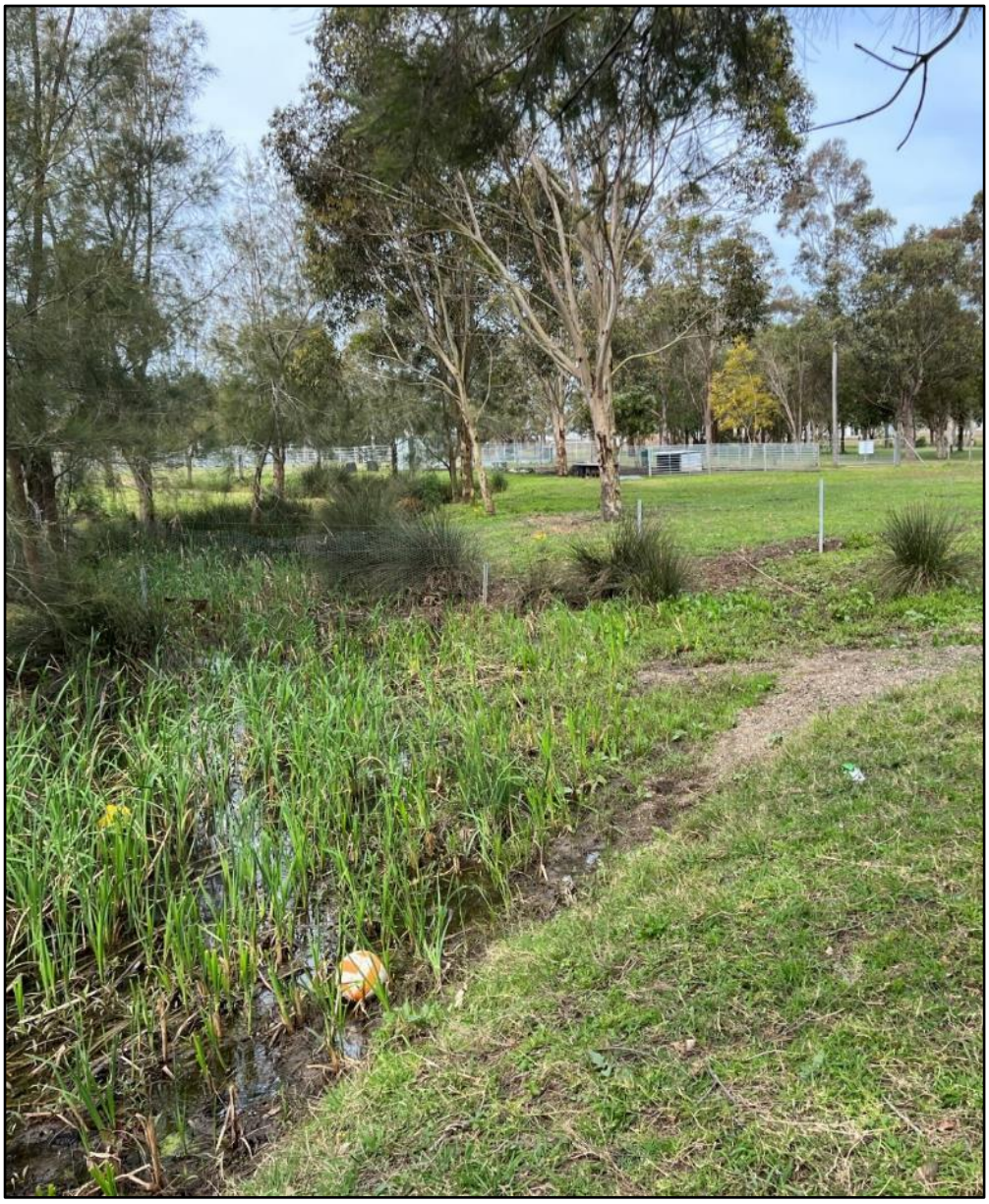
Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	6
Comments	Survey Point 20.2 is occupied by stormwater infrastructure that discharges flow from underground piping from the south. Urban development has altered the hydrological and geomorphological characteristics of the landscape. The inspection showed stormwater infrastructure through an urban environment. No WFL features, such as a defined bed and bank or a change in vegetation indicating a wetland were identified. Survey Point 20.2 does not constitute waterfront land.		

Site Photos – Survey Point 20.2

Survey Point 20.2 – mapped upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 20.3			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	3	Based on the desktop assessment, Segment ID 20 is mapped as a 2nd order stream.	3
Field Assessment – Survey Point 20.3			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3a	Laterally Unconfined Continuous – Bank Confined	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Erosion, Deposition, Riffle, Pool	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	No change in vegetation indicating wetlands.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		-
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	6
Aquatic Vegetation Present	Present	Aquatic vegetation is present, such as *Juncus usitatus,*	
Bank Vegetation (Toe to top of high Bank)	None present		

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	Present	*Casuarina glauca and Eucalyptus Sp.*	
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Comments	Discharge from stormwater infrastructure forms watercourse features approximately 35m south of Survey Point 20.3. Flow enters the existing watercourse to the north. Survey Point 20.3 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 20.3			



Survey Point 20.3 - upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 20.3 - downstream

Table 17 – Segment ID 21 Riparian Assessment

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 21.1			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	3	Based on the desktop assessment, Segment ID 21 is mapped as a 3rd order stream.	3
Field Assessment – Survey Point 21.1			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3b	Laterally Unconfined Continuous – Low Sinuosity	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Pool, Riffle, Erosion, Deposition	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	*Juncus usitatus* present along the bank.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		7
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	7
Aquatic Vegetation Present	Present	Aquatic vegetation is present, such as Casuarina *Juncus usitatus,*	

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Bank Vegetation (Toe to top of high Bank)	None Present	No native vegetation	
Riparian Vegetation (high bank to 40m)	Present	*Casuarina glauca and Eucalyptus Sp.*	
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Comments	Watercourse features are present at Survey Point 21.1. Rip rap has been deposited to allow vehicles to traverse the watercourse. Survey Point 21.1 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 21.1			

Survey Point 21.1 - upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 21.1 - downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 21.2			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	3	Based on the desktop assessment, Segment ID 21 is mapped as a 3rd order stream.	3
Field Assessment – Survey Point 21.2			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3c	Laterally Unconfined Continuous – Meandering	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Pool, Riffle, Erosion, Deposition, inside and Outside Bends	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	*Juncus usitatus* present along the bank.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		7
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	7
Aquatic Vegetation Present	Present	Aquatic vegetation is present, *Juncus usitatus,*	
Bank Vegetation (Toe to top of high Bank)	Present	No native vegetation	

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	Present	*Casuarina glauca*	
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Comments	Watercourse features are present at Survey Point 21.2. Survey Point 21.2 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 21.2			

Survey Point 21.2 - upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 21.2 - downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 21.3			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	3	Based on the desktop assessment, Segment ID 21 is mapped as a 3rd order stream.	3
Field Assessment – Survey Point 21.3			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3c	Laterally Unconfined Continuous – Meandering	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Pool, Riffle, Erosion, Deposition, inside and Outside Bends	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	*Juncus usitatus* present along the bank.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		7
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	7
Aquatic Vegetation Present	Present	Aquatic vegetation is present, *Juncus usitatus,*	
Bank Vegetation (Toe to top of high Bank)	Present	*Juncus usitatus,*	

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	None Present	*Casuarina*	
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Comments	Watercourse features are present at Survey Point 21.3. Survey Point 21.3 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 21.3			

Survey Point 21.3 - upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 21.3 - downstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Desktop Assessment – Survey Point 21.4			
Is your property located on a watercourse, lake or estuary within the shaded area in any of the NRAR waterfront land maps? (Appendix 1- NRAR Guidelines, 2020)	No	The Site Boundary is not located in a nominated shaded area, and is not exempt from Controlled Activity Approval.	1
Is your property within the shaded area on the NRAR Map—Western land map local government area? (Appendix 2- NRAR Guidelines, 2020)	No	The site location is Maitland LGA, which is excluded from the Western Land map.	1
Is there a watercourse visible on your property?	Yes	Yes, NSW Hydroline Spatial Data 1.0 indicates there is one (1) hydroline within the Site Boundary and an additional twenty (20) hydroline segments within the upstream reach (Site Boundary).	3
Is there a lake or wetland on your property or within 40 metres of the proposed work? (Appendix 3 - NRAR Guidelines, 2020—Lakes and Wetlands)	No	No wetlands or lakes are within 40m of the Site Boundary.	3
Using the Determining Stream Order fact sheet (Appendix 4 - NRAR Guidelines, 2020) and the NSW Hydro Line Spatial Data Map, what is the stream order of your watercourse?	3	Based on the desktop assessment, Segment ID 21 is mapped as a 3rd order stream.	3
Field Assessment – Survey Point 21.4			
Defined Bed and Banks (Yes / No)	Yes	Defined bed and bank visible	6
Type of Watercourse: Type 1, Type 2, Type 3a, Type 3b, Type 3c, Type 4, Type 5, Type 6, Type 7, None (Refer Appendix 5 - NRAR Guidelines, 2020)	Type 3c	Laterally Unconfined Continuous – Meandering	6
Watercourse Feature Present (Pool, Riffle, Erosion and Deposition, Inside and outside bend)	Yes	Pool, Riffle, Erosion, Deposition, inside and Outside Bends	-
Lakes or Wetlands (Appendix 3 - NRAR Guidelines, 2020)	No		-
Change in Vegetation Present to Indicate Wetlands (Appendix 7 - NRAR Guidelines, 2020)	No	*Juncus usitatus* present along the bank.	-
High Bank (Appendix 8 - NRAR Guidelines, 2020)	Yes		7
Ground-truthed Waterfront Land present?	Yes	The survey did identify a defined bed and bank, and watercourse features as described in Appendix 6 of the Waterfront Land Tool. This survey point does constitute waterfront land.	7
Aquatic Vegetation Present	Present	Aquatic vegetation is present, such as *Juncus usitatus,*	
Bank Vegetation (Toe to top of high Bank)	Present	*Juncus usitatus,*	

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Riparian Vegetation (high bank to 40m)	None Present		
Controlled Activity Approval Required (Y / N)	Yes	CAA is required for works within 40m of the top of banks.	6
Comments	Watercourse features are present at Survey Point 21.4. Survey Point 21.4 constitutes waterfront land and a CAA is required for works within 40m of the top of bank.		
Site Photos – Survey Point 21.4			

Survey Point 21.4 - upstream

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures

Survey Point 21.4 - downstream

4.0 Part 2 - Controlled Activity Approvals Report

The detailed WLAR in Part 1 of this Report, was able to assess a significantly large Site Boundary, as access was obtained. This assessment has enabled AEP to prepare a detailed merit based CAAR for the Site Boundary.

4.1 Ground-truthed Vegetation Assessment

The native vegetation within the Waterfront land has been ground-truthed, and contains one (1) Plant Community Type (PCT), in one (1) condition class with the remaining area being non-native and Planted Native. The PCT present within the Waterfront Land is PCT 4023 - *Coastal Valleys Riparian Forest* (0.11ha) in poor condition (refer **Figure 8**).

Within the proposed development footprint other vegetation communities were observed, however, not present within the Waterfront land.

4.2 Health of Aquatic Environments

As stated by Department of Primary Industry (Fisheries) *Fixing Fish Habitat*, 2007 "*The health of our rivers and creeks is influenced by our activities on the land. In the past, waterways throughout NSW have undergone extensive change due to urban, industrial and agricultural development. Erosion, drainage of floodplains and wetlands, the construction of instream structures which restrict fish passage and the removal of riparian and aquatic vegetation have all degraded fish habitat. These changes have put significant pressure on native fish populations and recreational fishing opportunities. Aquatic habitat rehabilitation has become progressively more important in NSW as the community recognises the benefits of natural, healthy systems for native plants and animals, our fisheries resources, the control of pollution and erosion, and the recovery of threatened species*".

Freshwater environments can be damaged directly by stock grazing, horticulture, cropping, sedimentation and erosion, online structures, carp fossicking for food in sediment, changed hydrology, in-stream activities, including dredging and reclamation, and also indirectly through shading or incidental manual damage (e.g. from launching or beaching water craft, boat-induced wave action, etc). The processes such as land use and erosion that damage freshwater ecosystems within the Site Boundary have been assessed and are proposed to be removed.

Key river features such as pools, provide important fish and amphibian habitat and refuge areas. As the flow in the river decreases, fish retreat to these pools to wait for the return of higher flows. Even after prolonged droughts, fish will rapidly recolonise a river provided these refuge areas are available. Other channel habitats such as undercut banks, rock ledges, boulders, snags, weed beds, and backwaters all offer essential habitat sites for fish.

The biodiversity of streams is also dependent on having a variety of substrates. The bed of the river may be comprised of bedrock, gravel, snags, sand or mud. These often provide breeding sites for different fish species. Gravel habitats are generally much more productive than equivalent areas of sand or mud. The spaces between the stones are inhabited by invertebrates, and provide small fish with refuge from predators and strong currents. Gravels also provide a surface for algae to grow, which, in turn, is eaten by many invertebrates and some fish. Gravel beds are used as spawning habitat for a variety of freshwater fish, including Macquarie perch and freshwater catfish.

In-stream vegetation may include trees, sedges and rushes, submerged macrophytes and algae. Some trees such as *Melaleuca* and *Casuarina* species can grow within channels and provide fish habitat. The tree roots stabilise sediments and the exposed vegetation increases channel roughness. This slows water flow, creating backwaters and eddies where fish can rest. Some sedges such as *Baumea* species and *Lomandra longifolia* grow directly along the lower part of banks and provide excellent bank protection and capture nutrients.

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.

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
- increasing the diversity of physical habitat types within the stream.

Aquatic weeds are of particular concern choking streams so that fish passage is prevented, reducing channel capacity and leading to problems of increased flooding, and producing high levels of biomass that create anoxic conditions. For example, para grass, an exotic species can reduce channel capacity by 20 times, create anoxic waters and decrease aquatic biodiversity to a fraction of natural levels.

Many weeds are identified as noxious in State legislation. Some weeds are listed as "weeds of national significance". Such species must be removed and destroyed.

4.2.1 Hunter River Catchment

The Hunter catchment lies east of the Great Dividing Range, around 100km north of Sydney, it is the largest coastal catchment in NSW, with an area of approx. 21,500km^2 . The Hunter catchment supports a range of landscapes, from high mountain ranges up to 1,500m, to broad fertile floodplains and extensive estuarine areas less than 50 metres high. In the west of the catchment there are large areas of wilderness and national park.

The Hunter River begins in the Mount Royal Range on the western side of the Barrington Tops, flowing for approx. 460km to Newcastle.

Tributaries of the upper Hunter River include the Pages and Isis rivers, and Middle, Dart, Stewart, Moonan, Goulburn River and Ormadale brooks. The largest tributary of the Hunter is the Goulburn River. It accounts for 40% of the Hunter’s catchment area, but makes up only 23% of its flow. The Goulburn River begins at Ulan near Mudgee and flows east to join the Hunter River near Denman.

The Paterson and Williams rivers rise in the Barrington Tops and drain the higher rainfall area in the north-east of the catchment. Both rivers flow south into the Hunter estuary.

The Hunter River Biodiversity Values are high supporting several large wetland complexes are listed as nationally or internationally important for their waterbird habitat. These are the Kooragang Nature Reserve in the Hunter Wetlands National Park, Hexham Swamp, the upland swamps of Barrington Tops, and the Hunter Wetlands Centre.

Wollemi National Park stretches across the south of the catchment between Wollombi and Bylong, forming part of the Greater Blue Mountains World Heritage Area.

The volume and pattern of flows in the Hunter River system have been significantly altered by the construction and operation of Glenbawn and Glennies Creek dams.

Large volumes of water are also taken and stored for power station use in Lake Liddell, mining in Singleton region, gazing and cropping in the lower floodplain and high urban and industrial development along its banks.

The historical and continual use of the Hunter River and its tributaries has allowed for severe decline in its health. The Hunter River Catchment is recorded as NSW most cleared catchment east of the dividing range, loss of native vegetation causes soil erosion, high sediment loads, water quality decline and salinity issues.

4.2.2 Tributaries of the Hunter River

As shown through decades of research upper tributaries like the one within the Subject Land play a vital role in the ecosystem health of the entire catchment by:

- During high flow events larger rivers and streams experience increased water velocity and turbulence, making it difficult for fish to navigate and find shelter. The lower ordered streams, being smaller and often more sheltered, can serve as refuges for fish during these events. The slower flow and greater abundance of submerged vegetation and woody debris in these smaller streams provide areas where fish can seek refuge from the strong currents and turbulent water conditions.
- The lower ordered streams often provide critical spawning habitat for many fish species. These small streams typically have gravel or rocky substrates, which are suitable for fish to deposit their eggs. During high flow events, the increased water flow can help carry fish eggs downstream to suitable nursery habitats in larger rivers and lakes, contributing to the dispersal and recruitment of fish populations.
- High flow events can also lead to the mobilisation of nutrients and organic matter from the surrounding landscape into streams and rivers. The lower ordered streams act as important receptors for these nutrients, which can stimulate primary production and support the growth of algae and other aquatic plants. This, in turn, provides a food source for fish and other aquatic organisms, helping to sustain fish populations during and after high flow events.
- Lower ordered streams contribute to the overall connectivity of riverine ecosystems. They serve as upstream sources of water, nutrients, and organic matter that are transported downstream and influence the ecological processes in larger rivers and estuaries. Maintaining connectivity between headwater streams and larger water bodies is essential for ensuring the resilience and adaptability of fish populations to changing environmental conditions, including high flow events.
- The lower ordered streams are often characterised by high levels of habitat diversity, including pools, riffles, and runs, as well as diverse riparian vegetation. These habitats support a wide range of fish species adapted to different ecological niches, making flower ordered streams biodiversity hotspots within riverine landscapes. Protecting and restoring these habitats is essential for conserving the overall biodiversity and ecological integrity of river ecosystems, especially during periods of increased disturbance such as high flow events.

