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Riparian Assessment Report

898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW

Prepared for: Lochinvar Developments Pty Ltd

C/- ADW Johnson Pty Ltd

AEP Ref: 2699

Revision: 01

July 2024

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Document Control

Document Name	Riparian Assessment Report for 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW
Project Number	2699
Client Name	Lochinvar Developments Pty Ltd C/- ADW Johnson Pty Ltd
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Revision

Revision	Date	Author	Reviewed	Approved
00	26/06/2024	Jarod Baxter	Brendon Young	Natalie Black
01	19/07/2024	Jarod Baxter	Brendon Young	Natalie Black

Distribution

Revision	Date	Name	Organisation
00	26/06/2024	Matthew London	ADW Johnson Pty Ltd
01	19/07/2024	Matthew London	ADW Johnson Pty Ltd

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Abbreviations

API	Aerial Photography Interpretation
CAA	Controlled Activity Approval
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
NEH	New England Highway
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 ADW Johnson to undertake a Riparian Assessment Report (RAR) to determine the presence of Waterfront Land within the Subject Site. 'Waterfront land' is defined 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).

This report 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 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 the required Vegetated Riparian Zones (VRZs) for the Controlled Activities Approval (CAA).

AEP has undertaken the desktop and field assessment to prepare RAR to inform the requirements of a CAA for potential residential subdivisions at 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW, refer **Figure 1**.

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

> Anderson Environment & Planning (2024). *Riparian Assessment Report for 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW.* Unpublished report for ADW Johnson.

2.0 Site Particulars

Table 1 – Site Details

Detail	Comments
Client	ADW Johnson
Address	898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd Lochinvar, NSW
Title(s)	Lot 2/DP 747391; Lot 3/DP 747391; Lot 4/DP 747391; Lot 5/DP 747391; Lot 6/DP 747391; Lot 12/DP 1219648; Lot 13/DP 1219648; and Lot 9/DP 747391.
Study Area	The Study Area encompasses the entirety of Lot 2/DP 747391; Lot 3/DP 747391; Lot 4/DP 747391; Lot 5/DP 747391; Lot 6/DP 747391; Lot 12/DP 1219648; Lot 13/DP 1219648; and Lot 9/DP 747391, and all upstream tributaries mapped by Water Management (General) Regulation 2018 hydroline spatial data 1.0 and associated Waterfront Land as defined by the *Water Management Act 2000* (**Figure 1**).
Subject Site	The Subject Site approx. 22.54ha, consists rural land currently being grazed. The vegetation is dominated by pasture grasses, exotics and weeds with remnant native vegetation dominate by scattered paddock trees
LGA	Maitland City Council
Zoning	C3 - Environmental Management: (pub. 21-4-2023) R1 - General Residential: (pub. 21-4-2023)
Current Land Use	The Study Area is a vacant, fenced lot consisting of unmanaged grassland and hydrolines, likely historically used as pasture.
NSW River Condition Index	This map describes the riverine condition. It is used to combine a range of indicators into a single condition score. The indicators include riparian vegetation, geomorphic condition, hydrologic stress, biodiversity, catchment disturbance and water quality. The Subject Site is mapped as “Very Poor”.
NSW River Styles Mapping	This map describes the physical characteristics and diversity of rivers and assesses geomorphic stream condition. It considers their capacity to adjust, sensitivity to change due to disturbance, and the pressures (natural and human) that affect their geomorphic condition. The Geomorphic stream condition of the Subject Site is mapped as “Poor”.
High Ecological Value Aquatic Ecosystem (HEVAE) Mapping	This map describes a range of instream values and their importance for NSW freshwater river reach. This includes values such as diversity, distinctiveness, naturalness and vital habitat. NSW HEVAE Instream Value is “Low” within the Subject Site.
Proposed Development	The proposed development includes a residential subdivision within the Lochinvar Urban Release Area.

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Figure 1 - Site Location

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699

3.0 Methodology

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

3.1 Information Sources

Information and spatial data provided within this RAR 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.

3.2 Desktop Assessment

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

3.2.1 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 Study Area and channels water along road side swales were 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. A large detention basin collects water and discharge through culverts under the NEH within the Study Area; and
- Numerous farm dams have been historically constructed on mapped hydrolines throughout the reach Study Area.

3.2.2 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 Subject Site:

- STVM v2.0 accessed via the SEED Portal (May 2024) was utilised to identify vegetation communities occurring within the Subject Site (**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**).

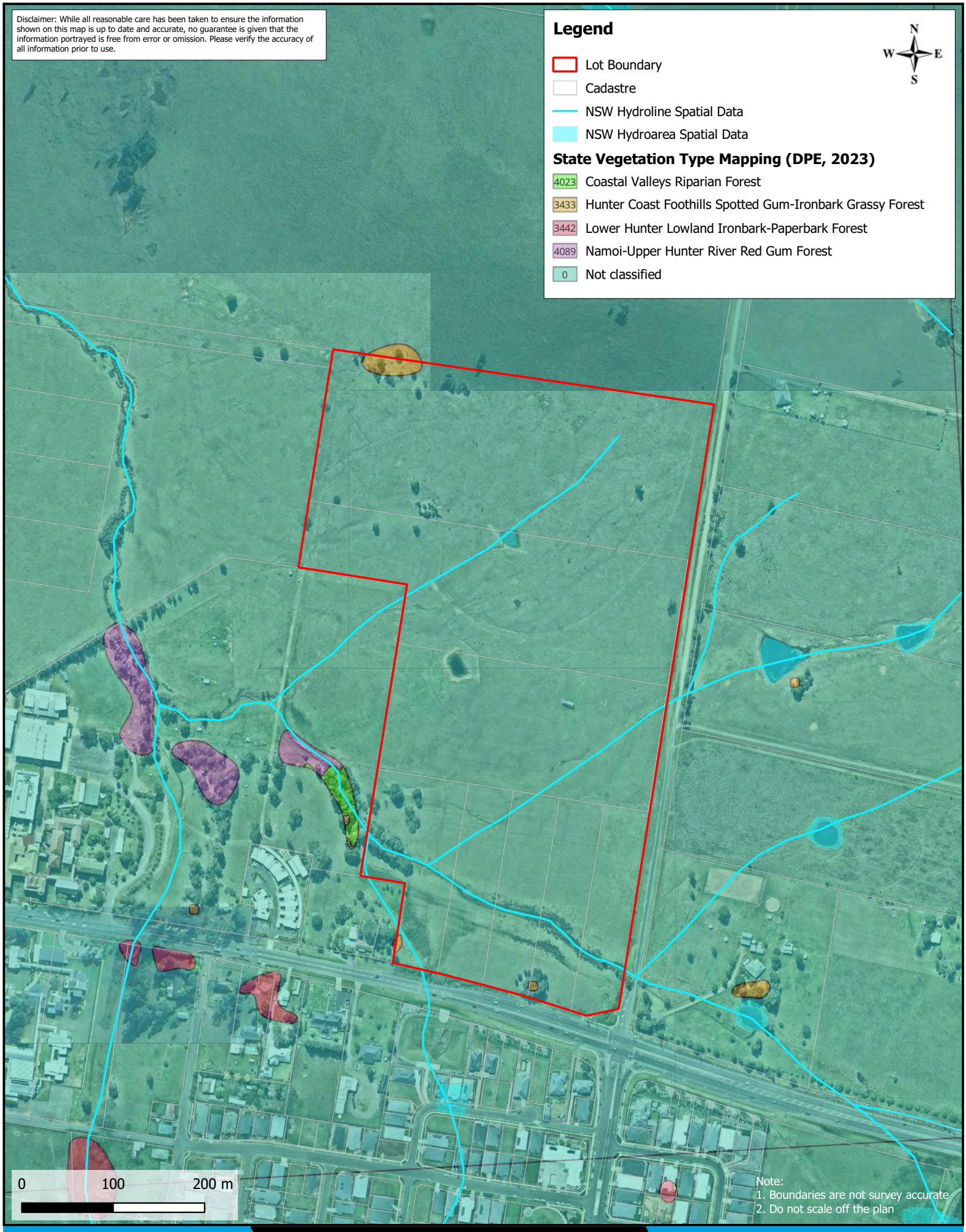

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Figure 2 - State Vegetation Type Mapping (DEP, 2023) Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd AEP ref: 2699

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Figure 3 - NSW Hydroline Data