4.2.3 Unnamed Tributaries Assessment

The Site Boundary contains one mapped unnamed Tributary that flows into Lochinvar Creek in the upper reaches of the Hunter River Catchment.

As shown in the WFL assessment (Part 1 of this report) the unnamed tributary within the Site Boundary is mapped 3rd order stream. Using the Departments WFL Tool AEP determined that there are mapped streams within the Site Boundary that are not present on ground, on that basis AEP has prepared the below Merit Based Assessment ensuring the objectives of the WM Act are met.

4.3 Merit Based Assessment.

The purpose of a Merit Based Assessment is to ensure that appropriate vegetated riparian zones (VRZ) are allocated to the ground-truthed rivers within a Site Boundary. AEP investigations over the recent years have shown that ground-truthing a system is vital in determining the appropriate VRZ, as the mapped hydrolines may not be reflective of what is on the ground.

Vegetated riparian zones comprise; the areas of vegetation adjacent to rivers, streams, lakes, or other water bodies and serve several important purposes:

- Riparian vegetation helps stabilise riverbanks and shorelines by binding soil with their roots. This reduces erosion caused by water flow and wave action, protecting banks adjacent to water bodies from being washed away.
- Vegetated riparian zones act as buffers between terrestrial and aquatic ecosystems, filtering pollutants such as sediments, nutrients, and chemicals before they enter water bodies. The plants absorb nutrients like nitrogen and phosphorus, which can otherwise cause algal blooms and degrade water quality.
- Riparian vegetation provides essential habitat for a diverse range of plant and animal species, including fish, amphibians, birds, and mammals. The vegetation offers food, shelter, nesting sites, and breeding areas for these species, contributing to overall biodiversity and ecosystem health.
- The roots of riparian vegetation help anchor soil, preventing bank erosion and slumping. This stabilization is crucial for maintaining the integrity of riverbanks, protecting infrastructure such as roads, bridges, and buildings located nearby, and preserving the natural landscape.
- Riparian vegetation provides shade, which helps regulate water temperature in streams and rivers. Cooler water temperatures are essential for fish and other aquatic organisms, as they can influence metabolism, oxygen levels, and overall ecosystem health.

Overall, vegetated riparian zones play a crucial role in maintaining the ecological integrity, water quality, and overall resilience of riverine ecosystems, making them vital components of sustainable land and water management practices.

NSW Department of Environment, Climate Change and Water Waterfront Land Tool provides the mechanism to determine the required VRZs to sustain and improve catchment health and condition. The tool has been developed as it acknowledges there has been significant change to our waterbodies throughout the state due to land use practices. The disturbances of our waterways changes means that all streams and wetlands within a site need to be ground-truthed for location, condition, river features and ordering to determine VRZs, these surveys ensure VRZs meet the department requirements which in turn provide a healthy ecosystem

4.3.1 Summary of WLA Results

Desktop investigations indicated the presence of eleven (11) 1st order, three (3) 2nd order, and one (1) 3rd order streams occur within the Site Boundary. However, field surveys identified a lack of watercourse features at numerous Segments throughout the Site Boundary. Ground–truth surveys show the surrounding landscape is highly modified/managed due to significant human disturbance.

- Segment IDs 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 14 16, 17, 18, 19, and 20 did not represent waterfront land as they lacked watercourse features. These were predominately swales/erosion gullies/channels / artificial waterbodies and stormwater infrastructure associated with the New England Highway, or erosion gullies / overland flow / managed grassland/water storage units associated with the surrounding rural properties' agriculture practices and the management of the VBL site itself. As a result, the above-mentioned Segment IDs are not present.
- Ground–truth surveys have shown Segment ID 7, 11, 13, 15 and 21 were observed with watercourse features and therefore constitute waterfront land. Watercourse features began at the most upstream Survey Point location of 21.1

Overall Vegetation Assessment

The vegetation within the broader Site Boundary has limited native vegetation in poor condition due to high weed and pasture grass loads from previous and present land uses. The seed loads being carried through the water are dominant exotic, hence this is reflected in riparian land. As stated above this has a significant impact on the overall Catchment Health, allowing for pest species to thrive, high sediment loads and poor water quality.

Overall Aquatic Health

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 Typha, 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 does not provide the variety of habitats required to support our native fish, macroinvertebrates and other aquatic/semi-aquatic species.

AEP surveys did not result in any macroinvertebrates and native fish (Carp Gudgeon) was observed, while several exotic species were observed in high numbers. Some of the exotic species are likely preying on native fauna, however, another reason for the high population of pest species is due to the limited habitat within the system.

4.3.2 Proposed Ground-truthed Measures

AEP has undertaken detailed surveys determining the presence or absence of mapped streams, and the health and condition of the aquatic and riparian ecosystems to guide the proposed development within the Site Boundary ensuring the Objects and provision of *Section 91* of the WM Act are met. As the Site Boundary does not reflect the mapped system a Merit Based Assessment has been prepared to ensure that both aquatic and terrestrial ecosystem health is significantly improved and maintained in perpetuity.

4.3.2.1 Vegetation Riparian Zones for Ground-truthed Streams

To ensure appropriate VRZs are applied to the land and all works within the streams are appropriate as outlined in **Table 18**, AEP used the method for ordering of mapped streams and applied this to the ground-truthed system. This assessment is not being used to re-order the mapped streams; it has been applied to demonstrate the merits of the proposed development regeneration works (outlined in **Part 3** of this Report).

Based on ground-truthed presence segment IDs have been allocated an VRZ meeting the requirements for order 1 or 2 systems, as shown in **Figures 8 and 9**.

Based on these results AEP has applied VZRs from the top of high bank. This application has also allowed AEP to guide the proposed development to meet the Department's Riparian Corridor Matrix (refer to **Table 18**).

Based on the above merit-based assessment a 20m VRZ has been applied to the unnamed creek within the Subject Site. **Figures 8** and **9** show the proposed top of bank VRZ areas.

The merit based VRZ areas are comprised of:

- Aquatic Zone – 1.07ha
    - Aquatic zone where aquatic vegetation will be planted;
    - Toe to 10m from High Bank, where suitable riparian vegetation will be planted.
- 10m inner VRZ high bank to 10m - 0.7ha;
- 10m plus (this varies up to 16m in parts) outer VRZ 0.8ha;

- Additional Area Regeneration Area to average the encroachment areas totalling 0.83ha of regenerated riparian vegetation (refer **Figure 9**).

The total area proposed to be managed and maintained under a Biodiversity Management Plan totals 2.3ha **Figure 3** in the BMP, 2025, shows the areas in the proposed management zones (refer to **Appendix C**).

4.3.2.2 Structures

AEP has used the above merit-based 20m VRZ to guide the proposed works in the waterfront land such as the road crossings, basins and outlet structures

The proposed road crossing will be a box culvert designed to meet NSW DPI (Fisheries) requirements for Fish Passage. This type of structure is appropriate for the stream present within the Subject Site, refer **Table 18**.

AEP is recommending that a rock-lined tail out drain be installed where the overflow meets the stream to ensure there is no point-sourced erosion.

Due to the highly degraded bank and bed in portions of the creek, AEP is recommending the creek be restored using a natural channel design to ensure waterfront land features are present within he regenerating BMP Lands.

Overall, the proposal will encroach 0.4ha of the outer VRA. This has been more than offset in the additional 0.83ha of proposed riparian regeneration to a Naturally Regenerating bushland (refer to **Figure 9**).

Table 18 – Riparian Corridor Matrix (extracted from DPIE, Controlled activities – Guidelines for riparian corridors on waterfront land Fact Sheet)

Type	VRZ width (each side of WC)	Total RC width	Cycleways and pathways	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st order	10m	20m + channel width	Yes	Yes	Yes	Yes	Yes	Yes	-	-
2nd order	20m	40m + channel width	Yes	Yes	Yes	Yes	-	Yes	-	-
3rd order	30m	60m + channel width	Yes	Yes	-	Yes	-	-	Yes	Yes
4th order or greater	40m	80m + channel width	Yes	Yes	-	Yes	-	-	Yes	Yes

Note: Where a watercourse (WC) does not exhibit the features of a defined channel with bed and banks, the NRAR may determine that the watercourse is not waterfront land for the purpose of the WM Act.

4.4 Do Nothing Option

The current condition and land use will result in a continual decline in the health of the unnamed stream and Hunter River Catchment. The impacts of a Do Nothing – Leave in Current State will be:

- Erosion will continue to reduce water quality through the downstream catchment.
- Stock will continue to access, causing further erosion, and allowing for untreated effluent to enter the catchment;

- Weeds species (instream and riparian) will continue to increase within the Ground-truthed Waterfront Land and downstream catchment due to the seed loads being moved through the system.
- There will be no increase in native fish habitat or native aquatic vegetation.

4.5 *Water Management Act 2000* Assessment

Part 1 and Part 2 of this report have shown that the current ecosystem is in decline and the proposed merit-based assessment will allow for 2.3ha to be regenerated and managed to a Naturally Regenerating bushland. As shown above, the health of Upper Tributaries has a significant impact on water quality and flows within the entire catchment, reinstating native vegetation, within the stream and adjoining riparian lands will allow for higher levels of infiltration, reduction in erosion and sedimentation, removal of pollutants and nutrient loads as the surface water moves through the native riparian zone. The area will ensure from the top of these tributaries native seeds will be transported through the catchment, reducing weed loads. The regeneration will provide VRZ for aquatic and terrestrial wildlife corridors.

The objectives of the *Water Management Act 2000* are to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. These objectives have been identified below in **Table 19** along with AEP's assessment.

Table 19 –*Water Management Act 2000* Assessment

Water Management Act 2000	**AEP Merit-Based Assessment**
Section 3 - Objects	
To apply the principles of ecologically sustainable development.	The proposed development has assessed and applied the principles of ESD to the proposal. By applying a 20m (40m in total) VRZ the ecological health of the unnamed tributary will be significantly improved. Providing improved water quality and proving connectivity for wildlife. These attributes are known to improve the health of people that live and work in such environments, by providing an area for passive recreation, which in turn assist with productivity and less strain on the local and broader economy.
To protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality.	AEP use of the Waterfront Land Tool to assess the presence and absence of mapped systems along with the detailed vegetation and health surveys of the riparian lands allows for a comprehensive approach to regeneration and developable land to ensure there is a Nature Positive outcome for Waterfront Land. The 20m VRZs applied for the proposed development with a full BMP ensures the restoration of water quality and ecosystem function in the unnamed tributary.
To recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including— • benefits to the environment, and • benefits to urban communities, agriculture, fisheries, industry and recreation, and • benefits to culture and heritage, and • benefits to the Aboriginal people about their spiritual, social, customary and economic use of land and water.	The proposed development has assessed and applied the principles of ESD to the proposal. Through the application of a 20m (40m in total) VRZ the ecological health of the unnamed tributary will be significantly improved. Providing improved water quality and proving connectivity for wildlife. These attributes are known to improve the health of people that live and work in such environments, by providing an area for passive recreation, which in turns assist with productivity and less strain on the local and broader economy.
To recognise the role of the community, as a partner with the government, in resolving issues relating to the management of water sources.	N/A

Water Management Act 2000	AEP Merit-Based Assessment
To provide for the orderly, efficient and equitable sharing of water from water sources.	N/A
To integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna.	The BMP (AEP, 2025) addresses the management of water sources through the management of the land, soil and vegetation within the VRZs.
To encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users.	N/A
To encourage best practices in the management and use of water.	N/A
Section 91 (2) Activities Approvals	
A controlled activity approval confers a right on its holder to carry out a specified controlled activity at a specified location in, on or under waterfront land.	This report and proposal have been prepared as part of the Controlled Activities Approval Application (it will be accompanied by a BMP (refer summary in **Part 3** of this report and full copy in **Appendix C**)

5.0 Part 3 – Biodiversity Management Plan

The aim of this BMP is to schedule rehabilitation through installation of a vegetated batter and fill to restore the severely eroded land adjoining the unnamed creek in the north, to provide weed management, planting and other measures necessary to enhance the vegetation present onsite. The successive stages of regeneration are applicable to ensure that the targets and objectives are achieved over the 5-year duration of the BMP and to minimise maintenance into the future.

This BMP incorporates best practices in bushland restoration, management of invasive species and revegetation in order to achieve the following objectives within the 5 years:

- Regenerate physical and biological functions of the remnant bushland present within the BMP Lands to improve habitat values and landscape connectivity;
- Enable natural and facilitated regeneration where appropriate, ensuring the structural and trophic complexity of the vegetation community is adequately represented;
- Develop management actions using the 'SMART' goals approach (Specific, Measurable, Achievable, Reasonable and Time specific);
- Ensure the site is maintained until vegetation in rehabilitated areas achieves a resilient and self-sustaining state; and

The overarching goal of this plan is to manage the retained vegetation for biodiversity conservation as part of the avoid and minimize strategy for the proposed development.

5.1 Existing Condition

PCT 4023 - Coastal Valleys Riparian Forest

PCT 4023 is located in patches along the creek. This zone contains an area of *Casuarina glauca* canopy and 3 small areas dominated by *Typha orientalis* without canopy.

Other ground stratum species include *Centella asiatica, Commelina spp., Einadia nutans subsp. linifolia, Lepidium spp., Lobelia concolor, Oxalis perennans, Persicaria decipiens, Rumex brownii Cynodon dactylon, Juncus usitatus, Typha orientalis, Bolboschoenus caldwellii, Machaerina juncea, Bothriochloa macra, Microlaena stipoides, Panicum effusum var. simile, Sporobolus creber.*

PCT 4023 is found onsite in two condition categories due to disturbance associated with cattle grazing; with canopy and without canopy.

Overall, the vegetation condition is considered to be poor throughout the BMP Lands. Non native pasture species are present in high densities with the majority of the site too degraded to ascribe a PCT.

PCT 4023 – Poor – with canopy & Poor – ground story only

Areas of PCT 4023 in poor condition with existing canopy. These have a high influence of edge effects associated with continued disturbance. Weed densities are high and include *Cestrum parqui, Ehrharta erecta, Olea europaea and Paspalum dilatatum.*

Areas of PCT 4023 in Poor condition without canopy have a high influence of edge effects associated with continued disturbance. Weed densities are high and include *Juncus acutus, Paspalum dilatatum, Senecio madagascariensis* and *Sporobolus africanus.*

Aquatic Description

The unnamed upper tributary of Lochinvar Creek is in a highly degraded condition, with bed and bank erosion, limited to no native aquatic flora or riparian vegetation, two crossings blocking fish passage and portions have been used to dispose of vegetation material.

The agricultural land use has caused severe degradation of the creek.

5.2 Regenerated Condition

The BMP lands have been segregated into four (4) Management Zones (MZs) according to management strategy necessary to achieve the objectives of this BMP. The location of each vegetation zone is presented in **Figure 3** of the BMP, 2025.

- Management Zone 1 (MZ1): Aquatic Zone Reconstruction,
- Management Zone 2 (MZ2): PCT 4023 – Flood Zone Reconstruction Batter;
- Management Zone 3 (MZ3): PCT 4023 – Riparian Reconstruction Forest; and
- Management Zone 4 (MZ4): PCT 4023 – Riparian Reconstruction Woodland.

Five years of regeneration by a Bush Regeneration Contractor and Project Ecologist and reported annual to Council.

5.3 Regeneration Targets

"Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed. (SER 2021)".

The overall target for the BMP Lands is to establish a naturally regenerating community that provides habitat for foraging, roosting and nesting for species associated with the PCT 4023 - Coastal Valleys Riparian Forest and the local region.

6.0 Summary of Investigations

Desktop assessment indicated the presence of a single 3rd order stream mapped within the Site Boundary and an additional eleven (11) 1st order streams, three (3) 2nd order streams and one (1) 3rd order stream mapped within the Site Boundary.

However, field surveys identified no WFL features in Segments 1, 2, 3, 4, 5, 6, 8, 9, 10. 12, 14, 16, 17, 18, 19 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.

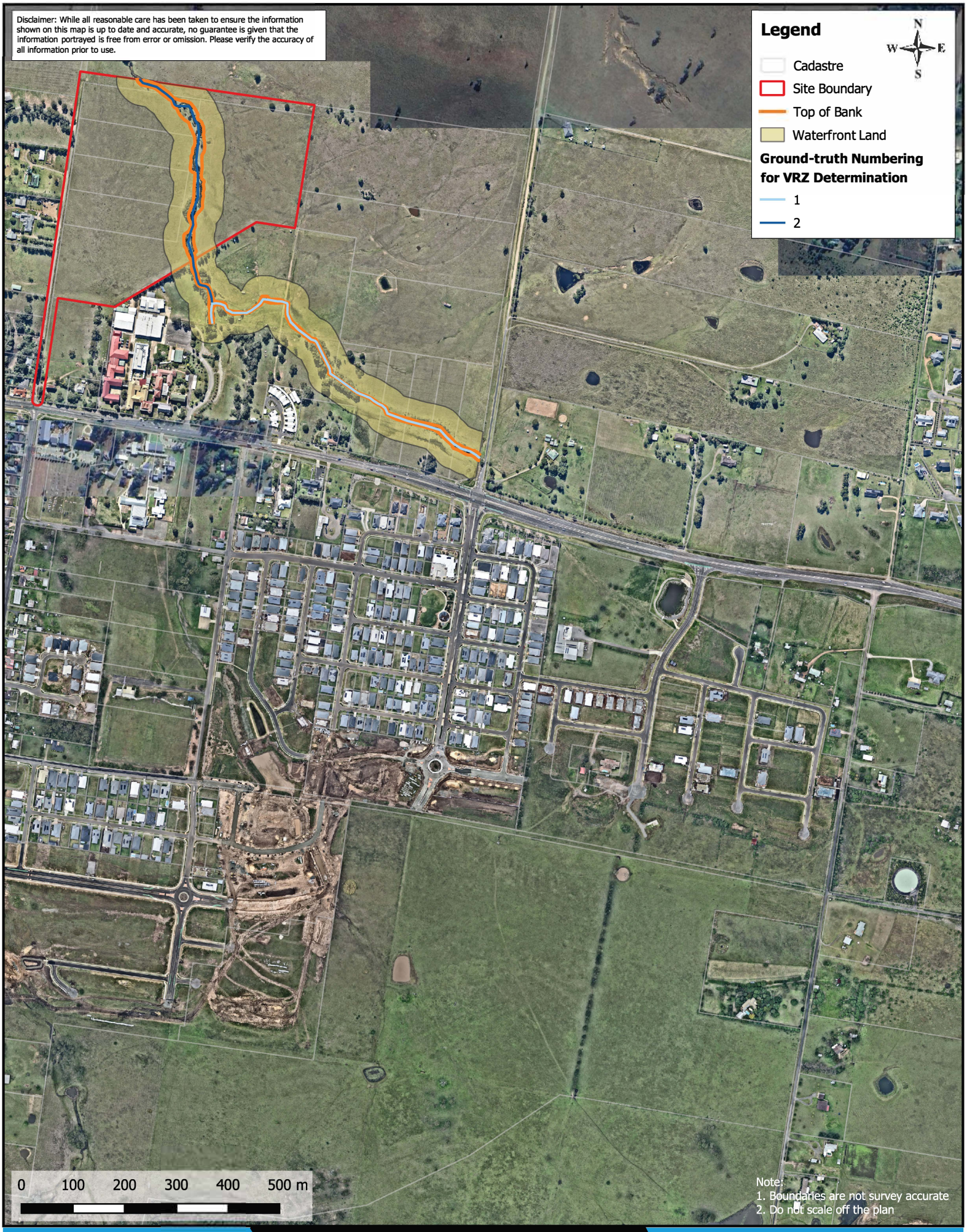
WFL features were observed in Segments 11, 15 and 21, and these Segments were determined to be WFL.

Under **Schedule 2** of the WM Act, a 20m VRZ (either side total of 40m) was allocated to Segment 21 for the purpose of a CAA and determining the appropriate VRZ within the Ground-truthed Waterfront Land.

The results of the assessment are provided in **Figure 6** to inform CAA requirements for appropriate works, in accordance with **Table 5**, and based on the current ground-truth conditions. **Figure 7** provides applicable VRZs as determined by results of the Waterfront Land Tool assessment.

Table 5 outlines the works and activities that can occur on WFL and in riparian corridors under the WM Act (note approvals may be required under other legislation). **Figure 8** demonstrates an example of allowable VRZ encroachment in the outer 50% of the VRZ, with a commensurate area offset within the Ground-truthed Waterfront Land.

Encroachment into the outer VRZ is 0.4ha and the additional offset area is 0.83ha, which has been incorporated into the BMP. The BMP is required for a CAA to rehabilitate works that disturb or modify the riparian corridor.



AEP

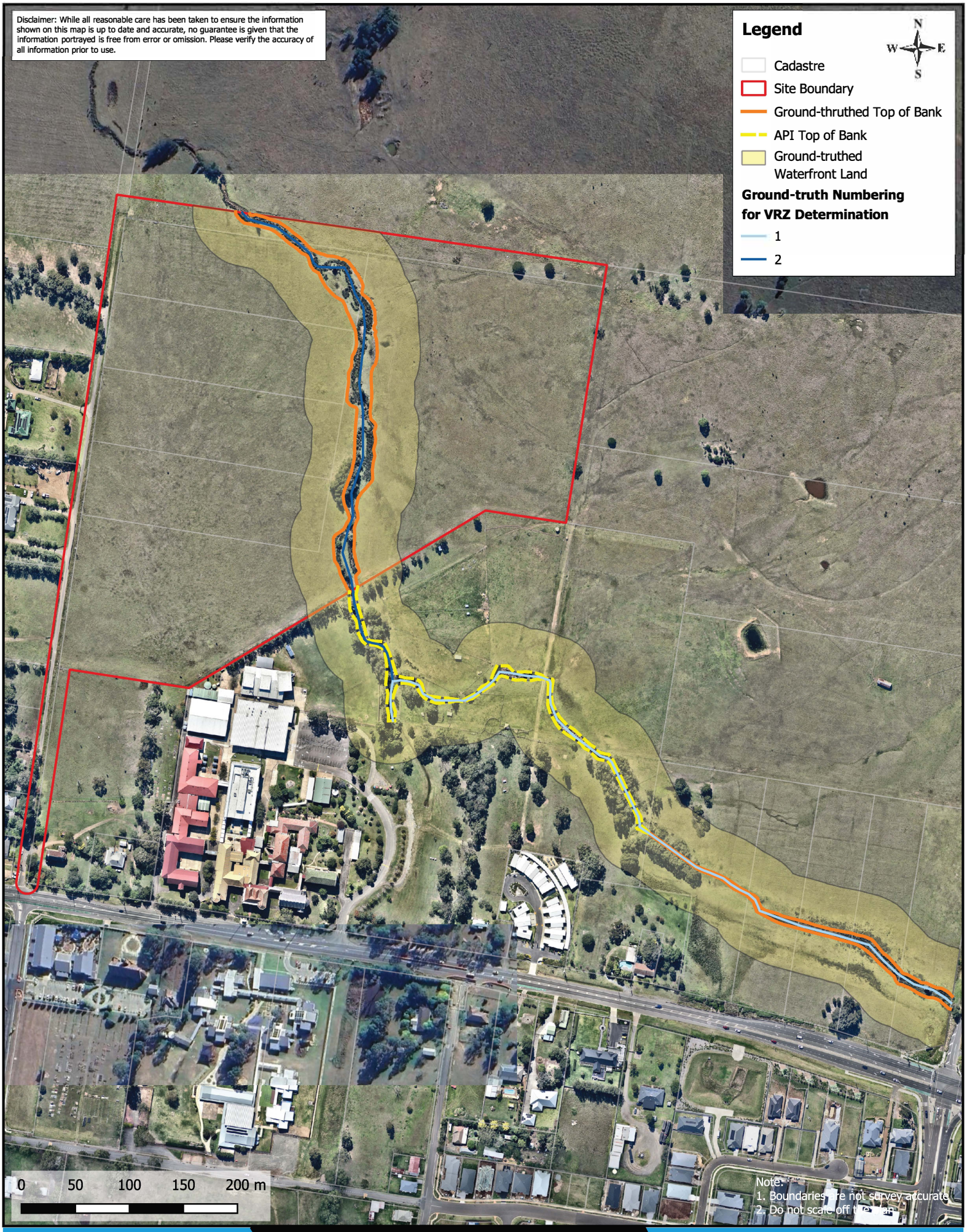
Figure 6 - Waterfront Land Assessment

Date: January 2025

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

Client: CDMN

AEP ref: 4951



AEP

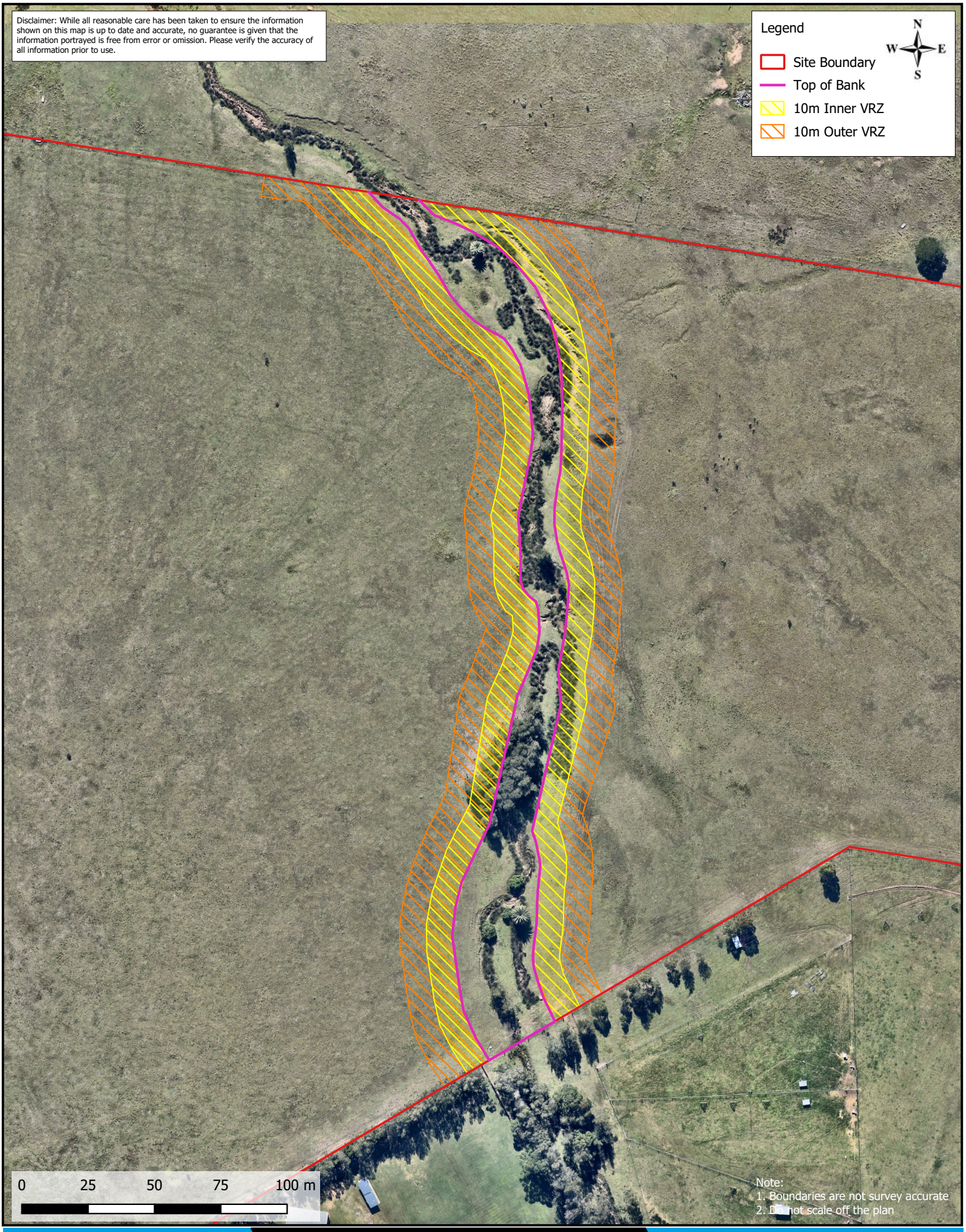
Figure 7 - Waterfront Land Assessment

Date: January 2025

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

AEP ref: 4951

Client: CDMN



AEP

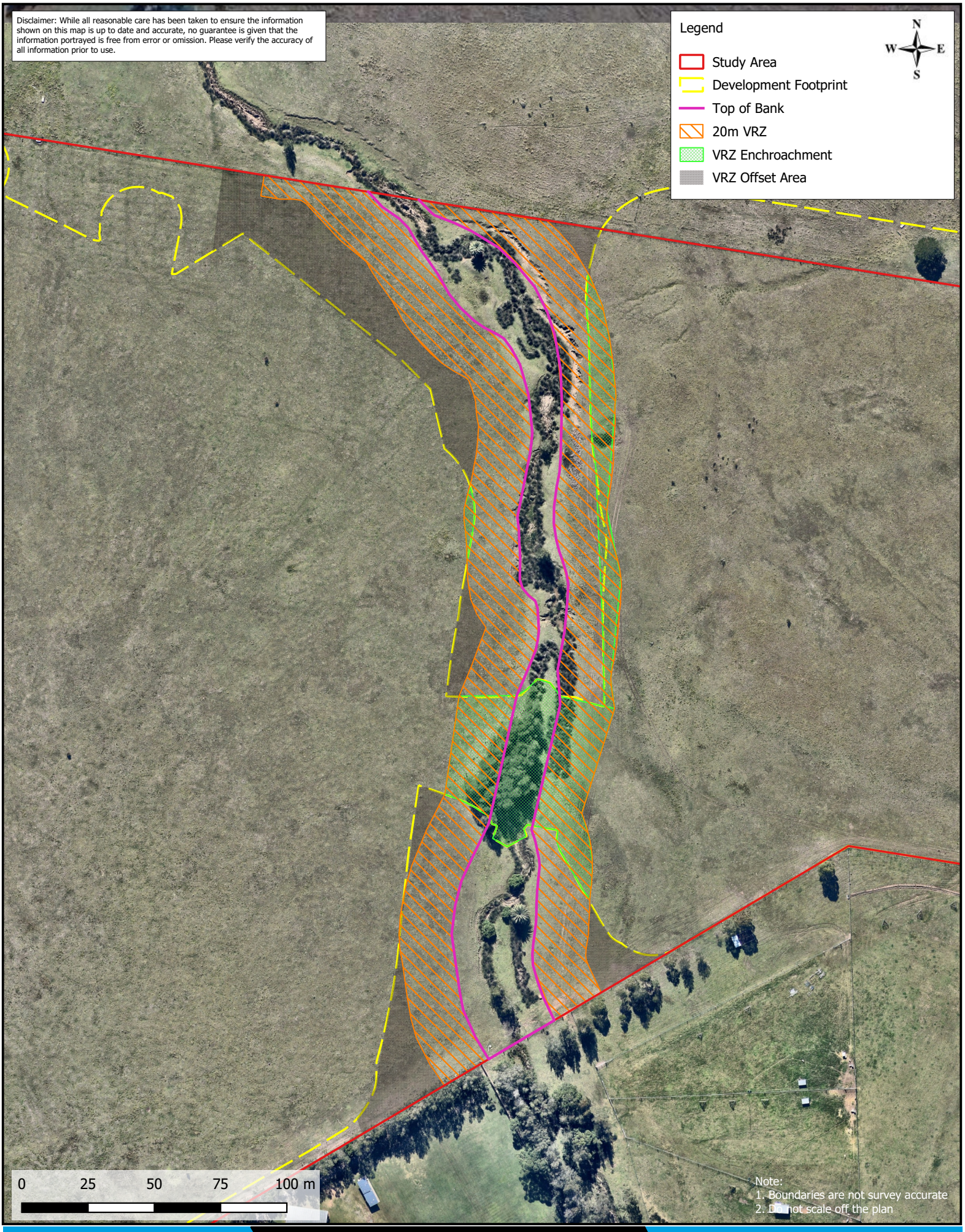
Figure 8 - Vegetated Riparian Zones

Date: January 2025

Location: 20 & 20A Cantwell Rd, Lochinvar NSW

Client: CDMN

AEP ref: 4951



AEP

Figure 8 - Vegetated Riparian Zones

Date: January 2025

Location: 20 & 20A Cantwell Rd, Lochinvar NSW

Client: CDMN

AEP ref: 4951

7.0 Conclusion

Works will occur within 40m of Waterfront Land, as such Controlled Activity Approval (CAA) will be required to accompany any DA that occurs within 40m of Waterfront Land.

The merit-based VRZs will be required to be implemented based on the above assessment. As shown in **Table 17** several activities can occur with associated streams. Details on certain activities would be assessed at the DA stage to ensure appropriate VRZ management is undertaken. As part of a CAA any impacts to VRZs require a Biodiversity Management Plan, this has been prepared and submitted (refer **Appendix C**). The BMP will accompany the CAA application.