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699

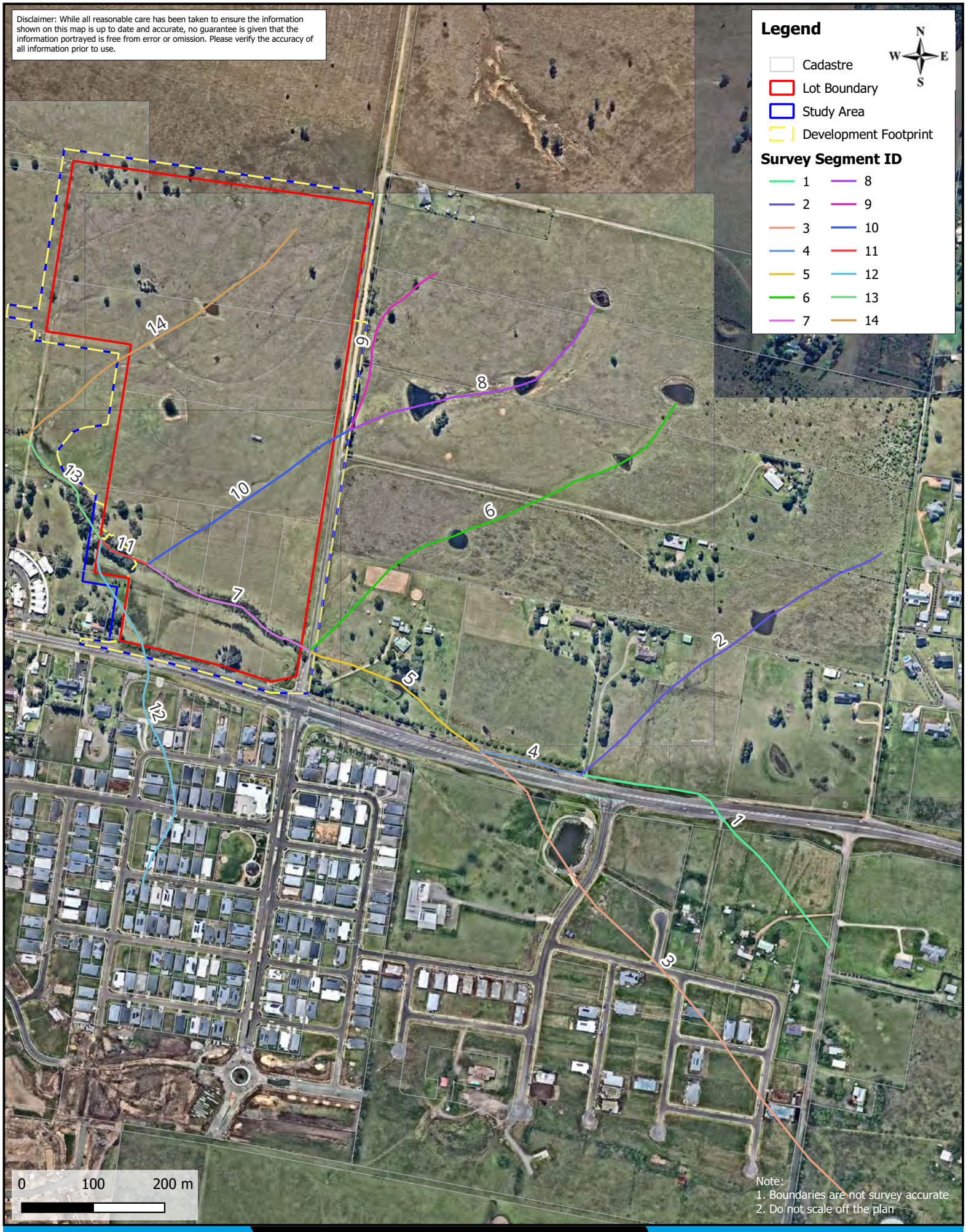

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Figure 4 - Hydroline Segment ID

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699

3.3 Site Assessment

The mapped hydrolines within the Subject Site were assigned individual Segment ID numbers (refer **Figure 4**) and assessed at various survey points with the mapped WFLT.

Desktop stream order indicated two (2) 1st order streams two (2) 2nd order streams and one (1) 3rd order stream was mapped within the Study Area. As a result, fifteen (15) hydroline segments and eighteen (18) survey points were identified for investigation. General observations outside of the Subject Site were undertaken to assess the hydrolines in the broader locality (refer **Figure 5** for survey effort). Investigations for streams outside of the Subject Site consist of roadside visual inspections and further desktop analysis.

The following data was collected at each Survey Point in accordance with the WFLT to ground-truth desktop level assessments:

- Identification of defined bed and banks;
- The location of the top of bank and high bank;
- Identification of the type of watercourse present;
- Determine and notate watercourse features;
- Determine presence of any Lakes or Wetlands; and
- Determine and notate any changes in vegetation communities indicating the presence of a wetland.

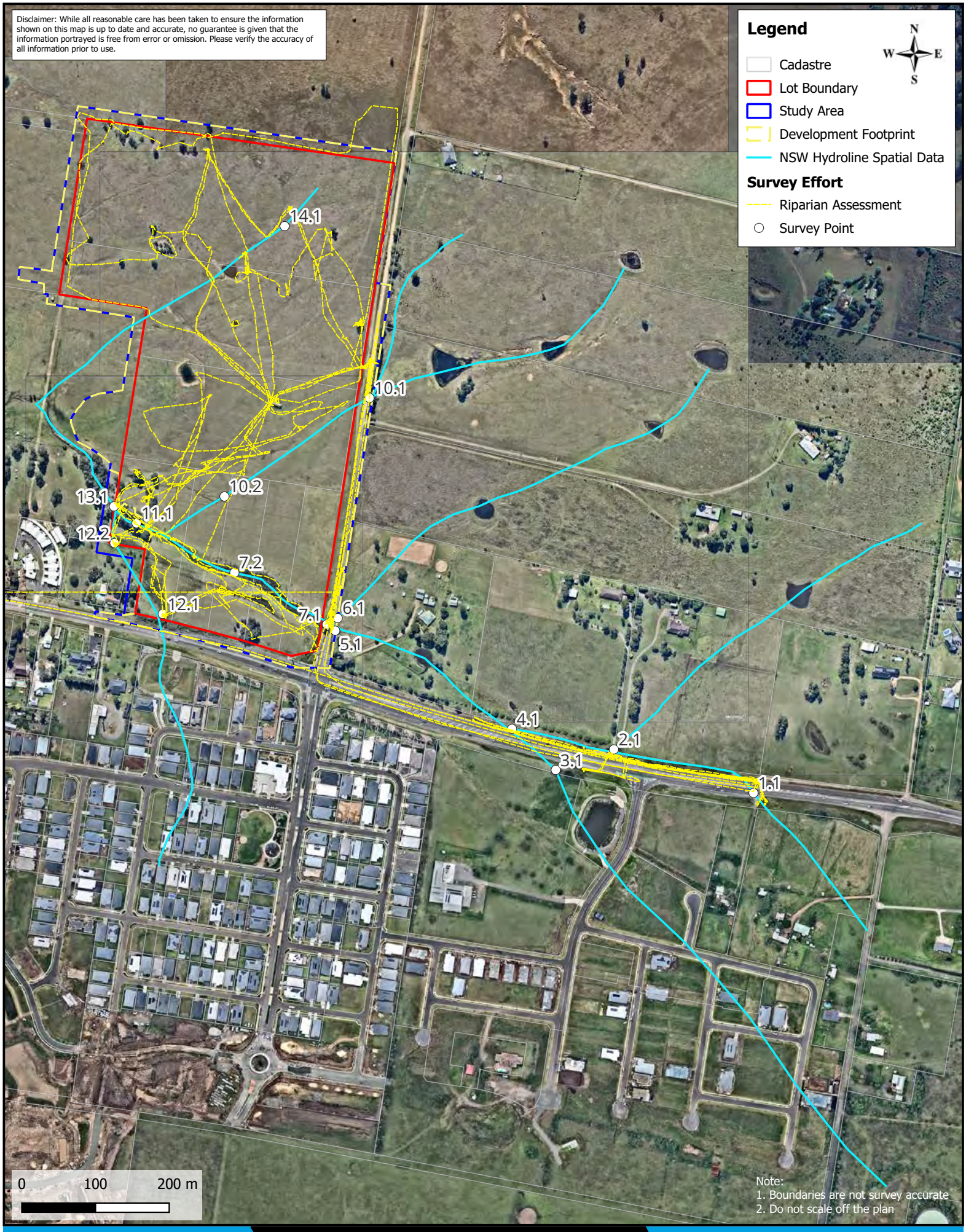

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Figure 5 - Survey Effort

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699

4.0 Site Assessment Results

Fieldwork was conducted on 23rd and 30th August 2022 and the 20th May 2024 to assess desktop determined Survey Points with the WFLT.

Site investigations to ground-truth waterfront land for the purpose of determining appropriate Vegetated Riparian Zones (VRZs) based on current hydrology and geomorphology identified some variation from the mapped hydrolines and stream order. Results of the WFLT site assessment are provided in **Tables 2-16**.

Table 2 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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		-

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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