8.0 References

Department of Planning, Industry and Environment (2020) Natural Resources Access Regulator Waterfront Land Tool https://www.dpie.nsw.gov.au/nrar/how-to-apply/controlled-activities/tools accessed April 2024.

Department of Primary Industries Office of Water (2018) Guideline for Riparian Corridors on Waterfront Lands, https://www.industry.nsw.gov.au/__data/assets/pdf_file/0003/160464/licensing_approvals_controlled_activities_riparian_corridors.pdf, accessed April 2023.

Ives, C. D., Mark Patrick Taylor, & Davies, P. J. (2013). A setback for river and riparian ecosystems: A response to the New South Wales Office of Water 2012 policy on riparian corridors. *Environment and Planning Law Journal*, *30*(2), 122–131.

NSW Government (2018) Determining Stream Order Fact Sheet; https://www.industry.nsw.gov.au/__data/assets/pdf_file/0020/172091/Determining-Strahler-stream-order-fact-sheet.pdf accessed April 2024.

NSW Government (2021) Water Management (General) Regulation 2018 Hydroline spatial data, https://trade.maps.arcgis.com/apps/webappviewer/index.html?id=07b967fd0bdc4b0099fc5be45b6d1392 accessed April 2023.

NSW Government (2022) SEED Portal Geocortex Viewer. Accessed July 2024.

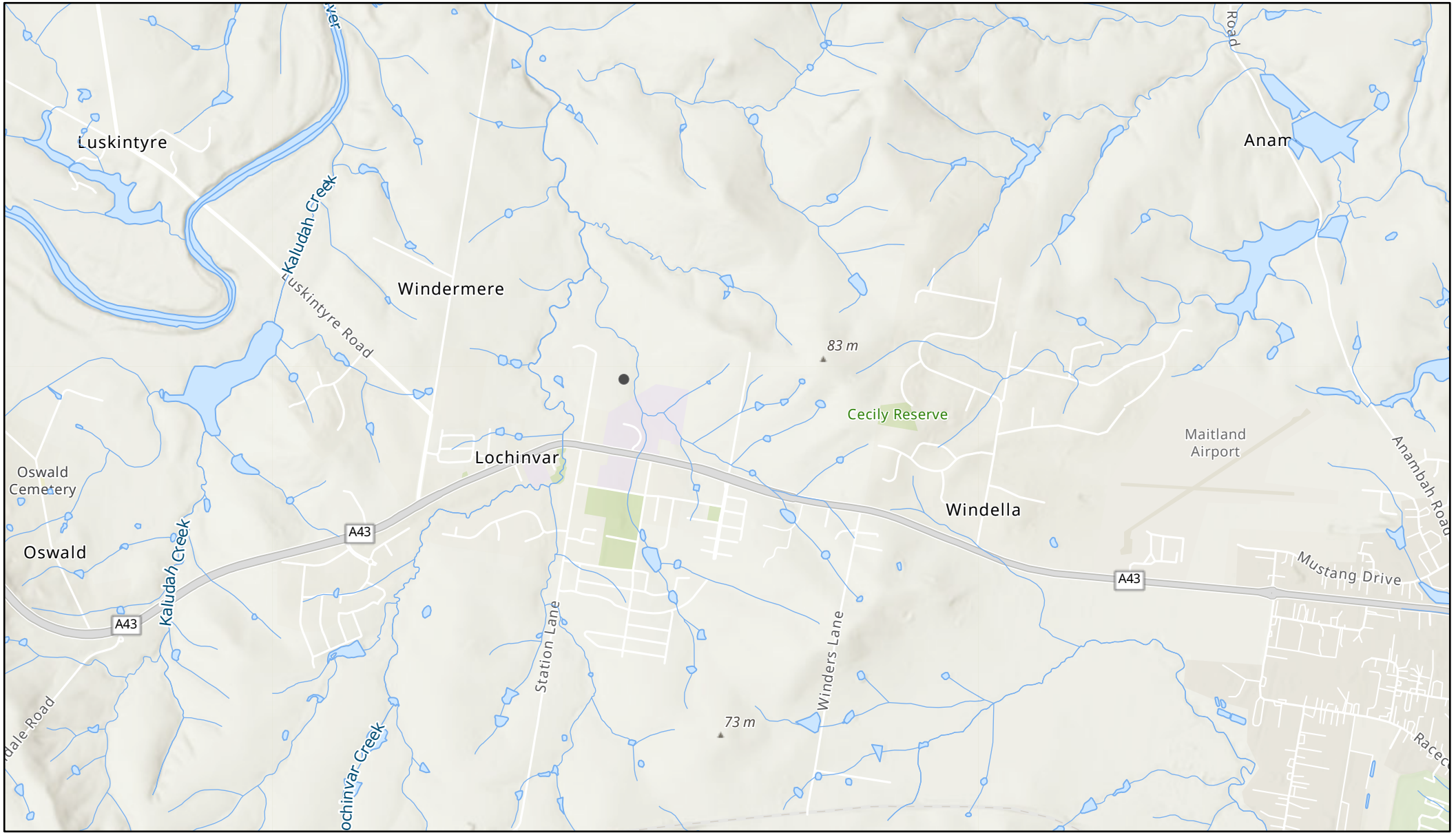
New South Wales Office of Water (2012) Controlled activities on waterfront land - Guidelines for riparian corridors on waterfront land. Department of Primary Industries.

Strahler, A.N. (1952) Dynamic basis of geomorphology. Geological society of America bulletin, 63(9), pp.923-938.

Water Management (General) Regulation 2018, NSW Government (2018), Current version for 29 April 2022, Schedule 2 Stream order of a watercourse https://legislation.nsw.gov.au/view/html/inforce/current/sl-2018-0480#sch.2 accessed April 2024.

Appendix A – NRAR Hydroline Spatial Data

2018 Hydroline spatial data 1.0



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Hydroline

1:36,112

0 0.25 0.5 1 mi

0 0.4 0.8 1.6 km

Water Management (General) Regulation

NSW Department of Industry | Lands and Water | Water

Appendix B –Additional Site Photos

Appendix C –Biodiversity Management Plan

BIODIVERSITY | BUSHFIRE | ARBORICULTURE

NEWCASTLE SYDNEY

Biodiversity Management Plan – Retained Land

Lots 1 & 2 DP1299958 – 20 & 20A Cantwell Road, Lochinvar, NSW

Prepared For: Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle

c/- Monteath & Powys

Prepared By: Anderson Environment and Planning

Date: February 2025

AEP Reference: 4951

Revision: 03

Newcastle | Sydney
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P 0420 624 707 E info@andersonep.com.au ABN 57 659 651 537

Cover Photo: Riparian area of creek on Subject Site

Document Control

Document Name	Biodiversity Management Plan – Retained Land and Lots 1 & 2 DP1299958 –20 & 20A Cantwell Road, Lochinvar, NSW
Project Number	4951
Client Name	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle
AEP Project Team	Natalie Black Yann Buissiere Byron de Jager Brendon Young Oliver Saunders Jarod Baxter Kathleen Bushell

Revision

Revision	Date	Authors	Reviewed	Approved
00	23/10/2024	Jarod Baxter	Brendon Young	Natalie Black
01	16/01/2025	Jarod Baxter	Natalie Black	Natalie Black
02	23/01/2025	Jarod Baxter	Natalie Black	Natalie Black
03	17/02/2025	Jarod Baxter	Natalie Black	Natalie Black

Distribution

Revision	Date	Name	Organisation
00	23/10/2024	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys
01	16/01/2025	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys
02	23/01/2025	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys
03	17/02/2025	Chad Beecham	Trustee of the Roman Catholic Church for the Diocese of Maitland Newcastle C/- Monteath & Powys

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Appendices

1.0 Introduction

Anderson Environment & Planning (AEP) have undertaken the necessary investigations to inform the production of a Biodiversity Management Plan (BMP) for the retained C3 - Environmental Management land located within Lots 1 & 2 DP1299958 –20 & 20A Cantwell Road, Lochinvar, NSW (the Subject Site).

This Biodiversity Management Plan (BMP) covers the management of retained vegetation within the Subject Site.

1.1 Biodiversity Management Plan Objectives

The aim of this BMP is to schedule weed management, planting and other measures necessary to enhance the vegetation present onsite. The successive stages of regeneration are applicable to ensure that the targets and objectives are achieved over the 5-year duration of the BMP and to minimise maintenance into the future.

This BMP incorporates best practices in bushland restoration, management of invasive species and revegetation in order to achieve the following objectives within the 5 years:

- Regenerate physical and biological functions of the remnant bushland present within the BMP Lands to improve habitat values and landscape connectivity;
- Enable natural and facilitated regeneration where appropriate, ensuring the structural and trophic complexity of the vegetation community is adequately represented;
- Develop management actions using the 'SMART' goals approach (Specific, Measurable, Achievable, Reasonable and Time specific);
- Ensure the site is maintained until vegetation in rehabilitated areas achieves a resilient and self-sustaining state; and

The overarching goal of this plan is to manage the retained vegetation for biodiversity conservation as part of the avoid and minimize strategy for the proposed development.

1.2 Document Referencing

In preparing this plan, reference has been made to the following documents:

- Anderson Environment & Planning (2025) Aquatic Ecology Assessment Report for 20 & 20A Cantwell Road and 60 New England Highway, Lochinvar NSW;
- Anderson Environment & Planning (2025) Waterfront Land Assessment Report for 20 & 20A Cantwell Road and 60 New England Highway, Lochinvar NSW; and
- Anderson Environment & Planning (2025) Streamlined Biodiversity Development Assessment Report for Staged Subdivision at for 20 & 20A Cantwell Road and 60 New England Highway, Lochinvar NSW.

For the purposes of referencing, this document should be cited as:

- Anderson Environment & Planning (2025). Biodiversity Management Plan for 20 & 20A Cantwell Road, Lochinvar, NSW.

1.3 About this Plan

This BMP is a comprehensive report developed to provide management for Flora, Fauna and water over the Subject Site for 5 (five) years. To allow for a concise and easily referable plan, the BMP has been divided into sections, which function cohesively together and as separate Plans:

- Section 1 – Introduction – provides information on objectives and referencing material;

- Section 2 – Site Context and Existing Condition – provides detailed information on the BMP lands and ground-truthed condition;
- Section 3 – Regeneration Approach and Targets – outlines the approach to revegetate the BMP Lands, including methodology and targets over the 5 years to achieve a Naturally Regenerating Site;
- Section 4 – Site Preparation – outlines the procedure to prepare the BMP Lands for management and the surrounding process to protect this land from surrounding development.
- Section 5 – Implementation of Regeneration – this section of the report outlines the specific Management Zone strategies for regeneration and schedule of works.
- Section 6 – Project Management – this section of the Plan addresses qualifications, monitoring and reporting procedures.

1.4 Commencement of BMP

The BMP will commence once the civil works required for the rehabilitation of the bank and installation of the culvert and associated civil works are completed. The BMP does not provide any information, on the design or management of these civil works, this is to be prepared by a suitable qualified Engineer.

The actions outlined within the BMP are for regeneration purposes such as weeding, planting, mulching, watering and monitoring.

From commencement of the BMP the Project Ecologist and Bush Regeneration Contractor in consultation with the Civil Works Contractor will undertake the required actions to ensure a naturally regenerating community is achieved.

2.0 Site Context and Existing Condition

2.1 Local context

The Subject Site largely contains C3 Environmental Management Zoned land forming the riparian corridor through land at 20 and 20A Cantwell Road, Lochinvar, NSW within the Maitland City Council Local Government Area (LGA).

An unnamed creek runs through the centre of the C3 zoned lands and feeds into Lochinvar Creek (see **Aquatic Assessment Report and Waterfront Land Assessment Report**).

The broader Study Area has varied land uses, rural, residential, educational and the New England Highway.

The proposal will regenerate approximately 2.3ha of native vegetation which provides both core habitat and landscape connectivity for a number of native fauna species including fish in the area. **Figure 1** shows the site location.

2.2 Biodiversity Management Plan Lands

Figure 1 shows the location and area of the Biodiversity Management Plan Land (BMP Lands) where this report applies. The remainder of the C3 Zoned land will be managed under a Landscape Plan and a proposed road crossing.

2.3 Vegetation Descriptions

Remnant vegetation present within Lots 1 & 2 DP1299958 has been assessed using six (6) BAM plots as a part of the **Streamlined Biodiversity Assessment Report**. Remnant native vegetation within the BMP lands is composed of one distinct Plant Community Type (PCT):

- PCT 4023 - Coastal Valleys Riparian Forest (0.11ha).

The location of remnant PCT 4023 within the BMP Lands is presented in **Figure 2**. The PCT has been further segregated into management Zones (MZs) according to vegetation conditions as described in **Section 3.2** below.

2.3.1 PCT 4023 - Coastal Valleys Riparian Forest

PCT 4023 is located in patches along the creek. This zone contains an area of *Casuarina glauca* canopy and 3 small areas dominated by *Typha orientalis* without canopy.

Other ground stratum species include *Centella asiatica, Commelina spp., Einadia nutans subsp. linifolia, Lepidium spp., Lobelia concolor, Oxalis perennans, Persicaria decipiens, Rumex brownii Cynodon dactylon, Juncus usitatus, Typha orientalis, Bolboschoenus caldwellii, Machaerina juncea, Bothriochloa macra, Microlaena stipoides, Panicum effusum var. simile, Sporobolus creber.*

PCT 4023 is found onsite in two condition categories due to disturbance associated with cattle grazing; with canopy and without canopy.

Vegetation Condition

Overall, the vegetation condition is considered to be poor throughout the BMP Lands. Non native pasture species are present in high densities with the majority of the site too degraded to ascribe a PCT.

Four (4) priority weeds of the Hunter are present; *Cestrum parqui* (Green cestrum), *Juncus acutus subsp. acutus* (Sharp Rush), *Opuntia stricta* (Common pear), *Senecio madagascariensis* (Fireweed). Five (5) High Threat Weeds (HTW), *Ehrharta erecta, Olea europaea, Paspalum dilatatum, Senecio madagascariensis* are also present.

Several exotic shrubs, grasses and herbaceous weeds occur throughout the site, including *Amaranthus spp., Aster subulatus, Cardamine flexuosa, Cardamine hirsuta, Cirsium vulgare, Conyza bonariensis, Daucus carota, Rumex spp., Gamochaeta americana, Hypochaeris radicata, Juncus cognatus, Anagallis arvensis subsp. arvensis, Medicago polymorpha var. vulgaris, Nothoscordum gracile, Onopordum acanthium, Plantago lanceolata, Poa annua, Ranunculus scleratus, Rumex crispus, Setaria geniculata, Setaria glauca, Sida rhombifolia, Solanum americanum, Solanum nigrum, Soliva pterosperma, Sporobolus africanus, Stellaria media, Trifolium repens, Verbena bonariensis, Verbena brasiliensis.* Weed density mapping is provided in **Figure 3**.

2.3.2 PCT 4023 – Poor – with Canopy & Poor – Groundcover Only

Areas of PCT 4023 in poor condition with existing canopy. These have a high influence of edge effects associated with continued disturbance. Weed densities are high and include *Cestrum parqui, Ehrharta erecta, Olea europaea and Paspalum dilatatum.*

Areas of PCT 4023 in Poor condition without canopy have a high influence of edge effects associated with continued disturbance. Weed densities are high and include *Juncus acutus, Paspalum dilatatum, Senecio madagascariensis* and *Sporobolus africanus.*

2.4 Aquatic Description

The unnamed upper tributary of Lochinvar Creek is in a highly degraded condition, with bed and bank erosion, limited to no native aquatic flora or riparian vegetation, two crossings blocking fish passage and portions have been used to dispose of vegetation material.

The agricultural land use has caused severe degradation of the creek

AEP

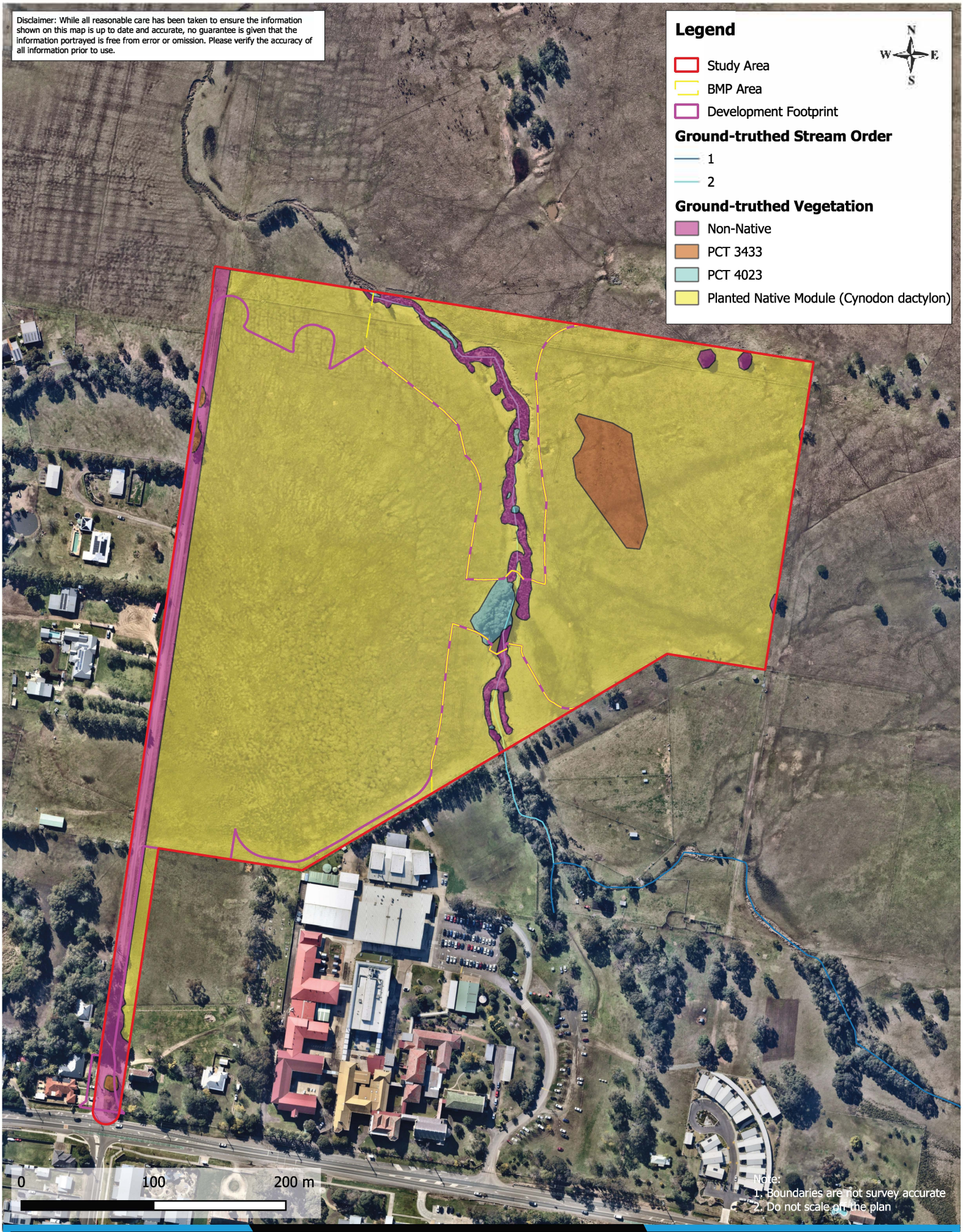
Figure 1 - Site Location

Date: January 2025

Location: 20 &20A Cantwell Road, Lochinvar NSW

Client: CDMN

AEP ref: 4951



AEP

Figure 2 - Ground-truthed Vegetation

Date: January 2025

Location: 20 & 20A Cantwell Road, Lochinvar NSW

Client: CDMN

AEP ref: 4951

3.0 Regeneration Approach and Targets

Regeneration of the BMP lands will be undertaken over a period of 5 years. Management of the site will be undertaken to ensure compliance with the *Biosecurity Act 2015*.

Regeneration of the BMP Lands will aim to reach a state of "Natural Regeneration" requiring minimal to no intervention. To achieve this, an Integrated Regeneration Approach has been designed, with key elements and targets identified for each vegetation community within each Management Zone.

It is anticipated that after the 5-year duration of the BMP, the vegetation present will be in a state of natural regeneration and will be self-sustaining only requiring a low level of maintenance to address sporadic weed incursions.

3.1 Integrated Regeneration Approach for BMP Lands

Regeneration of the BMP lands will be undertaken by utilising where possible the principles of the *Society for Ecological Restoration Australasia* (2021) *National standards for the practice of ecological restoration in Australia Edition 2.2*. An ecological regeneration approach has been deemed suitable for the BMP lands. This approach utilises three integrated restoration techniques to achieve the goal of a Natural Regenerating ecosystem and include:

- Reconstruction Approach;
- Facilitated Regeneration Approach; and
- Natural Regeneration.

National Guidelines assigned to BMP Land areas are based on their history of disturbance and current state. Due to the highly disturbed nature of the site, the Reconstruction Approach will be utilised within the BMP lands with the aim of achieving a state of Natural Regeneration by the end of the BMP period.

3.1.1 Reconstruction Approach

This approach is used across sites where the vegetation condition is poor, generally due to a range of causes of degradation that have led to partial or total damage to biotic and abiotic factors. The Reconstruction Approach includes:

- Primary weeding;
- Installation of jute matting and coir logs in areas of high water-flow;
- Mulching in areas without jute matting;
- Planting of tree, shrub and ground species in appropriate areas;
- Installation of guards around tree and shrub species;
- Watering;
- Secondary weeding;
- Maintenance watering;
- Maintenance of tree guards; and
- Replacement of dead plants.

This approach is proposed to be used extensively across the BMP area due to the low instance of native vegetation and eroded nature of the stream banks.

3.1.2 Facilitated Regeneration Approach

This approach is generally used on sites where regeneration progress is at an intermediate level and active intervention is minimised.

As stated, the Facilitated Regeneration Approach requires active interventions which are determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Weeding;
- Planting where appropriate;
- Installation of plant guards;
- Watering;
- Replacement of dead plants;
- Maintenance of tree guards;
- Watering.

It is expected works can move into this approach at the end of year 1 after primary works have been completed using the Reconstruction approach.

3.1.3 Natural Regeneration Approach

This approach is used where disturbance and weed cover are relatively low, and pre-existing biota should be able to recover after cessation of degrading practices or when recovery with assistance has reached a stage where intervention is minimal.

The Natural Regeneration Approach requires limited to no interventions with weeding being the only task undertaken to encourage continual natural regeneration.

The majority of the BMP Lands will require significant works and maintenance before this approach can be used due to lack of canopy and high problematic weed loads. It is expected that the BMP lands will reach a stage where this approach is appropriate by the end of year 4.

3.2 Management Zones

The BMP lands have been segregated into four (4) Management Zones (MZs) according to management strategy necessary to achieve the objectives of this BMP. The location of each vegetation zone is presented in **Figure 3**.

- Management Zone 1 (MZ1): Aquatic Zone Reconstruction,
- Management Zone 2 (MZ2): PCT 4023 – Flood Zone Reconstruction Batter;
- Management Zone 3 (MZ3): PCT 4023 – Riparian Reconstruction Forest; and
- Management Zone 4 (MZ4): PCT 4023 – Riparian Reconstruction Woodland.

Weed densities are based on weed mapping conducted in 2024. Weed densities are subject to change over time. Baseline monitoring will establish updated weed densities for each MZ. This data will be used to adjust the relevant restoration techniques for each MZ. Management actions specific to each MZ are detailed in the following sections.

Plate 1 shows a cross section of watercourse to assist with the location of each zone.

A review of the current literature showed that reinstating a natural channel within the creek would ensure key features are present within the creek, and result in improved water quality and habitat for terrestrial and aquatic organisms. **Plate 2** shows an example of a natural channel design.

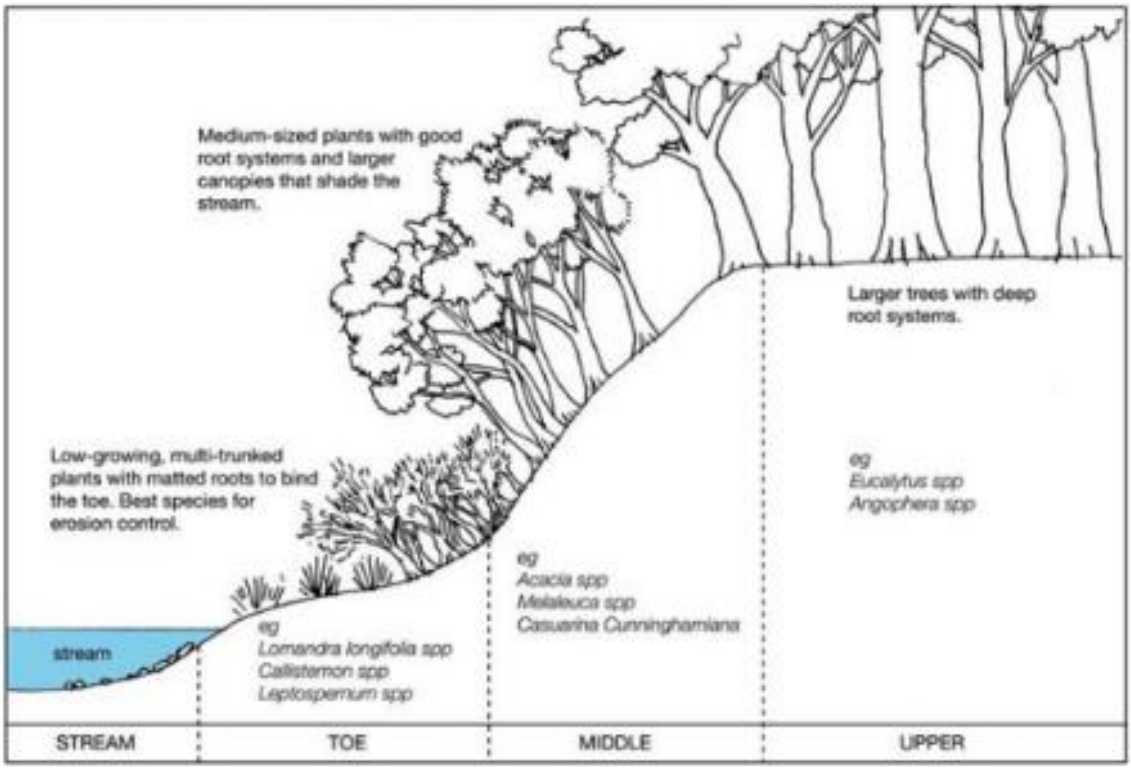


Plate 1 - Cross Section of Riparian Corridor (NSW Water, 2022).

Plate 2 – Bundamba Creek Regeneration works (Australian Wetland Consulting, 2018)

This BMP provides the concept plan for the channel design, detailed engineering plans should be prepared prior to guide construction.

3.2.1 Restoration of Natural Channel

Heavy erosion along the bank of the northern section of the watercourse is present. In order to restore the function of the stream, a vegetated batter will be implemented to reduce the impacts of erosion and sedimentation. Surrounding road infrastructure may be visually integrated into the surrounding landscape with the aid of vegetated batters, which can also have positive environmental effects (e.g., erosion management, improve biodiversity and visual amenity, increase canopy cover, and provide habitat).

3.2.2 Establishment of aquatic vegetation

Health and function of the stream and its associated riparian corridor has been assessed by AEP in an **Aquatic Ecology assessment** and **Waterfront Land Assessment**. These reports have been used to inform this BMP. In order to improve aquatic habitat within the creek, native vegetation should be re-established as soon as practical within the channel.

Macrophyte species have been identified as suitable due to being identified within the other riparian corridors present onsite. They include species such as *Juncus usitatus, Baumea juncea, Lomandra longifolia* and *Persicaria decipiens.* A full species list for revegetation is provided in **Appendix B**.

3.2.3 Re-snagging

As a part of this BMP, some reconstruction works within the creek waters will be required, including the removal of two blockages from rudimentary creek crossings and the installation of a minimum of five (5) snags installed using native trees either won from clearing or sourced from off site. Snags should be introduced to existing pools within the section of the Lochinvar Creek tributary that crosses the BMP lands following guidelines from DEW (2021):

- Prior to removal of blockages and re-snagging there will be a stream diversion put in place to allow for installation of the culvert without stopping water flow.
- The timing of any works should be during a period of low rainfall and low flow in the creek, if possible, such as winter and 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, if possible, as this period is generally when native fish are moving to spawn or recruit within NSW waters;
- Access requirements should be identified for the works points to minimise disturbance to bed and banks;
- Provisions to protect fish during the dewatering process of any coffer dams or the clearing of screens. These should include:
    - 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.
- Preferred sites for the stockpiling of fill or excavated materials on flood prone lands should be secure from a 1 in 10-year flood and have effective sediment control measures in place to contain any runoff in order to avoid sedimentation;

- Snags should be installed as a priority before mulching, erosion control or planting takes place to prevent damage to other works;
- Position timber at a 45 degrees angle in a downstream direction from the edge of the bank with the base (or root wad) of the snag placed closely against the bank; and
- Once positioned, the structure must be pinned to secure it in the desired position or secured in a method that will not move or impact downstream river users.
- Any fill required during reclamation works must consist of only natural material. Contaminated material, tyres, building and demolition rubble or acid sulphate soils (ASS) should not be used as fill in any aquatic environment.

Plate 3 provides an example configuration.

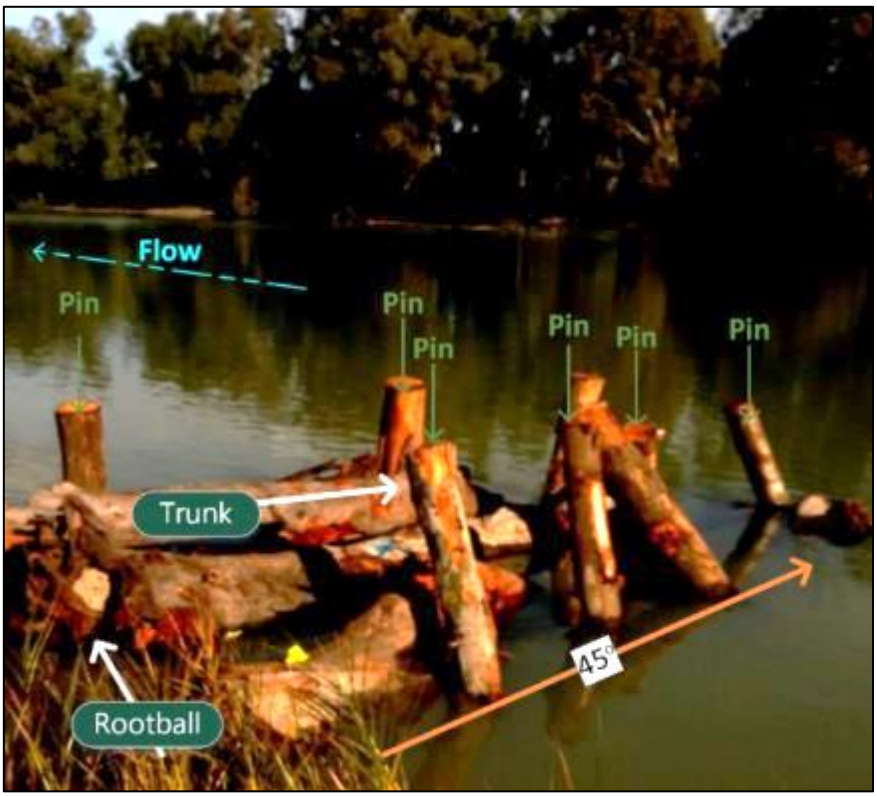


Plate 3 – Re-snagging Guidelines for the Lower River Murray (DEW Technical Report 2021)

The most suitable timber for re-snagging is native Australian hardwood which has been recently legally felled. Exotic trees felled as part of the proposal should not be used due to the potential for invasive species to propagate downstream.

3.2.4 MZ1: PCT 4023 – Aquatic Zone Reconstruction

This zone covers all areas within the stream which are shallow enough for planting of macrophytes throughout the BMP area. The existing creek exhibits the geomorphological features of a significant watercourse such as defined bed and bank, pools, riffles and meanders. There are no snags present however, so these will require installation see **section 3.2.2.** The majority of this zone is in poor condition, with moderate to high weed density. *Juncus acutus* (Sharp Rush) occurs extensively within this zone. *Typha orientalis*, although native, will require control to facilitate fish movement in the stream. Canopy trees planted will eventually provide shade which will discourage its growth.

The composition of this zone is poor with few native species present. As such, the Reconstruction Approach has been allocated to MZ1.

Work to be undertaken in MZ1 include;

- Primary weeding;
- Installation of instream snags;
- Secondary weeding;
- Planting of macrophytes; and
- Maintenance weeding.

Weed Control

It is proposed that weed control works in this area are coordinated with culvert installation when water flow in the creek is either redirected or stopped. *J. acutus* is the most problematic weed in this zone and the most effective control technique is spraying with herbicide, however this can't be done while water is in the creek due to potential harm to fish and frogs. This makes the period of flow control an excellent opportunity for weed control. Alternatively, a period without rain may provide the same conditions. Mechanical removal of *J. acutus* is not recommended due to soil disturbance being a trigger for germination of seed already in the soil. It is proposed that this area is traversed regularly targeting all weeds present to prevent new weeds becoming established.

- Several attempts at control of *J. acutus* may be required to ensure complete removal;
- Soil disturbance should be avoided where possible;
- Planting should take place after primary *J. acutus* control is finished.

MZ2: PCT 4023 – Flood Zone Reconstruction Batter

This zone is located on the north eastern side of the unnamed creek. The area to the east of the proposed batter has had extensive erosion, as a result of land clearing and erosive rill soils. AEP had a site inspection with the engineering team to determine how to rehabilitate this section of bank and stop the erosion. A soft design of a vegetated batter and filling of the erosion has been designed to ensure the rill erosion is prevented from spreading further in the floodplain.

The composition of this zone is poor with few native species present. As such, the Reconstruction Approach has been allocated to MZ2.