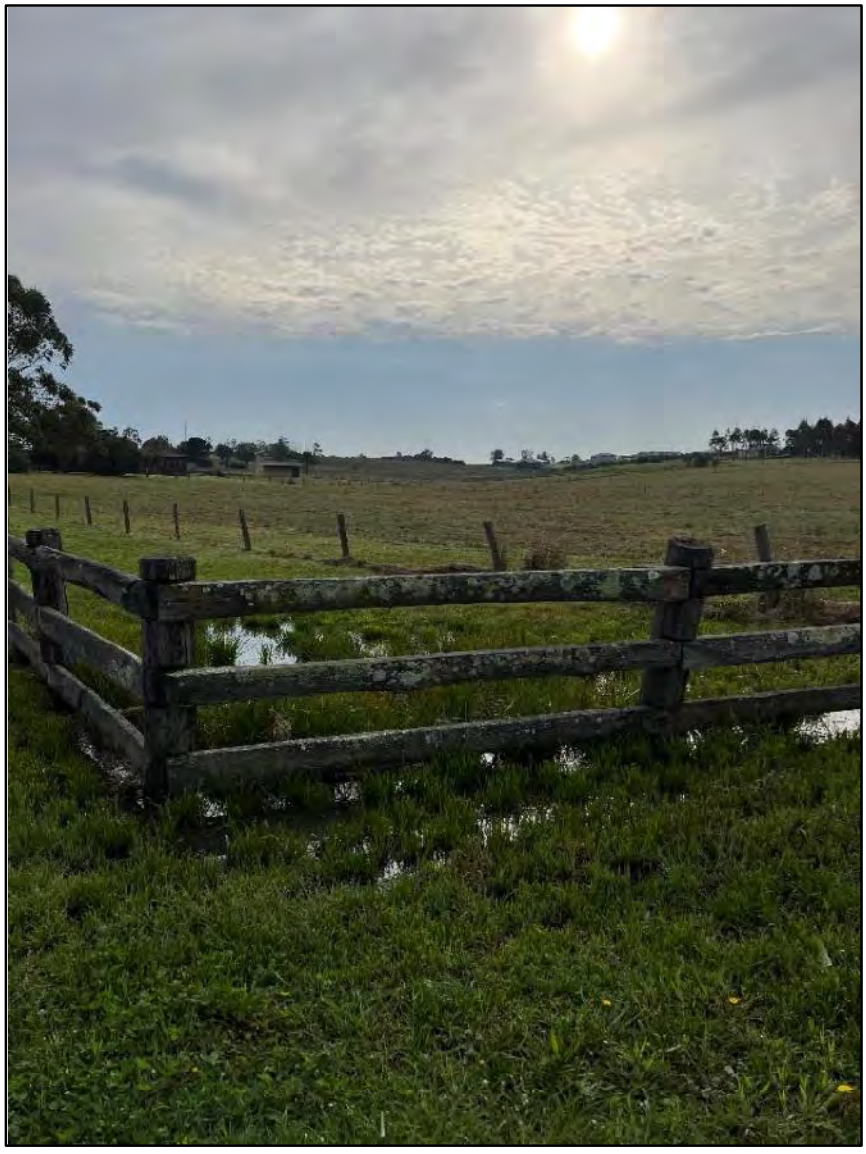
Survey Point 1.1

Table 3 - 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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 4 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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 5 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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 6 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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 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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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 7 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	N/A	Not applicable	-
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.		

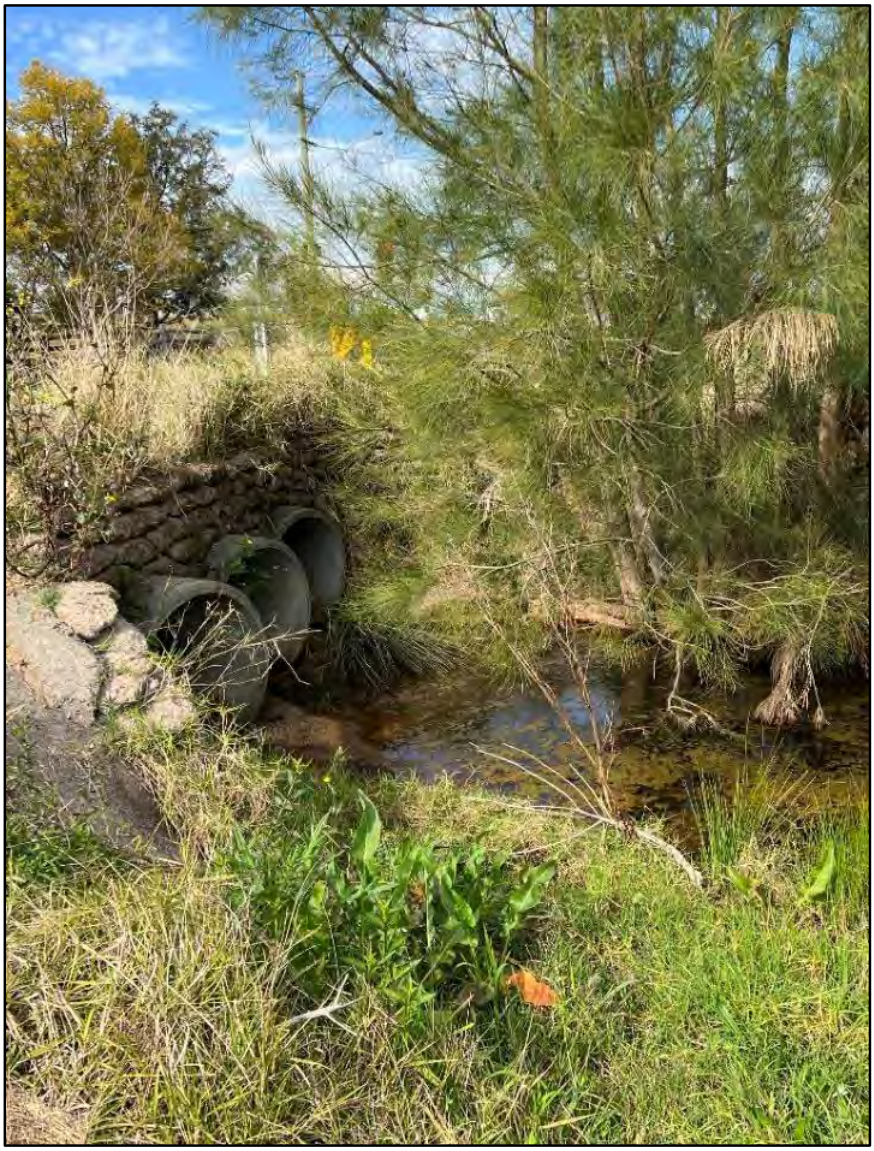
Site Photos – Survey Point 6.1

Survey Point 6.1

Table 8 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	1	Under *Water Management (General) Regulation 2018* Schedule 2, Survey Point 7.1 is	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
		considered Order 1 for the purposes of determining the appropriate VRZ.	
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Vegetated Riparian Zone Requirement	10m	A VRZ of 10m is required from the top of bank either side of the watercourse.	7
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			



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

Survey Point 7.1 - upstream

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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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	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
Ground-truthed Numbering to Determine VRZ	1	Under *Water Management (General) Regulation 2018* Schedule 2, Survey Point 7.1 is	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
		considered Order 1 for the purposes of determining the appropriate VRZ.	
Controlled Activity Approval Required (Y / N)	Yes	CAA required for works within 40m of the top of banks.	6
Vegetated Riparian Zone Required (m)	10m	A VRZ of 10m is required from the top of bank either side of the watercourse.	7
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 9 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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 10.1

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

Survey Point 10.2 -downstream

Table 10 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	Yes	1	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	Yes	CAA required.	6
Vegetated Riparian Zone Required (m)	10m	Defined bed and bank visible	7
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 11 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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			

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Survey Point 12.1 – mapped upstream			

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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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 12 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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 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
Ground-truthed Numbering to Determine VRZ	Yes	1	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	Yes	CAA required.	6
Vegetated Riparian Zone Required (m)	10m	Defined bed and bank visible	7
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 13 – 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 Subject Site 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 Subject Site and an additional twenty (20) hydroline segments within the upstream reach (Study Area).	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 Subject Site.	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
Ground-truthed Numbering to Determine VRZ	N/A	Not applicable	6

Task – Waterland Tool (2020)	Assessment	Comments (provide evidence)	Figures
Controlled Activity Approval Required (Y / N)	N/A	WFL does not occur at this survey point.	-
Vegetated Riparian Zone Required (m)	No	Not applicable	-
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

4.1 Summary of Results

Desktop assessment indicated the presence of two (2) 1st order, two (2) 2nd order and one (1) 3rd order stream mapped within the Subject Site, and an additional six (6) 1st order streams and two (2) 2nd order streams mapped within the Study Area.

However, field surveys identified no WFL features at Segments 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, and 14. API and historical review identified urban and rural development has likely resulted in the modification at the location of these segments, and consequently are not considered WFL or tributaries as defined under the WM Act.

WFL features were observed at Segments 7, 11 and 13 and these Segments were determined to be WFL.

Under **Schedule 2** of the WM Act, Order 1 was allocated to Segment 7 for the purpose of a CAA and determining the appropriate VRZ within the Subject Site. Consequently, a 10m VRZ is required.