Bank stabilisation measures should be implemented during removal of blockages and construction of the of the culvert while water flow is being controlled to minimise erosion risk. Due to periodic flooding of the area mulching is not appropriate in MZ2 so jute matting and coir logs are recommended where erosion control is needed.

Work to be undertaken in MZ2 include;

- Rubbish removal;
- Primary weeding;
- Secondary weeding;
- Installation of batter and filling of rill erosion;
- Installation of jute matting and coir logs;
- Planting with native trees, shrubs, grasses and forbs from PCT 4023;
- Installation of plant guards on shrub and canopy species;
- Maintenance weeding; and
- Replacement of dead plants and maintenance of plant guards.

Weed Control

It is proposed that weed control works in this area are coordinated with culvert installation when water flow in the creek is either redirected or stopped. *J. acutus* is the most problematic weed in this zone and the most effective control technique is spraying with herbicide, however this can't be done over water due to potential harm to fish and frogs. This makes the period of flow control an excellent opportunity for weed control. Alternatively, a period without rain may provide the same conditions. Mechanical removal of *J. acutus* is not recommended due to soil disturbance being a trigger for germination of seed already in the soil and leaving them in-situ will help provide stability until planted species are established. It is proposed that this area is traversed regularly targeting all weeds present to prevent new weeds becoming established.

- Several attempts at control of *J. acutus* may be required to ensure complete removal;
- Soil disturbance should be avoided where possible; and
- Planting should take place after primary *J. acutus* control is finished.

Revegetation

Planting should consist of species which are suited to periodic inundation and which will capture sediment and provide soil stability. Canopy species should be planted close to the creek to facilitate shading the water to reduce stream blockage from *Typha orientalis.* This zone is to be densely planted to represent a forest vegetation formation. A plant list for revegetation is provided in **Appendix B**.

3.2.5 MZ3 – PCT 4023 Riparian Reconstruction Forest – Reconstruction

This management zone is located in the inner (10m) Vegetation Riparian Zone buffer from top of bank out to 10m. Weed density is moderate with only scattered occurrences of problem weeds. The inner 10m will be densely planted with PCT 4023.

Work to be undertaken in MZ3 include;

- Primary weeding;
- Secondary weeding;
- Spreading mulch mixed with native seed;
- Densely planted trees, shrubs, grasses and forbs from PCT 4023;
- Installation of plant guards on shrub and canopy species;
- Maintenance weeding; and
- Replacement of dead plants and maintenance of plant guards.

Weed Control

It is proposed that this area is regularly traversed to control any occurrence of weeds such as *Paspalum dilatatum* which may compete with planted natives. Mulching after secondary weeding will prevent reestablishment of weeds. Note that this management zone will be directly adjacent to the future development and as such, it is likely to impacted by ongoing edge effects. Therefore, the urban bushland interface should be carefully maintained to identify quickly any new weed occurrence and respond in a timely manner to prevent encroachment in the wider Subject Site.

- Herbicide may be used at the discretion of the bush regeneration contractor if deemed necessary and posing low risk to surrounding vegetation from off-target spray.

Sediment control

As mentioned in the **Aquatic Assessment**, The Prosser and Karssies guidelines on designing filter strips has been considered and the required soil capture will be made possible within the native VRZ

through dense planting of native rushes, grasses and forbs along the urban bushland interface. An additional grass filter strip will not be necessary considering the low gradient of the land The proposed land use without soil tillage will not create loose soil in need of capture which is the main function of filter strips.

Revegetation

Planting is recommended to be dense along the urban bushland interface to discourage public traffic and capture sediment in urban runoff. A plant list for revegetation is provided in **Appendix B**.

3.2.6 MZ4: PCT 4023 Riparian Reconstruction Woodland

This zone covers the outer 10m VRZ and additional areas within the BMP Lands. This area is to be planted in a woodland density to ensure the Safer by Design principles are met. The woodland formation will provide a wildlife corridor with mixes of canopy trees and shrubs while allowing for sightlines to reduce undesirable behaviour. Such vegetation will also provide improved catchment health by dispersing over land flows, allowing for groundwater infiltration and nutrient absorption, creating a buffer between the proposed development and MZ2. The majority of this zone is in poor condition, with moderate to high weed density. There is currently grazed agricultural land surrounding the riparian area.

The composition of this zone is poor with few native species present. As such, the Reconstruction Approach has been allocated to MZ4.

Work to be undertaken in MZ4 include;

- Rubbish removal;
- Primary weeding;
- Secondary weeding;
- Installation of erosion control where appropriate including jute matting and coir logs;
- Planting with native trees, shrubs, grasses and forbs from PCT 4023 in a woodland formation;
- Installation of plant guards on shrub and canopy species;
- Maintenance weeding; and
- Replacement of dead plants and maintenance of plant guards.

Weed Control

It is proposed that this area is regularly traversed to control any occurrence of weeds such as *Paspalum dilatatum* which may compete with planted natives. Mulching after secondary weeding will prevent reestablishment of weeds. Note that this management zone will be directly adjacent to the future development and as such, it is likely to impacted by ongoing edge effects. Therefore, the urban bushland interface should be carefully maintained to identify quickly any new weed occurrence and respond in a timely manner to prevent encroachment in the wider Subject Site.

- Herbicide may be used at the discretion of the bush regeneration contractor if deemed necessary and posing low risk to surrounding vegetation from off-target spray.

Revegetation

Planting should consist of species which are suited to periodic inundation and which will capture sediment and provide soil stability. Planting with native trees, shrubs, grasses and forbs from PCT 4023 in a woodland formation. A plant list for revegetation is provided in **Appendix B**.

4.0 Ecosystem Targets

"Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed. (SER 2021)*"*

The overall target for the BMP Lands is to establish a naturally regenerating community that provides habitat for foraging, roosting and nesting for species associated with the PCT 4023 - Coastal Valleys Riparian Forest and the local region.

There are many ways to generate targets and establish measure tools to determine the health of an ecosystem such as:

- Benchmark conditions set under the Biodiversity Assessment Method 2020;
- Percentage of species presence from community list per as a whole or per stratum;
- Species composition;
- Physical condition;
- Absence or presence of threats;
- Structural diversity;
- Coverage of the flora species;
- Diversity of fauna gilds present; and
- Abundance of fauna recorded within the subject site.

AEP acknowledges that all of the above are valid assessment tools to utilise and measure success, however there are several factors that limit all communities from reaching Benchmark Conditions:

- Availability to purchase seed or tube stock of many native species;
- Topographic features of each site vary;
- Aspect of BMP lands variation between sites;
- Accessibility / connectivity for mobile fauna to access and use the site;
- Soil types;
- Surrounding vegetation communities influence the seed stock and hence natural regeneration;
- Presence or absence of canopy, impacting the microclimates;
- Rainfall variation; and
- Growth timeframes.

When developing targets for BMP Lands the above must be taken into consideration without losing the main objective to *assist the recovery of an ecosystem.* Therefore, AEP has developed targets (refer to **Table 1**) for Reconstruction Approach that will achieve a naturally regenerating functioning ecosystem, within the timeframes outlined in the BMP.

Utilising ecological references to identify the particular terrestrial or aquatic ecosystem and inform the targets of a regeneration project involves describing the specific compositional, structural and functional ecosystem attributes requiring reinstatement, before the desired outcome, "*assist the recovery of an ecosystem",* can be said to have been achieved. These attributes in combination can then be used to derive the targets for a BMP. A restored state is considered to have been achieved when an ecosystem is naturally regenerating.

4.1.1 BMP Land Targets

The Integrated Regeneration Approach will be used across the entire BMP Lands and the following targets have been designed to be specific, measurable, achievable, reasonable and time bound (SMART), providing qualitative data within the BMP Lands.

Given the current degraded condition of the BMP Lands the focus is on weed removal then reconstruction through planting and native seed mixed into the mulch, which in turn will promote the growth of native vegetation from seed brought in by mobile fauna.

Tables 1 to **3** outline the targets the BMP is aiming for each attribute within the BMP Lands.

Surveys undertaken by AEP showed vegetation present to be in poor condition requiring the reconstruction approach to regeneration:

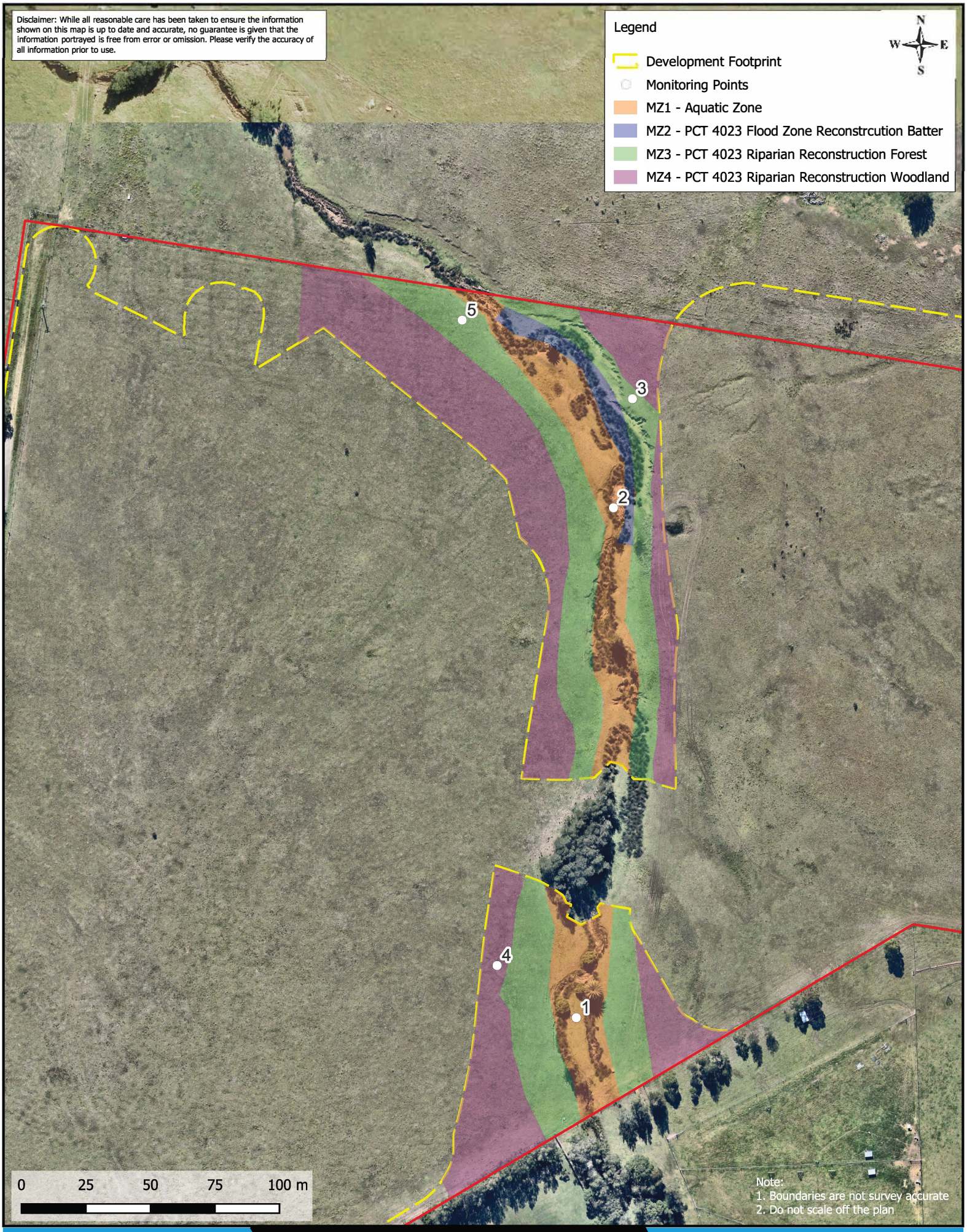
- **Management Zones 1, 2, 3,** and **5** were considered to be in poor condition requiring regeneration based on Reconstruction Approach. Targets are outlined in **Table 1**

As stated above the condition of vegetation communities can vary significantly and as such baseline data will be collected to determine the targets for each of the Management Zones within the BMP Lands. The baseline report will be prepared at commencement of the BMP and submitted to Council outlining the specific targets for each zone, based on **Tables 1.**

Table 1 – Regeneration Targets for Reconstruction Approach

Attribute	Baseline Data	Level 1	Level 2	Level 3	Level 4	Level 5
Approximate Timeframe from Commencement	**Commencement**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Species composition	At each monitoring point collect: • Native Species abundance • Native Species Cover • Weed / exotic Species abundance • Weed / exotic Species Cover	• 90% survival of each planted stratum. • 80% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 85% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 85% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 95% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 95% reduction in weeds from baseline data.
Structural diversity	Record the native growth forms present: • Tree; • Shrub; • Grass / grass like; • Forb; • Fern; and • Other.	Due to minimal native species present and low potential for regeneration from soil seedbank or faunal reintroduction, structure and growth form complexity will be planted in year one.	Maintain or improve on diversity in all growth forms recorded after planting.	Maintain or improve on diversity in all growth forms recorded after planting.	Maintain or improve on diversity in all growth forms recorded after planting.	Maintain or improve on diversity in all growth forms recorded after planting.
Ecosystem Function	Habitat baseline recorded	Ground and in-stream habitat installed. Tube stock planted.	No decline in ground habitat (replace if removed or damaged)	5% increase in ground habitat through planting growth (replace if removed or damaged)	10% increase in ground habitat through planting growth (replace if removed or damaged))	20% increase in ground habitat through planting growth (replace if removed or damaged)

Attribute	Baseline Data	Level 1	Level 2	Level 3	Level 4	Level 5
Approximate Timeframe from Commencement	**Commencement**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
	Stem classes present	No increase required as tube stock planted.	No increase required as tube stock planted.	No increase required as tube stock planted.	No increase required as tube stock planted.	2 -10% increase in stem class presence from baseline data



AEP

Figure 3 - Management Zones and Monitoring Points

Date: January 2025

Location: 20 &20A Cantwell Road Lochinvar NSW

Client: CDMN

AEP ref: 4951

5.0 Site Preparation

Prior to the commencement of regeneration, the BMP Lands must be prepared. The following works have been recommended to assist in site preparation.

5.1 Fencing

The boundary between the development site and BMP lands should be identified by a surveyor in conjunction with the Project Ecologist and subsequently marked using flag reel fencing (or similar method) to facilitate identification of the development/conservation land interface during clearing. This will also facilitate access to BMP Lands for placement of in-stream snags. Temporary fencing restricting access must be installed prior to any further work commencing:

- The fence must be installed around the entire interface between the development site and BMP Lands;
- Install temporary signs on fence. Conservation areas are to be clearly marked as a "No Go Area" on the fencing itself. Signs should be placed at 50 metre intervals along the entire length of the fence;
- Gates should be installed to facilitate maintenance access for the bush regeneration contractor and installation of in-stream snags;
- The fence must be maintained for the duration of all construction works. Construction impacts must be restricted to the development site and must not encroach into areas of retained native vegetation and habitat;
- No clearing of vegetation, storage of vehicles or machinery, stockpiling, materials storage or unauthorised access is to occur within the fenced conservation area;
- Permanent fencing may be considered post BMP in discussion with Maitland City Council.

5.2 Site induction

Induction for all personnel entering/working onsite should highlight the sensitive nature of the conservation land and discuss the importance of avoiding all impact to this land including all the following activities:

- Clearing of vegetation;
- Storage of vehicles or machinery;
- Stockpiling, materials storage;
- Unauthorised access; and
- Dumping of rubbish or building waste.

5.3 Weed / Pathogens / Disease Control

Diseases which could affect the BMP Lands include the root-rot fungus (*Phytophthora cinnamomi*) and Myrtle rust (*Puccinia psidii*), affecting Myrtaceous plants including Eucalyptus species as well as Amphibian Chytrid fungus disease, Chytridiomycosis, caused by Chytrid fungus (*Batrachochytrium dendrobatidis*).

To minimise the potential for any such introductions, it is recommended that appropriate hygiene controls be employed and hygiene stations supplied:

Plant, Machinery, Tools and Boots Hygiene

- All plant/machinery is to be washed down upon entry to site and prior to exiting site;
- The location of wash down bays is to be clearly identified within the site;

- All tools utilised on site should be sterilised and washed free of soil before use and at the end of each day;
- Boots should be clean and free of soil and seeds before entry to site and before exiting site;
- Boots should be sterilised in a similar manner to tools after soil and seed removal; and
- Sterilisation of tools and boots shall be undertaken using 60% alcohol, methylated spirits or Phytoclean™ applied via spray bottle or brush dipped in the mixture.

Phytophthora cinnamomi

- Minimisation of work during excessively wet or muddy conditions;
- All personnel to be inducted on Phytophthora identification and management; and
- All plants and soils used/brought into site must be disease-free.

Amphibian Chytrid fungus

- Minimisation of work during excessively wet or muddy conditions;
- All personnel to be inducted on Chytrid management measures for the site;
- Handling of frogs only when necessary, using fresh disposable gloves to handle individual frogs.

Myrtle Rust

- All personnel to be inducted into the identification and management of Myrtle rust; and
- Should any areas on site be identified as areas contaminated by the above, additional exclusion measures including, work program directions, soil storage and waste disposal programs must be implemented.

5.4 Erosion and Sedimentation Control

An Erosion and Sedimentation Control Plan (ESCP) should be prepared for the proposed development and may form part of the Construction Environmental Management Plan (CEMP). Erosion and Sediment control measures should be implemented in accordance with specifications set out in the latest edition of the Landcom publication “Soils and Constructions – Volume 1” (The Blue Book).

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.

Bank stabilisation measures may be required in places to minimise long-term erosion risk including localised reshaping of the incised bank may leave bare areas exposed to the elements and prone to immediate erosion. As such, erosion control measures including installation of ground stabilising matting and revegetation using suitably dense planting of groundcovers, trees, shrubs and grasses should take place immediately upon completion of bank stabilisation.

The potential for erosion to arise from weed control activities is low due to the preferred method of control of *J. acutus* being herbicide spraying and for woody weeds is cut or scrape and paint with herbicide rather than manual removal. All weed control activities and methods employed should weigh the potential to generate erosion.

5.5 Rubbish Removal

Rubbish and waste are to be removed from BMP lands. The need to remove such material should be assessed on a case-by-case basis as in some instances the material is inert, such as concrete, rocks and timber posts, etc. Such material may inadvertently provide geomorphic stability and suitable shelter and habitat for native fauna.

5.6 Monitoring and Reporting

Upon completion of site preparation, a report outlining compliance with the above will be provided to Council. Monitoring is to occur in accordance with the CEMP.

6.0 Implementation of Regeneration

Project Ecologist and Bush Regeneration Contractor (BRC) to meet on site to establish location of monitoring points and establish management boundaries.

Baseline data collection at commencement of regeneration is vital to establishing the condition of the communities and setting the methodology to achieve the above targets. Given the Hunter Region has variable climatic conditions the vegetation conditions may vary from season to season and year to year. Hence determining the condition of the vegetation on commencement of a project is essential in determining the most appropriate methods to achieve the target above.

6.1 Baseline Data

Installation of monitoring and data collection points are to be undertaken by the Project Ecologist and BRC prior to site preparation. It is recommended that a minimum of four (4) monitoring points one in each MZ consisting of a 10m x 10m quadrat marked with two 1.8m star pickets located at the northeast and southwest corner. The location of the northeast corner should also be marked with a GPS waypoint to facilitate identification in the field and will be used as photo monitoring point.

Baseline data will cover:

- Species diversity (both native and exotic) within 10x10 quadrat;
- Species Projected Foliage Cover (both native and exotic expressed in percentages) within 10x10 quadrat;
- Overall health of the BMP Lands;
- Photo records at monitoring points at each aspect; and
- Record incidental fauna.

On completion of the baseline data collection the BRC will commence with works to meet the targets for Year 1:

- Primary weed removal;
- Jute matting and mulching;
- Installation of ground habitat (logs from timber felled as part of the proposal if applicable);
- Planting of Vegetation (see **Appendix B** for detailed species). All plant stock must be provenance specific seed / material collected from locally endemic species, grown by suitably experienced and qualified nurseries, and hardened-off before planting. This will ensure the structure and composition of these communities will meet the targets set;
- Preference should be given to native species known to be pioneering species able to compete with exotic regrowth; and
- Watering.

6.2 Weed Management

Weeds have significant impact on structural integrity of the vegetation present. Flora surveys identified the following weeds present.

6.2.1 Priority Weeds for Onsite Management

- ***Juncus acutus* (Sharp Rush);**
- *Axonopus affinis* (Narrow-leafed Carpet Grass);
- ***Senecio madagascariensis* (Fireweed);**

- ***Opuntia stricta* (Prickly Pear);**
- *Olea europaea* (Common Olive);
- *Ehrharta erecta* (Panic Veldtgrass);
- *Paspalum dilatatum* (Paspalum); and
- ***Cestrum parqui* (Green Cestrum).**

The aforementioned exotic species will be the focus of weed management activities, based on legal requirement to control the species listed as Priority Weeds for the Hunter Region (Hunter Regional Strategic Weed Management Plan 2023-2027) under the Biosecurity Act 2015 (**in bold**), as well as other species occurring in high density onsite that have the potential to further colonise the BMP Lands and undermine regeneration efforts. A list of all weed species identified onsite is provided in **Appendix A.**

The *Biosecurity Act 2015* outlines several 'duties'; the general biosecurity duty, and additional duties under mandatory measures, regional measures, prohibited matter or biosecurity zone. Specific action for these measures may be required. Weed control is required to occur in the following sequence:

6.2.2 Sequential Weed Control

Weed Control works within each Management Zone are to be undertaken by a qualified bushland regeneration team using industry standards.

Any reproductive material of weeds, including weeds which can spread vegetatively, or seeds, must be taken off site to be disposed of at an appropriate local waste management centre. No weed material with the potential of spreading must be stockpiled within the development site or BMP Lands.

1. **Primary Weeding** – First six-months. This is where most problematic weeds are removed from Management Zones.
2. **Consolidation (Secondary and tertiary weeding)** – Six-months following the completion of primary weeding. Management Zones will require monthly visits to remove weeds that are emergent annuals, regenerating and/or have grown in response to the disturbance. These visits are essential, otherwise the weeds will recolonise and inhibit native regeneration.
3. **Maintenance Weeding** – Starts six-months to a year post-secondary or tertiary weeding and will continue on a monthly basis for the following year. Maintenance will decrease overtime based on weed cover within Management Zones. Changes to frequency will be outlined in annual reports.

This interval will be evaluated based on site conditions during each monitoring period. Depending on the management zone, weed control works across the site are to be undertaken over the maintenance period of up to five (5) years. However, given the adaptive management approach, this time-frame is flexible, and may need to be extended based on changing site conditions and monitoring results indicating management zones have reached targets set out in this BMP.

6.2.3 Herbicides

Where herbicide usage is proposed, the following factors are to be taken into consideration when selecting the herbicide:

- The safety of the particular herbicide to users and use near waterways, desirable plants, soil micro-organisms, amphibians, birds and mammals; and
- The economics and time constraints of using herbicides over other methods of weed control.

Directions must be strictly followed and all precautions followed over time. For example, Glyphosate herbicides are systemic and non-selective. All staff spraying herbicide must possess an AQF3 Chemical Accreditation.

6.2.4 Reuse of Biomass

Some of the vegetation removed from the development site or brought in from another clearance site should be reused to benefit the BMP Lands.

- Salvaged logs should be used to install Re-snagging along the creek see **3.2.2 Re-snagging.**
- Salvaged logs should be placed at the interface between the future development and the BMP Lands to create a physical buffer that will provide some level of protection to the vegetation present;
- After construction works in the unnamed creek are completed such as, road crossing, rehabilitation batter, installation of snags heavy machinery should be restricted from entering the BMP Lands. In order to minimise further soil compaction and introduction weeds, no machinery should enter the BMP. Instead, logs should be carried by the clearing supervision ecologist into suitable locations, preferably using existing tracks.

6.3 Planting of Native Vegetation

The majority of vegetation within BMP lands is considered to be in poor condition without potential for regeneration. As such, reconstruction by mulching and planting will be necessary. A site-specific planting list has been provided in **Appendix B** based on the plant community present onsite.

The following measures are recommended to be implemented to enhance revegetation works:

- Preference should be given to native species known to be pioneering species able to compete with exotic regrowth e.g. acacias;
- Timing for revegetation work should avoid the summer months and should ideally be planned for spring and autumn;
- Soil preparation should include the addition of Terraform Plant Establisher or similar native fertilizer as well as the use of water crystals where necessary, at the discretion of the bush regeneration contractor;
- Protection guards should be placed around plantings so that revegetation efforts within BMP lands are not compromised by grazing from rabbits or kangaroos;
- If monitoring within management zones indicates pest species pose notable impediments to achieving the aims of the BMP (i.e., through excessive browsing, etc.), then management actions will be reviewed to address these issues;
- Mulching or jute matting will be necessary in most areas to help suppress weeds, stabilise soil and conserve soil moisture around the planting. This will help with minimizing the maintenance required for the planting to establish. Mulch should be sourced from a reputable source, from native trees only and be cured for a minimum period of 4 weeks prior to utilizing to avoid nitrogen draw down;
- Species selected for planting must occur in PCT 4023 - Coastal Valleys Riparian Forest.
- All plant stock must be provenance specific, seed / material collected from locally endemic species, grown by suitably experienced and qualified nurseries, and hardened-off before planting; and

- Watering may be necessary depending on the weather forecast during and in the weeks and month following planting events. As such the watering regime should be adapted to the conditions.

These measures will enable the structure and composition of these communities to meet the targets set.

6.4 Pest Species

Rabbits and hares have been observed onsite. Therefore, protection guards should be placed around plantings so that revegetation efforts within BMP lands are not compromised by grazing. If monitoring within management zones indicates pest species pose notable impediments to achieving the aims of the BMP (i.e., through excessive browsing, burrowing, spreading seed etc.), then management actions will be reviewed to address these issues.

It is strongly recommended to engage with Local Land Services (LLS) and adjacent landholders to identify the most suitable approach to control rabbits in the locality. The most effective approach combines a number of specific management actions including

- Baiting with Pindone;
- Warren destruction;
- Warren fumigation;
- Trapping; and
- Biological control.

Note that baiting with 1080 should not occur less than 500m from habitations as per LLS guidelines and as such should not be used onsite. Pindone is the only poison that can be used in urban area. Also note that Shooting is not recommended due to proximity to existing and proposed urban development.

No significant evidence of other feral animals was observed on site.

6.5 Fire as a Management Tool

Fire is essential for the regeneration of native sclerophyll ecosystems and should be considered for the long-term management of the remnant vegetation present onsite. Recommended fire intervals are based on vegetation formation and class. The following table provide details on the recommended fire interval for the PCT present onsite.

Table 2 - Recommended Fire Intervals

PCT 4023	
Vegetation Formation	Forested Wetland
Vegetation Class	Coastal Floodplain Wetlands
Recommended Fire Interval by Hotspots Fire Project	Scientists have not yet studied the role of fire in this vegetation type in any detail; however variable intervals between 7 and 35 years have been suggested.

According to the NSW Rural Fire Service (2002) Minimum Fire Interval for Strategic Fire Management Zones (SFAZ) and Land Management Zones (LMZ) Forested Wetland: Coastal Floodplain Wetlands, the recommended minimum fire intervals are 7 years for SFAZs and 10 years for LMZs.

Given that the site currently contains very little vegetation and extensive planting is required, it is recommended that the site should not be burnt until the higher end of the interval, beyond the period of the BMP.

Impacts from fire or other serious impacting events is discussed in **Section 7.2 Interventions.**

7.0 Project Management

The client will be responsible for the engagement of a suitably qualified Bush Regeneration Contractor (BRC) to undertake weed control and planting works outlined in this BMP.

Bush Regenerator(s) or company(s) shall have;

- Australian Association of Bush Regenerators (AABR) Accreditation. The Bush Regenerators shall hold a current AQF3 qualification;
- Site Supervisor must have demonstrated minimum of 4 years' experience in the bush regeneration or related field and must have experience at a supervisory level in providing training, supervision and technical advice to staff, clients, volunteers and members of the public; and
- The Site Supervisor must hold a current AQF 3 qualification or higher and must have completed the Bush Regeneration Level IV Certificate or have a diploma or degree in a field related to natural resource management.

An official handover of the BMP to the BRC will be conducted by the Project Ecologist at the time of baseline monitoring and data collection (See **Section 7.1.1**). This will be undertaken via a site walkover and provide the opportunity to discuss BMP actions, targets, methodologies, requirements of sediment and erosion control, pest management, zone-specific management issues and placement of Photo Monitoring Points.

7.1 Monitoring and Reporting

The Project Ecologist will be responsible for the establishment of monitoring points within the BMP lands along with collection of baseline data that will be monitored over the five year period of this BMP with reporting on the achievement of overall targets and weed management, and regeneration approach success. Monitoring will occur at commencement on an annual basis for the duration of the BMP.

7.1.1 Baseline Data

Baseline monitoring and data collection to commence prior to site preparation and report submitted to Council.

7.1.2 Bush Regeneration Contractor Monthly Summary of Work

The BRC will provide a monthly summary of works undertaken which will be reviewed by the Project Ecologist and added to the annual report. If any issues arise these will be outlined in the monthly summaries and the BRC and Project Ecologist will determine action required to meet the set targets. If such determination requires significant change to the management outline in the BMP, the Project Ecologist will contact Maitland City Council to inform them of the changes.

7.1.3 Annual Monitoring by Project Ecologist

This is to occur once a year, (spring or autumn preferably) for the duration of the BMP. Monitoring should include the same metrics as the baseline data but should also include information such as:

- Effectiveness of weed control methods;
- State of fencing and erosion and sedimentation measures.

Annual monitoring will inform the evaluation of management effectiveness, until the Regeneration Benchmark Targets are met.

7.1.4 Reporting

Progress reports are to be submitted to Maitland City Council's Ecologist annually for a minimum of five years following issue of the construction certificate. Reports are to detail the progress of the works and any recommended additional actions, with a final report certifying completion of the BMP at the end of the implementation period, or once the specific objectives of the plan have been met. Any recommended additional actions must be completed to the satisfaction of Maitland City Council's Ecologist prior to lodgement of the final report.

Once in a state of Natural Regeneration following completion of the BMP period, management of the site will be undertaken in accordance with the *Biosecurity Act 2015* & *Biosecurity Regulations 2017.*

7.2 Interventions

With all regeneration plans, objectives and targets are set based on good conditions, however, this may not always be the case. The following table has been prepared as an action plan to accommodate setbacks and ensure targets can be achieved.

Table 3 – Intervention Steps

Element Change	Step 1	Step 2	Step 3	Step 4	Step 5
Fire	BRC to notify Project Ecologist and arrange a joint site inspection.	Assess impact to BMP Lands.	Prepare regeneration plan	Submission of notification and modified Plan to Council.	Implement approved Plan
Flood					
Drought					
Other weather event					
Pest Species damage					
Introduction of pathogen					
Vandalism					
Theft					

7.2.1 Fire

Fire and other impacts above have the potential to drastically alter monitoring results compared to previous reporting. In the event of fire or other serious event impacting VMP Lands, the Project Ecologist would develop a report reviewing impacts of the event and suggesting changes required to the BMP to be approved by Council Ecology.

Table 4 – Proposed Works Schedule

Activity	Specific Action	Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
BMP Lands Preparation	Installation / removal of fencing and signage	Installed at the beginning of Year 1 and removed once construction is finished																			
	Implementation of pathogen and disease controls	To be implemented throughout the duration of the BMP																			
	Installation of sediment and erosion control	Installed at the beginning of Year 1 and monitored throughout the duration of the BMP																			
	Bank stabilisation measures																				
	Rubbish removal																				
	Installation of in-stream snags																				
	Relocation of logs to BMP Lands																				
	Installation of erosion control																				
	Mulching																				
Planting	Primary planting																				
	Watering																				

Activity	Specific Action	Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Planting	Installation of plant guards																				
	Maintenance of tree guards																				
	Infill planting if required																				
	Maintenance watering																				
Weed Control	Primary weeding all MZs (Monthly)																				
	Consolidation (Secondary and Tertiary) weeding (Monthly)																				
	Maintenance Weeding - Frequency to be adjusting according to monitoring findings																				
Project Management	Set up Monitoring Plots and collect baseline data																				
	Annual monitoring																				

Activity	Specific Action	Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Management	Reporting (to be submitted to Maitland City Council within 2 weeks of annual monitoring																				
	Certification report (One-off on completion of the project)																				

8.0 References

Auld, B A & Medd, R W, (1992) Weeds, An Illustrated Botanical Guide to the Weeds of Australia. Inkata Press, Sydney.

Bradley, J (2002) Bringing back the Bush: the Bradley Method of Bush Regeneration. Lansdowne Publishing. Sydney.

Buchanan, R (1989) Bush Regeneration, Recovering Australian Landscapes. Macarthur Press Pty. Limited. Australia.

Cropper, S (1993) Management of Endangered Plants. CSIRO Publishing, Collingwood, Victoria.

Davies, P & Dixon, P (2003) Bush Regeneration: A Practical Guide to Contract Management. Environment Protection Authority (NSW).

Department of Primary Industries (2012) Guidelines for Vegetation Management Plans on Waterfront Land. Office of Water (NSW)

Department of Environment and Heritage (2023) Khappinghat Creek. https://www.environment.nsw.gov.au/topics/water/estuaries/estuaries-of-nsw/khappinghat-creek

eWater (2024). Introducing MUSICX. Retrieved May 2024 from; https://ewater.org.au/products/music/introducing-musicx/

Harden, G (ed) (2000) Flora of New South Wales, Volume 1. Revised edition. UNSW, Kensington, NSW.

Harden, G (ed) (2002) Flora of New South Wales, Volume 2. Revised edition. UNSW, Kensington, NSW.

Harden, G (ed) (1992) Flora of New South Wales, Volume 3. UNSW, Kensington, NSW.