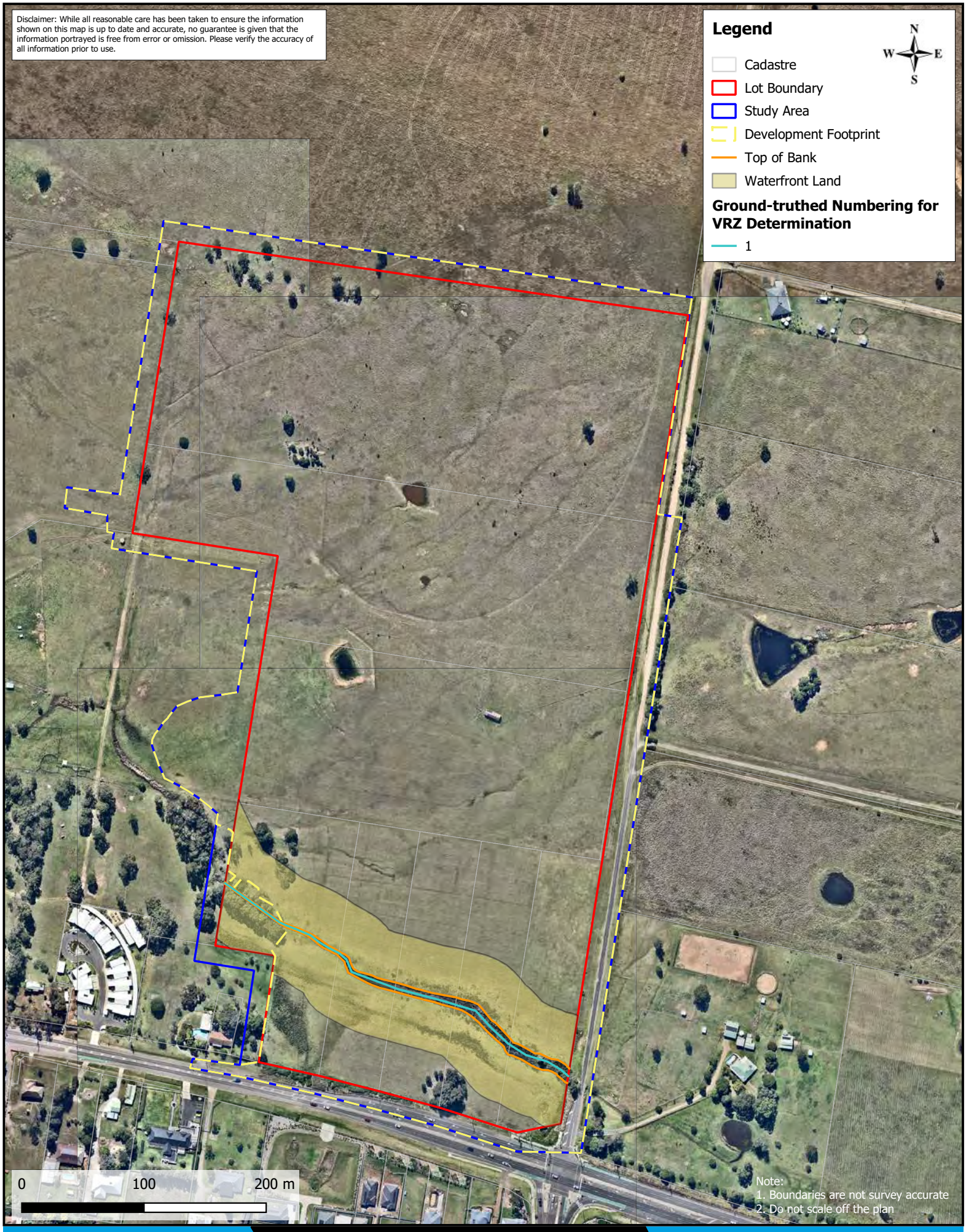
The results of the assessment are provided in **Figure 6** to inform CAA requirements for appropriate works, in accordance with **Table 14**, and based in the current ground-truth conditions.

Table 14 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 7** provides the location of the stream re-alignment of Segment 7. A Biodiversity Management Plan (BMP) has been created to support the CAA and rehabilitate works that disturb or modify the riparian corridor, including regeneration an area of freshwater wetland (**Appendix B**).

Table 14 - Riparian Corridor Matrix (DPI Water, 2018)

Stream Order	VRZ	RC Offsetting for non-RC uses	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	10m	Yes	Yes	Yes	Yes	Yes	**Yes**	Yes	-	-
2nd	20m	Yes	Yes	Yes	Yes	Yes	-	Yes	-	-
3rd	30m	Yes	Yes	Yes	-	Yes	-	-	Yes	Yes
4th+	40m	Yes	Yes	Yes	-	Yes	-	-	Yes	Yes

Note: Where a watercourse 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.



AEP

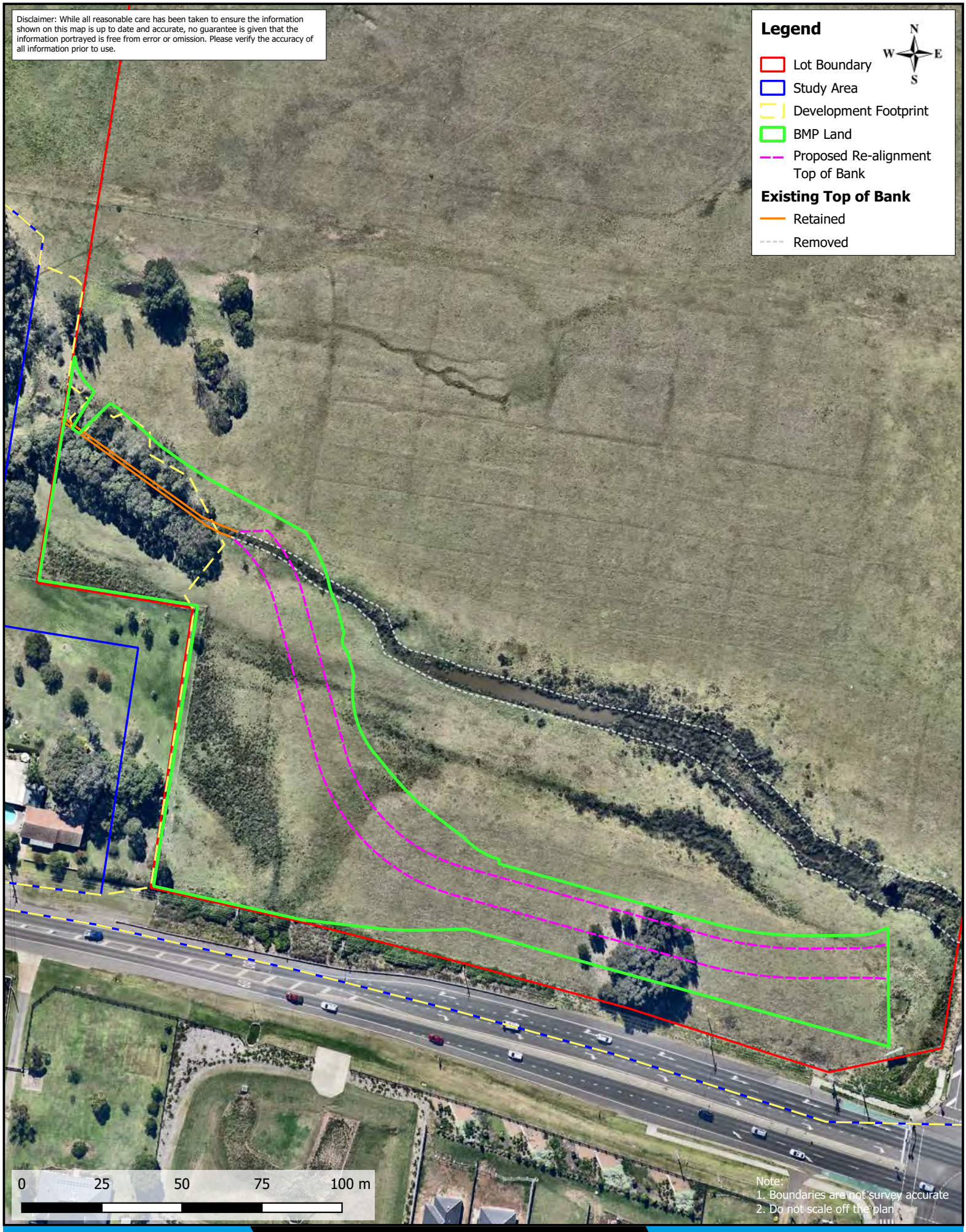
Figure 6 - Ground-truthed WFL Assessment

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699



AEP

Figure 7 - Stream Re-alignment

Date: July 2024

Location: New England Hwy and Wyndella Rd, Lochinvar

Client: Lochinvar Developments Pty Ltd

AEP ref: 2699

5.0 Conclusion

No WFL features were identified at Segment IDs 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, and 14, and these Segments do not constitute waterfront land, or tributaries under the Strahler ordering system, as defined under the WM Act.

WFL features were observed at Segments 7, 11, and 13 and these Segments were determined to constitute waterfront land as defined under the WM Act. Under **Schedule 2** of the WM Act, Order 1 was allocated to Segment 7 for the purpose of a CAA and determining the appropriate VRZ within the Subject Site. Consequently, a 10m VRZ is required.

Works will occur within Waterfront Land and a CAA will be required to accompany any Development Application (DA) for works that occurs within 40m of top of bank.

A number of controlled activities can occur within the VRZ, including the proposed stream re-alignment. A CAA application will require riparian vegetation is rehabilitated within the VRZ to reconstruct natural function of the riparian corridor. A 5-year BMP has been provided to fulfill this requirement.

6.0 References

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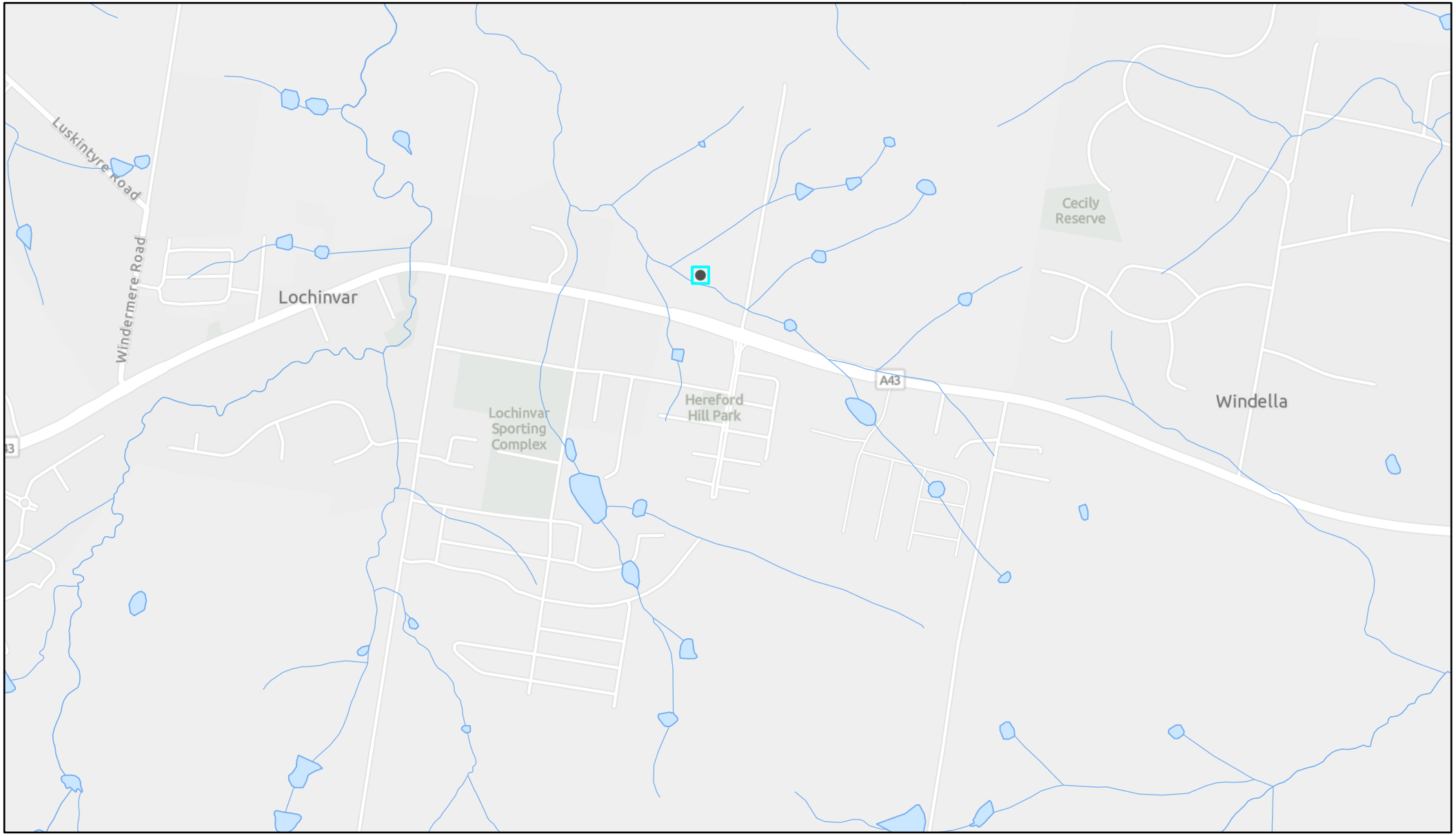
Appendix A – NRAR Hydroline Spatial Data

2018 Hydroline spatial data 1.0



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Esri Community Maps Contributors, Maitland City Council, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS

Water Management (General) Regulation

NSW Department of Industry | Lands and Water | Water

Appendix B – Biodiversity Management Plan

Draft Biodiversity Management Plan – 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW

Prepared For: Lochinvar Developments Pty Ltd

Prepared By: Anderson Environment and Planning

Date: July 2024

AEP Reference: 2699.04

Revision: 01

Plate 1 – Existing creek line north west of BMP lands

Plate 2 – Planted native vegetation resembles PCT 3433

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1.0 Introduction

At the request of Lochinvar Developments Pty Ltd, on behalf of ADW Johnson Pty Ltd (the client) Anderson Environment & Planning (AEP) have undertaken the necessary investigations to inform the production of a Biodiversity Management Plan (BMP) to schedule rehabilitation measures associated with the development of land at 898 New England Hwy, 25 Wyndella road and 39 Wyndella Road Lochinvar, NSW, henceforth referred to as the Subject Site (**Figure 1**). As the proposed development will be impacting waterfront land, a BMP is required as part of the controlled activity approvals outlined below (DPI 2012):

> *Controlled activities carried out in, on or under waterfront land are regulated by the Water Management Act 2000 (WM Act). When a proposed controlled activity disturbs or substantially modifies the riparian corridor, its restoration or rehabilitation will be a requirement of the controlled activity approval. A vegetation management plan (VMP) details how the restoration or rehabilitation will be carried out.*

Although this level of detail is not typically provided as part of the development application, rather it comes with the application for the CAA post-consent, it has been provided upfront to support the proposed stream realignment works.

1.1 Biodiversity Management Plan Objectives

The aim of this BMP is to determine the reconstruction of a riparian area, schedule weed management and revegetation measures necessary to enhance habitat value and improve landscape connectivity of retained lands. This will be achieved by providing a stable watercourse and riparian corridor as well as enhancing existing vegetation.

The purpose of this plan is to:

- Reinstate a natural channel creating both ecological and hydraulic function.
- To create a Wildlife Corridor for native fauna in the area, with provisions such as connective canopy species such as the Endangered *Petaurus norfolcensis* (Squirrel Glider) are able to move through the Subject Site.
- To revegetation to a point that it can be naturally regenerated.
- To improve water quality within the Hunter Catchment.
- Provide habitat for both native terrestrial and aquatic species.

The BMP requires action to regenerate riparian lands while creating safe space within the proposed subdivision. The BMP incorporates best practices in bushland restoration, management of invasive species and revegetation to achieve the following objectives within the 5 years imparted:

- Regenerate physical and biological functions of the remnant bushland present within the VMP Lands to improve habitat values and connectivity for locally occurring biota;
- Reconstruct highly disturbed areas that cannot naturally regenerate, to stabilise and reinstate landforms and vegetation communities that are generally representative of those present prior to disturbance;
- Develop management actions detailed using the 'SMART' goals approach (Specific, Measurable, Achievable, Reasonable and Time bound);
- Ensure the site is maintained until vegetation in rehabilitated areas achieves a self-sustaining state;
- Enhance habitat and connectivity across the site through salvage of biomass from the development site and revegetation.
- Implement erosion and sediment control measures to minimise the transfer of soil and sediments into downslope receptors; and
- Implement a hygiene protocol to prevent the transfer of weeds and pathogens onto and off the site.

1.2 Supporting Reports

The BMP must be read and implemented in conjunction with the following reports:

- Anderson Environment & Planning (2024) *Streamlined Biodiversity Assessment Report for Residential Subdivision and Associated Infrastructure at 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW.*
- Anderson Environment & Planning (2024) *Aquatic Ecology Assessment Report for 898 New England Hwy, 25 Wyndella Rd and 39 Wyndella Rd, Lochinvar, NSW.*

2.0 Site Context and Existing Condition

2.1 Local Context

Lochinvar Developments Pty Ltd are proposing a 258 Lot residential subdivision with internal road, services, and asset protection zones (APZs). The residential development will be situated within Lots 2-6 and 9 DP747391, Lots 12 and 13 DP1219648 (approx. 21.99ha) currently zoned for General Residential (R1) land use. The proposed development is a large residential subdivision planned under the Lochinvar Urban Release Area with retained creek line proposed to be managed under a biodiversity management plan.

The BMP lands, totalling 1.37ha, are situated within an area designated as R1 - General Residential zoning, and were previously cleared and managed as agricultural land. The BMP will apply to land within the following five (5) lots:

- Lot 2 in DP 747391;
- Lot 3 in DP 747391;
- Lot 4 in DP 747391;
- Lot 5 in DP 747391;
- Lot 6 in DP 747391.

General ecological inspections and floristic surveys were undertaken by AEP in April 2024. Riparian assessments and fauna surveys were conducted between August 2022 and January 2023. The existing hydroline was assessed against the NRAR *Waterfront Land Tool* for the purposes of determining Vegetated Riparian Zones (VRZ).

A section of the creek is proposed to be realigned under the BMP and will require plantings and erosion and sediment controls to ensure the banks of the creek remain stable and natural flow and ecological function are maintained.

The BMP will utilise the principles of Brisbane City Council's 2003 Natural Channel Design to restore natural features within the proposed management zones and regenerate aquatic and riparian ecosystems. The channel will be restored with species from PCT 3975, and the riparian corridor PCT 3433, to create a functioning wildlife corridor focusing on *Petaurus norfolcensis* (Squirrel Glider), *Litoria aurea* (Green and Gold Bell Frog) and other native fauna. Proposed interventions include pocket plantings of canopy trees for Glider movement, low-lying fire-resistant species to minimize bushfire risk, and compliance with Safer by Design Guidelines to reduce potential antisocial behaviour.

To ensure consistency with water sustainable urban design principles the tailout scour protection area will not utilise chemical weed control this area is proposed to be managed by hand weed removal to ensure water quality is maintained (refer **Figure 3**).

The BMP lands are proposed to be managed under a 5-year Biodiversity Management Plan, including natural channel design, plantings, weed management, pest and disease management and installation of habitat.

All APZs are located outside of BMP lands and are to be managed under the provisions outlined in the Bushfire Report.

Figure 2 shows ground-truthed vegetation boundaries. **Figure 3** outlines the proposed management zones and areas impacted by the development.

2.2 Stages

The development is proposed in stages, to ensure the regeneration works are not impacted Stage 1 of the regeneration works are temporary to stabilise soils.

Stage 1 is the installation of a culvert on Wyndella Road. The removal of the existing road crossing will be undertaken and replaced with a culvert designed to ensure Fish Passage is maintained in perpetuity. The works are will be seeded with native groundcovers to stabilise soils.

Stage 2 is the commencement of the BMP, as outlined below.

2.3 Existing Vegetation Description

The Study Area covers approximately 26.49ha and the Subject Site totals approx. 22.25ha, comprising approx. 0.87ha of poor and highly degraded condition native vegetation, with the remainder of the Subject Site

consisting of non-endemic planted natives, exotic species and cleared lands.

The native vegetation within the BMP lands contains two (2) plant community types (PCTs), which are present in varying condition.

- 4044 - *Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest* – Highly degraded (0.51ha)
- 3433 - *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* – Degraded (0.12ha)

It should be noted that PCT 3433, a dry sclerophyll forest community (**Plate 2**), was planted approximately 20 years ago at the western extent of the riparian corridor. However, this vegetation type is not the most appropriate for a riparian zone as it does not naturally occur in these low-lying areas. PCT 4044 is expected to occur within this area and is likely to have been the naturally occurring plant community type historically.