Harden, G (ed) (1993) Flora of New South Wales, Volume 4. UNSW, Kensington, NSW.

Landcom (2004) Managing Urban Stormwater: Soils and Construction. Landcom Parramatta.

Mortlock, W (1998) Florabank Guideline 5: Seed Collection from Woody Plants for Local Revegetation. Florabank, ACT.

MidCoast Council (2019). Guidelines for Water Sensitive Design Strategies.

NSW Department of Primary Industry (No Date) NSW Weedwise. https://weeds.dpi.nsw.gov.au/

OEH (2014) Threatened Species, Populations and Ecological Communities. (https://www.environment.nsw.gov.au/threatenedspeciesapp/).

Rural Fire Services (2022) Bushfire Environmental Assessment Code – Supporting Document. Fire Intervals for Strategic Fire Advantage Zones and Land Management Zones

Society for Ecological Restoration Australasia (2018) National standards for the practice of ecological restoration in Australia.

Appendix A – Weed Species Found within the BMP Lands

Weed Species present within the BMP Lands

Family	Scientific Name	Common Name	Priority Weeds for the Hunter (BC Act 2015) Hunter Regional Strategic Weed Management Plan 2023-2027 (LLS 2022)
Alliaceae	*Nothoscordum borbonicum*	Onion Weed	General Biosecurity Duty
Amaranthaceae	*Amaranthus spp.*	Amaranth	General Biosecurity Duty
Apiaceae	*Daucus carota*	Wild Carrot	General Biosecurity Duty
Asteraceae	*Aster subulatus*	Wild Aster	General Biosecurity Duty
Asteraceae	*Cirsium vulgare*	Spear Thistle	General Biosecurity Duty
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	General Biosecurity Duty
Asteraceae	*Gamochaeta purpurea*	Purple Cudweed	General Biosecurity Duty
Asteraceae	*Hypochaeris radicata*	Cat's ear	General Biosecurity Duty
Asteraceae	*Onopordum acanthium subsp. acanthium*	Scotch Thistle	General Biosecurity Duty
Asteraceae	***Senecio madagascariensis***	**Fireweed**	High Threat Weed - not manageable
Asteraceae	*Soliva sessilis*	Bindyi	General Biosecurity Duty
Brassicaceae	*Cardamine flexuosa*	Wood Bittercress	General Biosecurity Duty
Brassicaceae	*Cardamine hirsuta*	Common Bittercress	General Biosecurity Duty
Caryophyllaceae	*Stellaria media*	Common Chickweed	General Biosecurity Duty
Fabaceae (Faboideae)	*Medicago polymorpha*	Burr Medic	General Biosecurity Duty
Fabaceae (Faboideae)	*Trifolium repens*	White Clover	General Biosecurity Duty
Juncaceae	*Juncus acutus subsp. acutus*	Sharp Rush	Regional Recommended Measure* (for Regional Priority - Asset Protection) Land managers should mitigate the risk of the plant being introduced to their land. Land managers should mitigate spread of the plant from their land. A person should not buy, sell, move, carry or release the plant into the environment. Land managers should reduce the impact of the plant on assets of high economic, environmental and/or social value.
Juncaceae	*Juncus cognatus*	0	General Biosecurity Duty
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	General Biosecurity Duty
Oleaceae	*Olea europaea*	Common Olive	High Threat Weed - manageable

Family	Scientific Name	Common Name	Priority Weeds for the Hunter (BC Act 2015) Hunter Regional Strategic Weed Management Plan 2023-2027 (LLS 2022)
Cactaceae	***Opuntia stricta***	**Prickly Pear**	Regional Recommended Measure* (for Regional Priority - Asset Protection) Land managers should mitigate the risk of the plant being introduced to their land. Land managers should mitigate spread of the plant from their land. A person should not buy, sell, move, carry or release the plant into the environment. Land managers should reduce the impact of the plant on assets of high economic, environmental and/or social value.
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	General Biosecurity Duty
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	High Threat Weed
Poaceae	*Ehrharta erecta*	Panic Veldtgrass	High Threat Weed
Poaceae	*Paspalum dilatatum*	Paspalum	High Threat Weed
Poaceae	*Poa annua*	Winter Grass	General Biosecurity Duty
Poaceae	*Setaria parviflora*	Slender Pigeon Grass	General Biosecurity Duty
Poaceae	*Setaria pumila*	Pale Pigeon Grass	General Biosecurity Duty
Poaceae	*Sporobolus africanus*	Parramatta Grass	General Biosecurity Duty
Polygonaceae	*Rumex crispus*	Curled Dock	General Biosecurity Duty
Primulaceae	*Lysimachia arvensis*	Scarlet Pimpernel	General Biosecurity Duty
Ranunculaceae	*Ranunculus sceleratus*	Celery Buttercup	General Biosecurity Duty
Solanaceae	*Cestrum parqui*	Green Cestrum	Regional Recommended Measure* (for Regional Priority - Asset Protection) Land managers should mitigate the risk of the plant being introduced to their land. Land managers should mitigate spread of the plant from their land. A person should not buy, sell, move, carry or release the plant into the environment. Land managers should reduce the impact of the plant on assets of high economic, environmental and/or social value.
Solanaceae	*Solanum nigrum*	Blackberry Nightshade	General Biosecurity Duty
Verbenaceae	*Verbena bonariensis*	Purpletop	General Biosecurity Duty

Family	Scientific Name	Common Name	Priority Weeds for the Hunter (BC Act 2015) Hunter Regional Strategic Weed Management Plan 2023-2027 (LLS 2022)
Verbenaceae	*Verbena quadrangularis*	0	General Biosecurity Duty

Species indicated in bold are also listed as Weeds of National Significance (WoNS) under the Federal Government's National Weed Strategy.

Appendix B – Revegetation Species List

Revegetation Species List - Approximate densities and species for revegetation of the BMP lands

Tree	Density	Shrubs	Density	Groundcovers	Density
MZ1, Aquatic					
N/A	N/A	*N/A*	N/A	*Juncus usitatus* *Juncus kraussii* *Carex appressa* *Carex longebrachiata* *Gahnia clarkei* *Baumea juncea* *Machaerina juncea* *Cycnogeton spp.*	4/m^2
MZ2 & MZ3: PCT 4023 - PCT 4023 - Coastal Valleys Riparian Forest					
Eucalyptus moluccana *Eucalyptus amplifolia* *Acacia parramattensis* *Eucalyptus tereticornis* *Acacia decurrens* *Angophora floribunda* *Casuarina cunninghamiana*	1/20 m^2	*Bursaria spinosa* *Breynia oblongifolia* *Melaleuca styphelioides* *Melaleuca decora* *Rubus parvifolius* *Acacia implexa* *Hibbertia diffusa* *Melaleuca linariifolia* *Melaleuca thymifolia* *Ozothamnus diosmifolius* *Pittosporum revolutum* *Trema tomentosa var. aspera*	1/10m^2	*Microlaena stipoides* *Oplismenus aemulus* *Echinopogon ovatus* *Entolasia marginata* *Juncus usitatus* *Paspalidium distans* *Lomandra longifolia* *Themeda triandra* *Entolasia stricta* *Cymbopogon refractus* *Lomandra multiflora subsp. multiflora* *Carex appressa* *Carex breviculmis* *Dichondra repens* *Lobelia purpurascens* *Centella asiatica* *Commelina cyanea* *Dianella longifolia* *Hydrocotyle sibthorpioides* *Cheilanthes sieberi subsp. sieberi* *Cheilanthes distans* *Adiantum aethiopicum* *Blechnum spinulosum* *Hypolepis muelleri*	4/m^2

Appendix C – BMP Lands Signage

NO UNAUTHORISED ENTRY

This is a Vegetation Rehabilitation Area

- **NO DUMPING or WASTE DISPOSAL**
- **NO ANIMALS, VEHICLES or MACHINERY**

For information – contact Site Manager

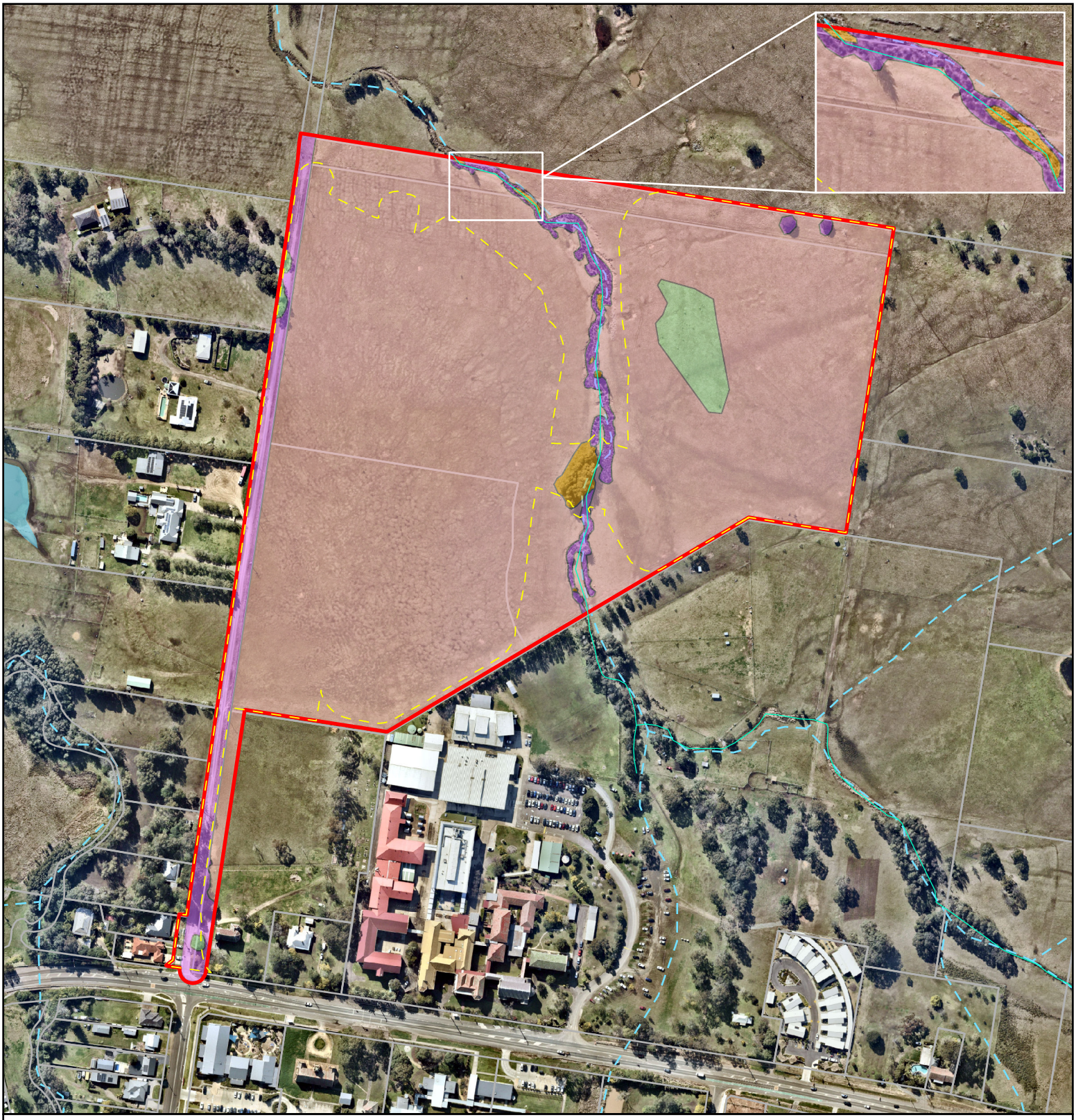
AEP VMP SIGNAGE permanent sign, minimum size 600mm x 400mm erected and maintained at key access points to VMP lands for the life of the project

Appendix D – CVs

The fieldwork, data analysis and reporting for the BMP was undertaken by:

Staff	Title/Qualification	Tasks
Natalie Black	Senior Environmental Manager BSc (Hons), Master Planning, Cert IV (TA) BAAS: 19076	Technical Review
Yann Buissiere	Senior Ecologist BEnv & ResMgt, Dip Cons Land Mgt	Report review
Byron de Jager	Ecologist B. Science, Sustainable Resource Mgt, Cert III Cons Land Mgt AABR accredited member	Report Author and Field work
Brendon Young	Ecologist Master of Environmental Management (Water Resources) Grad Cert Fish Cons & Mgt B. Applied Sc (Fisheries) with Honours	Fieldwork
Oliver Saunders	Ecologist BSc Science Env Mgmt	Field work
Kathleen Bushell	B. Science (Hons), Marine Bio & Env Science & Mgt.	Fieldwork and mapping

Appendix D – Ground-truthed Plant Communities (Extracted from SBDAR, 2025)



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 E – 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.

Jarrod Baxter
Ecologist

Profile Summary

Jarod works with AEP in the role of `Ecologist. He graduated with a Bachelor of Science (Marine Systems). Jarod has previously worked in football administration before coming to AEP. Jarod has experience in a variety of aquatic and marine work, both paid and unpaid. Jarod's special interest areas and expertise include the identification of aquatic flora and fauna species observed during Riparian Assessments and Aquatic Surveys.

Academic Qualifications

- Bachelor of Science (Marine Systems & Management) – Southern Cross University, 2023
- Higher School Certificate – Northholm, Grammar School, 2020

Training, Licences and Professional Memberships

- NSW Class C Driver's Licence
- WHS NSW Construction Induction White Card
- First Aid (Provide First Aid HLTAID011)
- Currently undertaking PADI Open Water dive course, Coffs Harbour

Professional Experience

Ecologist — 2024 – Present
Anderson Environment & Planning
Newcastle NSW

Referee Administration Assistant — 2023 - 2023
Norther NSW Football
Speers Point NSW

Football Referee — 2023 - Present
Northern NSW Football
Speers Point NSW

Events & Admin Coordinator — 2023 - Present
Northern NSW Football
Speers Point NSW

Work Placement Intern — 2022 - 2022
Marine Discoveries
Cains QLD

Ocean Youth Ambassador — 2019
Sea Life
Sydney NSW

Relevant Project Experience

Ecological Surveys

- Targeted Nocturnal Surveys searching for Squirrel Glider in Wyee (2024)
- Spot Analysis Techniques surveys in Austral (2024)

Ecological Assessment

- Riparian Assessments across NSW (2024)
- Aquatic Assessments searching for Key Fish Habitat and Purple Spotted Gudgeon in Stubbo and Lochinvar (2024)

Ecological Monitoring

- VMP Monitoring in the Northern Beaches (2024)

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 Surveys for Cumberplain 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, Hillsborough, 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

I have prepared over 125 Biodiversity Development Assessment Reports all in varying states of assessment, from on-going assessment through to approved. Examples of approved Biodiversity Development Assessment Reports:

- Teraglin Village, Chain Valley Bay;
- Railway Road, Warnervale;
- McFarlane's Road, Chisholm;

- Fairlands Road, Medowie;
- Raymond Terrace Road Chisholm,
- 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

- Newcastle Golf Course Seniors Living
- Lovedale Eco Tourism

Aquatic / Marine Assessment

Honours project was sponsored by Wyong Shire Council and Stormwater Trust to determine the reason for significant levels of seagrass rack and odours in Tuggerah Lake. Honours project was undertaken while working for NSW Fisheries as Conservation Officer where I was required to undertaken assessments of jetties, boat ramps, seawalls, boat sheds, dredging, reclamation and blockages to fish passage on marine, estuarine and freshwater systems.

During my final 18 months at NSW Fisheries, I was the Fish Passage Expert in Northern Catchment, Port Macquarie to Tweed Head including all western catchments draining to east coast. This role required identification of Fish Passage blockages and determine which structures can be retrofitted or replaced to allow fish to move freely through the catchment from sea to upper tributaries. This project had Commonwealth Funding of one million dollars. To apply the funding the I undertook the following assessment, where access was granted by land owners:

- Stream order;
- Stream geomorphology features (meanders, pools riffles, aquatic vegetation);
- Bank and bed structure and condition;
- Location and type of blockage;
- Surrounding terrestrial plant communities;
- Modifications; and
- Potential risk for opening passage such as bed erosion, release of contamination etc.

The information from the above resulting 26 structures being removed/replaced with Fish Friendly structures including opening up 19km of the Brunswick River and contributed to the development of fish friendly structures and providing data and evidence for the production of How do Fish Cross a Road.

The above skills allowed for me to teach the following units aquatic units at Hunter Tafe at varying levels, Certificate iv, Diploma and Advance Diploma from 2010 until 2019:

- Catchment Management;
- Coastal Processes;
- Freshwater and Marine Ecosystems;
- Environmental Legislation; and
- Freshwater, Estuarine and Marine assessment and management.

My role at AEP includes the Lead Aquatic Ecologist, training, assessing, preparing and reviewing the following aquatic assessments:

- Riparian Assessment Reports (for controlled Activity Approvals);
- Aquatic Ecology Assessments (for all environments that trigger Section 7 of the FM, Act);
- Biodiversity Management Plan for Riparian, estuarine and marine environments; and
- Preparation of Permit and Approvals under FM Act and WM Act.