Figure 1 and **2** shows the site location ground-truthed vegetation respectively.

2.3.1 PCT 3433 - Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest

PCT 3433 - Hunter Coast Foothills-Ironbark Grassy Forest currently present on site is dominated by a canopy of Spotted Gum (*Corymbia maculata*) and Grey Gum (*Eucalyptus punctata*). The vegetation is deemed not remnant due to being planted in what appears to be parallel lines no later than 20 years ago.

The species present are a mixture of Dry Sclerophyll Forest and Forested Wetland species such as *Casuarina glauca, Carex appressa* and *Juncus usitatus* as a result of plantings adjacent to the hydroline. Ground stratum species include *Centella asiatica, Rumex brownii, Lachnagrostis aemula* and *Parsonsia straminea*.

PCT 3433 – *Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest* is associated with the Endangered Ecological Community *Lower Hunter Spotted Gum – Ironbark Forest* (BC Act 2016). Given the absence of midstory, sparse native understory and fragmented condition of the site, the vegetation present is a highly disturbed variant of the EEC.

Plate 3 – PCT 3433 – Hunter Coast Foothills Spotted Gum – Ironbark Grassy Forest

2.3.2 PCT 4044 - Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest

This PCT is in the southern low-lying areas of the BMP lands covering approx. 0.51ha. The canopy is dominated *Casuarina glauca*, with a ground stratum consisting of *Juncus appressa, Juncus usitatus* and *Cynodon dactylon.*

Plate 4 – PCT 4044 – Northern Creekflat Eucalypt-Paperbark Mesic Swamp

2.3.3 Planted Native

Much of the BMP Lands consists of highly disturbed grassland (**Plate 5**). This area is largely cleared and dominated by planted *Cynodon dactylon* (Couch Grass) and introduced species such as *Paspalum dilatatum* (Paspalum), *Senecio madagascariensis* (Fireweed), and *Juncus acutus*.

While *Cynodon dactylon* is considered native by the NSW Herbarium, it is listed as non-native by the Commonwealth. Despite being widely cultivated as a lawn and pasture grass (DPE, 2022), it is historically associated with agricultural grazing practices, where it was likely sown. Consequently, the *Cynodon dactylon* present at the site is classified as 'planted native vegetation'.

Plate 5 – Exotic grassland in southern BMP lands

2.3.4 Exotic Riparian

The riparian zone of the BMP lands located in the south, is dominated by exotic species including *Juncus acutus, Hypochaeris radicata* and *Cyperus eragrostis*.

Plate 6 – Exotic riparian vegetation in unaltered hydroline alignment

2.4 Native Vegetation Condition

2.4.1 PCT 3433 - Hunter Coast Foothills Spotted Gum - Ironbark Grassy Forest

Areas of PCT 3433 are in moderate condition as a result of edge effects and disturbance from grazing cattle. The mid stratum is absent likely due to suppression of shrubs from grazing. The lower stratum, although highly disturbed, containing a large number of exotics, also comprises regenerating native understory species.

Plate 7 – PCT 3433 in moderate condition in west of BMP lands

2.4.2 PCT 4044 - Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest

PCT 4044 within the BMP lands is in a highly degraded condition. The native vegetation is limited to a small number of native species including *Casuarina glauca, Carex appressa* and *Juncus usitatus.* The majority of weed load in this area is comprised of understory species *Cyperus eragrostis* and *Juncus acutus.* Degraded ground cover in the south west is subject to extensive runoff from the development south of the NEH draining into this area and is starting to form a freshwater wetland, albeit in the early stages. Areas directly impacted by increased runoff will be reconstructed with aquatic species from PCT 3975 *Southern Lower Floodplain Freshwater Wetland* to reflect and support the change in conditions, assist in water treatment from road runoff and from adjoining residential subdivision, the species in this PCT are known for their ability to improve water quality. Additionally, reconstruction of PCT 3975 will be undertaken to ensure vegetation communities are commensurate with the Threatened Ecological Community (TEC) *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.* The wetland PCT will also provide potential habitat for amphibians such as Green and Golden Bell Frog.

Plate 8 – PCT 4044 in poor condition view facing east to west, proposed to be regenerated with PCT 3975 as freshwater wetland.

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 years 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* and 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. These include the Natural Regeneration and Facilitated Regeneration approaches that will be utilised within the BMP lands with the aim of achieving the Natural Regeneration state by the end of the BMP Management period.

Note that the Reconstruction Approach will not be utilised due to the low weed load within the BMP Lands and resilience of the vegetation present. Nonetheless, adaptive management require the consideration for active restoration via supplementary planting due to the potential for unforeseen factors to arise such as new weed incursion, vandalism or introduction of pathogens that may impact one or more strata of vegetation.

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:

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

Zones 1,2,4,5 and 6 within the BMP lands have been appointed to be reconstructed.

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, the tasks of which will be determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Replacement of dead plants;
- Weeding;
- Watering;
- Mulching; and
- Maintenance of tree guards.
- Maintenance of jute matting

3.1.3 Natural Regeneration Approach

This approach is where damage is relatively low, and pre-existing biota should be able to recover after cessation of degrading practices.

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 be managed via this approach due to weed loads being mostly low to negligible. Where weed densities are moderate, ongoing weed control targeting the vicinity of the tracks is expected to manage the edge effect and provide opportunities for native flora to recruit and colonize areas cleared of exotic species. Ongoing monitoring will determine whether weed control is effective and if adjusting management strategy to facilitated regeneration and/or reconstruction is necessary.

3.1.4 Natural Channel Design and Vegetated Riparian Zone

As part of the development footprint, the existing mapped hydroline will be realigned within the BMP lands. A section of the creek, currently vegetated with planted PCT 3433, will be retained. The rest of the riparian corridor will be regenerated with PCT 3433, In-stream aquatic vegetation will be from PCT 3975. This is shown in **Figure 3**.

The existing creek is highly degraded, eroded and modified by past and present agricultural uses. The Department of Planning and Environment (Water) requires a 10m VRZ from the top of bank on a 1st order stream.

The realigned creek has been designed to include:

- Defined bed and bank;
- Meanders;
- Pools;
- Riffles; and
- Aquatic vegetation.

Plates 9-12 below show examples of these design features.

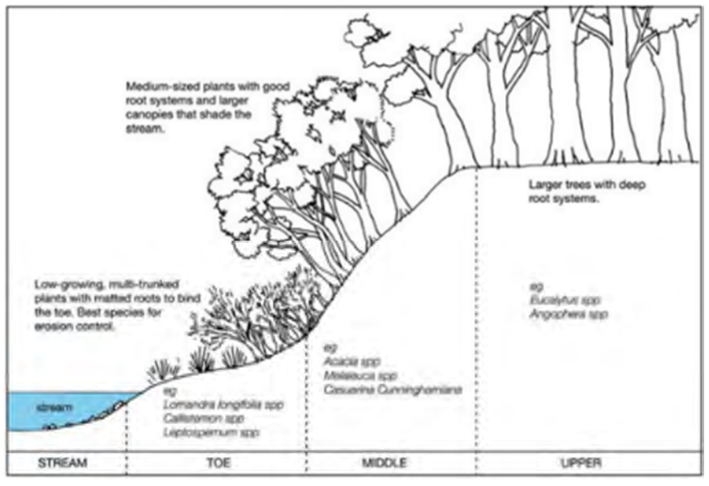

Plate 9 - Cross Section of Stream (NSW Water, 2022)

A review of the current literature showed that reinstated natural channels within the unnamed creek would ensure the above key hydrological features are present within the creek, and as a result improved water quality and habitat for both terrestrial and aquatic organisms will be provided. **Plates 7 – 9** show photos of natural channel design examples.

This BMP provides the concept plan for the channel design, detailed engineering plans will be prepared prior to Construction Certificate.

Plate 10 – Meanders, Riffles and shallow pools (STORMWATER, 2018).

Plate 11 – Low Flow Channel (Australian Wetland Consulting, 2018).

Plate 12 – Bundamba Creek Restoration works (Australian Wetland Consulting, 2018)

4.0 BMP Stages

4.1 Stage 1

Before the commencement of BMP works in Stage 2, temporary regeneration will occur before the stream alignment. This is due to the upgrade of Wyndella Road carriageway and the installation of a shared pathway. The focus of this stage is temporary bank stabilisation prior to Stage 2 works. The operation of the stream will also be in use short term, by implementing the BMP to a two-stage approach, the necessary road closures of Wyndella Road will be reduced to minimise disruption to local residents.

4.2 Stage 2

The permanent stream realignment will occur in association with the subdivision stage. Once all civil works are completed for the subdivision, the BMP works will commence.

5.0 Management Zones

The BMP lands within will be managed in six (6) Management Zones (MZs) to clearly identify objectives and targets. **Figure 4** shows the Management Zones.

- Management Zone 1 (MZ1): PCT 3975 Reconstruction - Low Flow Channel;
- Management Zone 2 (MZ2): PCT 3433 Reconstruction - Watercourse Bank;
- Management Zone 3 (MZ3): PCT 3433 – Facilitated Regeneration ;
- Management Zone 4 (MZ4): PCT 3433 Reconstruction – Riparian;
- Management Zone 5 (MZ5): PCT 3975 Reconstruction - Freshwater Wetland (Ground Cover); and

- Management Zone 6 (MZ6): PCT 3433 Reconstruction - Proposed Berm.

5.1 Management Zone 1 : PCT 3975 Reconstruction - Low Flow Channel

MZ1 (approx. 0.07ha) zone is located in the low flow channel to the top of the toe, consisting of a width of 1m – 2m. It will include the reinstating of aquatic vegetation and habitat such as snags and woody debris.

The Reconstruction Approach is being utilised in MZ1 due to the realignment of the creek line and density of weeds found on either end of the creek (East and West). De-watering, trenching, digging, construction and planting of native water plants will need to be implemented**.**

Weeding as defined in **Table 2**, effectively controlling priority species and areas through appropriate methods to eliminate highly competitive weeds from an area.

All works should be undertaken to ensure bed and bank stability, provisions of aquatic habitat for both flora and fauna.

As stated, the Reconstruction Approach requires active interventions, the tasks of which will be determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Construction of natural channel;
- Planting of grasses;
- Installation of snags;
- Weeding;
- Watering; and
-
- Replacement of dead plants (1:1).

The BMP aims to move into Natural Regeneration Approach by the end of Year 5.

5.2 Management Zone 2 : PCT 3433 Reconstruction - Watercourse Bank

MZ2 (approx. 0.34ha) is located from the top of the toe to the top of the high bank approximately 2m either side of MZ1. MZ2 will be planted out with species commensurate with PCT 3433.

The Reconstruction Approach is being utilised in this section due to the realignment of the creek line and density of weeds found on either end of the creek (East and West). Therefore, planting of native species from PCT 3433 will assist with meeting the Targets outlines in Section 6.

To prepare for planting, spot spraying of the area should be undertaken and direct seeding of native grasses and ground covers may occur around the planting. This will be decided by the bush regeneration contractor.

Maintenance of the plantings will include watering and spot spraying of herbaceous weeds over the following months as well as replacement of dead plants if conditions are still favourable for planting. If weather is unsuitable, replacement and infill planting will be postponed till the following spring at autumn.

Weeding will be commenced, as defined in **Table 2** (effectively control priority species and areas through appropriate methods to eliminate highly competitive weeds from an area).

All works should be undertaken to ensure bed and bank stability, provisions of terrestrial habitat for both flora and fauna.

As stated, the Reconstruction Approach requires active interventions, the tasks of which will be determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Planting of grasses and shrubs;
- Weeding;
- Watering;
- Mulching (if required); and
- Replacement of dead plants (1:1).

The BMP aims to move into Natural Regeneration Approach by the end of Year 5.

5.3 Management Zone 3 : PCT 3433 - Facilitated Regeneration

MZ3 (approximately 0.12ha) is located on the western boundary and currently consists of planted PCT 3433 and some regenerating casuarinas surrounding an existing watercourse. While canopy cover is present, there is no midstory, necessitating the initial planting of shrubs to establish a microclimate conducive to groundcover growth. Proposed interventions include pocket plantings of canopy trees and low-lying, fire-resistant species to facilitate Squirrel Glider movement, minimize bushfire risk, and comply with Safer by Design Guidelines to reduce potential antisocial behaviour.

The Facilitated Regeneration Approach is being employed in MZ3 due to high weed loads and the absence of mid and lower stratum vegetation. Planting native species from PCT 3433 will help achieve the targets outlined in **Section 5**. Primary weeding, as detailed in **Table 2**, will involve foliar herbicide application and the physical removal of woody weeds to effectively control priority species and eliminate highly competitive weeds.

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

- Weeding;
- Planting;
- Watering;
- Mulching (if required); and
- Maintenance of tree guards;
- Maintenance of jute matting;
- Replacement of dead plants (1:1).

The BMP aims to move into Natural Regeneration Approach by the end of Year 5.

5.4 Management Zone 4 : PCT 3433 Reconstruction - Riparian

MZ4 (approx. 0.45ha) is from the edge of the floodplain to the landscaped road batters and parkland area. This zone will be planted to reflect a derived woodland of PCT 3433. This will ensure the Safer by Design Guidelines are met with more pocket plantings to ensure clear sightlines and no spaces where antisocial behaviour can occur.

The Reconstruction Approach is being utilised in MZ4 due to the high weed loads and lack of native vegetation within this zone. Therefore, canopy trees, shrubs and understory form PCT 3433 will assist with meeting the Targets outlines in **Section 6.**

Primary weeding as defined in **Table 2** to effectively control priority weed species and eliminate highly competitive weeds from an area. This may include high-volume herbicide application.

As stated, the Reconstruction Approach requires active interventions, the tasks of which will be determined by the Bush Regeneration Contractor (BRC) and may involve the following tasks:

- Installation of logs along edge as a buffer;
- Planting of grasses, shrubs and canopy species;
- Installation of habitat;
- Weeding;
- Watering;
- Mulching (if required); and
- Replacement of dead plants (1:1).

The BMP aims to move into Natural Regeneration Approach by the end of Year 5.

5.5 Management Zone 5: PCT 3975 Reconstruction - Freshwater Wetland

MZ5 (approximately 0.31ha) will be established to enhance connectivity and support the surrounding hydrological regime as part of a water sustainable urban design. This area will predominantly feature a mixture of freshwater wetland and semi-aquatic groundcover commensurate with PCT 3975. MZ5 plantings will be limited to ground cover only to reduce future bushfire risk to adjacent properties. These elements are designed to integrate with the terrestrial environment and meet the hydrological needs of the site. It is crucial to design this area to avoid shading the water features, as prolonged shading will reduce habitat suitability. The planting densities are based on evidence and historical data from various reports and case studies.

Shrubs and canopy in MZ4 will add a layered structure that assists MZ5 in reducing grassy weed cover and preventing weed incursion into the BMP lands from the road to the south.

The following management tasks are to be undertaken:

- Primary planting (Aquatic and terrestrial wetland ground cover vegetation commensurate with PCT 3975);
- Watering; and
- Ongoing maintenance (Watering, replacement of unsuccessful plantings).
- Primary and secondary weeding.

5.6 Management Zone 6: PCT 3433 Reconstruction - Proposed Berm

MZ6 (approximately 0.09ha) has been established to manage hydrological overflow and dispersion as part of a water sustainable urban design. This zone will regenerate PCT 3433 ground cover and shrub layer on a constructed berm and support various ecological functions.

The following management tasks are to be undertaken:

- Primary weeding;
- Planting of ground cover and mid-strum species only from PCT 3433;
- Weed control; and
- Maintenance weeding and replacement of any dead plantings.

6.0 Regeneration Targets

6.1 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 PCTs and 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 Methods 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 guilds present; and
- Abundance of fauna recorded within the subject site.

AEP acknowledges that all 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 of 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 **Appendix A)** for each Regeneration Approach that can achieve a naturally regeneration functioning ecosystem, within the timeframes outlined in the BMP.

Utilising ecological references to identify the terrestrial or aquatic ecosystem and inform the targets of a regeneration project involves describing the specific compositional, structural, and functional attributes needing reinstatement. Only then can the desired outcome of "assisting the recovery of an ecosystem" be 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.

6.1.1 BMP Land Targets

Integrated Regeneration Approach will be applied across the entire BMP Lands, with the following targets designed to be specific, measurable, achievable, reasonable, and time-bound (SMART), providing quantitative data within the BMP Lands.

Given the current condition of the BMP Lands the focus is on weed removal, which in turn will promote the growth of native vegetation from the seed bank in the soil and the seed brought in by mobile fauna.

Appendix A outlines the targets the BMP is aiming for each attribute within the BMP Lands.

When surveys were undertaken by AEP the vegetation within communities were was identified to be in two conditions requiring two of the three approaches to regeneration:

- **Management Zones 1, 2, 4, 5 and 6** were in poor condition requiring regeneration based on Reconstruction Approach. Targets are outlined in **Tables 1 - 2.**.
- **Management Zone 3** was identified in moderate condition requiring regeneration based on a Facilitated approach. Targets are outline in **Tables 1 - 2.**.

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 - 2.**.

The Integrated Regeneration Approach will be used across the entire BMP Lands and the targets (**Tables 1 - 2**) have been designed to be measurable, providing both quantitative and qualitative data on species abundance and cover for the vegetation communities within the BMP Lands.

Weeds have a significant impact on structural integrity of vegetation communities. African Olive (*Olea europaea subsp. cuspidate*) was the only woody weed present, as both in juvenile and adult form. Various exotic grasses and herbs were present, primarily Black Nightshade (*Solanum nigrum*), Galenia (*Galenia pubescence*), Fire weed (*Senecio madagascariensis*), Pale Pidgeon *Grass (Setaria pumila),* Panic Veldt grass *(Ehrharta erecta),* Paspalum *(Paspalum dilatatum*) and Purple top (*Verbena bonariensis*).

Some of these species are identified as priority weeds (**Appendix A**) for the Hunter. These include priority weeds African Olive, Fire Weed and Galenia. Treatment of all other weeds will be a secondary measure.

To achieve Natural Regeneration throughout the entire BMP lands within five (5) years targets have been set within **Tables 1 - 2.**.

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	• 70% survival of each planted stratum. • 50% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 60% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 80% reduction in weeds from baseline data.	• 80% survival of each planted stratum. • 90% 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.	One or fewer strata present and no spatial patterning or trophic complexity relative to from baseline data.	More strata present but low spatial patterning and trophic complexity, relative to benchmark from baseline data.	Most strata present and some spatial pattering and trophic complexity relative to benchmark from baseline data.	All strata present. Spatial pattering evident and substantial trophic complexity developing, relative benchmark from baseline data.	All strata present and spatial pattering and trophic complexity high. Further complexity and spatial pattering able to naturally regenerate.
Ecosystem Function	Leaf litter	A 2% - 5% increase from baseline data.	A 5% - 15% increase from baseline data.	A 15% - 25% increase from baseline data.	A 25% - 35% increase from baseline data.	A 35% - 50% increase from baseline data.
	Ground habitat installed	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)
	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
	Observed fauna: • Native species • Pest species	• No increase of native fauna required from baseline data. • 5%-10% reduction in pest species from baseline data	• No increase of native fauna required from baseline data. • 10% -20% reduction in pest species from baseline data	• 5% -15% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	• 15% -25% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	• 25% - 50% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data

Table 2 – Regeneration Targets for Facilitated Approach

Attribute	Baseline Data	Tired Targets (base on Baseline Data)	Level 2	Level 3	Level 4	Level 5	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	**Tier 1 – Diversity good at baseline.** No supplementary planting or other works required.	• Diversity / cover Maintained or improved from baseline data. • 60% reduction in weeds from baseline data.	• Diversity / cover Maintained or improved from baseline data. • 80% reduction in weeds from baseline data.	• Diversity / cover Maintained or improved from baseline data. • 90% reduction in weeds from baseline data.	• Diversity / cover Maintained or improved from baseline data. • 95% reduction in weeds from baseline data.	Maintain or improve on Year 4 targets
		Tier 2 – Diversity moderate to low at baseline. Works required such as supplementary planting, possible thinning, etc required.	• 80% survival of each planted stratum. Noting this will increase diversity in where required. • Maintain diversity recorded at baseline data. • 60% reduction in weeds from baseline data.	• 80% survival of each planted stratum. Noting this will increase diversity in where required. • Maintain diversity recorded at baseline data. • 80% reduction in weeds from baseline data.	• 80% survival of each planted stratum. Noting this will increase diversity in where required. • Maintain diversity recorded at baseline data. • 90% reduction in weeds from baseline data.	• 80% survival of each planted stratum. Noting this will increase diversity in where required. • Maintain diversity recorded at baseline data. • 95% reduction in weeds from baseline data.	
Structural diversity	Record the native growth forms present: • Tree; • Shrub; • Grass / grass like; • Forb; • Fern; and • Other.	N/A	More strata present but low spatial patterning and trophic complexity, relative to benchmark from baseline data.	Most strata present and some spatial pattering and trophic complexity relative to benchmark from baseline data.	All strata present. Spatial pattering evident and substantial trophic complexity developing, relative benchmark from baseline data.	All strata present and spatial pattering and trophic complexity high. Further complexity and spatial pattering able to naturally regenerate.	
Ecosystem Function	Leaf litter	N/A	A 5% - 15% increase from baseline data.	A 15% - 25% increase from baseline data.	A 25% - 35% increase from baseline data.	A 35% - 50% increase from baseline data.	
	Ground habitat installed		No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	No decline in ground habitat (replace if removed or damaged)	
	Stem classes present		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	

Attribute	Baseline Data	Tired Targets (base on Baseline Data)	Level 2	Level 3	Level 4	Level 5	Level 5
Approximate Timeframe from Commencement	Commencement		Year 1	Year 2	Year 3	Year 4	Year 5
	Observed fauna: • Native species • Pest species		• No increase of native fauna required from baseline data. • 10% -20% reduction in pest species from baseline data	• 5% -15% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	• 15% -25% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	• 25% - 50% increase in observed native fauna from baseline data. • 5% -10% reduction in pest species from baseline data	

7.0 Wildlife Management Strategy

7.1 Fauna Management

Macropods and possums were observed onsite and in the surrounding area. Consequently, protective guards should be installed around plantings to safeguard revegetation efforts in BMP lands from browsing. Should monitoring within management zones identify significant interference by pest species — such as excessive feeding — management strategies will be reassessed to mitigate these impacts.

Incidental fauna records are to be undertaken during monitoring surveys and reported.

Throughout all works onsite, any required fauna handling is to consider and/or implement the following:

- Native terrestrial and aquatic fauna will be transported by an appropriate method to a suitable nearby, vegetated area or permanent waterway as determined by the Project Ecologist.
- If fauna species encountered are listed as threatened species, all work must cease and the Project Ecologist must consult with a Council Ecology representative and Department of Primary Industries (Fisheries Unit) to review procedures.
- Frog handling will be undertaken in accordance with the Hygiene Protocol for the Control of Disease in Frogs (Murray et al. 2011).
- Fish species identified as exotic are to be ethically euthanised by a suitable method as determined by the Project Ecologist, and pest species eggs encountered are to be disposed at a suitably licenced landfill.
- The tailout scour protection area will not utilise chemical weed control to ensure water quality is maintained (refer **Figure 3**).

7.2 Habitat Corridor

The riparian vegetation and installation of ground habitat throughout the BMP Lands will provide a wildlife corridor within the Subject Site. The design of the corridor focused on both terrestrial and aquatic species ensuring mobile fauna can move through the BMP lands, including fish. The design of the corridor and planting regime must be undertaken to ensure a functioning corridor.

The focus was to ensure, movement and canopy connection. The Squirrel Gliders was not detected within the Subject Site, however, has been detected within the LGA, BioNet indicates sightings within 2 km. AEP used the movement, foraging and nesting requirements of this species to determine densities, and species to ensure they will be able to move through the BMP lands. This design supports the movement and foraging for many other native species.

Below outlines the species requirements.

7.2.1 Squirrel Glider

Squirrel Gliders (*Petaurus norfolcensis*) are threatened small gliding marsupials that have distinctive membranes of skin, stretching between their front and hind legs, that enable them to glide with ease through the air.

7.2.2 Breeding and foraging habitat

The Squirrel Glider prefers wet and dry sclerophyll forests and woodlands. The most common vegetation area where they can be found are typically characterized by one or more species of ironbark eucalypts (Australian Museum, 2024).

Squirrel Gliders tend to occur within three broad habitat types; Dry sclerophyll forests and woodlands dominated by winter flowering eucalypts such as Spotted Gum (*E. maculata*), various Box Gums and Ironbarks (such as *E. crebra*), Swamp Mahogany or Red Gum (*E. tereticornis*); Dry sclerophyll forests with an understorey of gum-producing acacias; Dry sclerophyll forests and woodlands with understorey of winter and autumn flowering banksias, as well as spring and summer flowering eucalypts (A.P.Smith and M.Murray, 2003).

The facilitated regeneration of MZ3 using PCT 3433 and reconstruction of MZ1,2,4,5 and 6 using species from PCT 3433 and PCT 3975 will allow for a suitable wildlife corridor and provide habitat for this species.

Where planting constraints allow the planting of canopy trees, a minimum twenty (20) *Eucalyptus robusta* will be planted and maintained by the BRC for the life of the BMP, to establish food and gliding resources.

7.2.3 Gliding Requirements

Glide calculations - extract from Goldingay & Taylor, 2009, the glide angle on average is 28.5 degrees with horizontal distance varying based on launch height. With the average gap crossing being 1.8m times the height. Therefore, gliding distance is launch height x 1.8. The above recommendation of planting 20 *Eucalyptus Robusta* approximately 15m apart should allow for future movement of the species within the BMP Lands.

7.3 Other habitat features

The BMP proposes the installation of Overwintering Habitat Structures, the aim of these structures is to create areas of refuge outside of the inundated areas and to provide some form of overwintering habitat for fauna that require them, including insects, lizards, snakes and amphibians. The simplest construction of these types of refuges is the placement of rocks into a pile while a slightly more complex structure can involve digging a small hole approx. 0.5m in depth and up to 1m width, filling the hole with a jumble of bricks or rocks up to approx. 0.5m above ground level and then placing plant material, soil/clay and other natural material loosely over the top of the bricks or rocks. The aim being to create small spaces that are reasonably thermally stable that can be used to hibernate or seek refuge if threatened while commuting or foraging.

Rocks used in this process should be between approx. 150mm to 200mm in diameter and environmentally stable, meaning they will not affect the pH of the water.

At least one (1) of these structures should be placed in Zone 6 area as indicatively indicated in **Figure 3**.

7.4 Aquatic Fauna

7.4.1 Conservation and Habitat Restoration

Habitat for various aquatic fauna species includes semi-permanent/ephemeral wet areas and within 1km of swamps, waterbodies or wet areas. Potential habitat is present for Green and Golden Bell Frog (*Litoria aurea)* within the broader lot. However, two nights of nocturnal searches within the recommended survey period did not detect this species within the proposed impacted dams (*AEP, EAR 2023*). The creek realignment will include the creation of four (4) in-channel reservoirs within the low flow line. In addition, one (1) dispersion area and overwintering habitat structure will be installed in the south west of the BMP lands. Freshwater wetland in MZ5 will utilise vegetation species from PCT 3975 for regeneration plantings which is known to be associated with *L. aurea.* All these areas offer suitable habitat for numerous aquatic species potentially present within the locality as documented in historic Bionet records.

7.4.2 Breeding and Foraging Habitat

A large range of aquatic fauna species have been recorded in the locality within a number of habitat types including coastal swamps, marshes, dune swales, lagoons, lakes and other estuary wetlands, as well as around floodplain wetlands and slow flowing or non-perennial streams. Many of these species prefer foraging in areas that contain flowering plants, grasses and foliage. The vegetation may be near breeding sites or considerable distance away. Tussock forming plants provide ideal foraging habitat and shelter. Regenerated vegetation will aim to provide habitat for a range of aquatic fauna.

7.4.3 Hydrological Dispersion and Overwintering Habitat Structures Construction

Examples of aquatic habitat are provided within **Appendix D** and are provided to give examples, not to be strictly adhered to, with on-site conditions likely to determine exact shape and placement of potential permanent and/or ephemeral habitat.

7.4.4 Permanent and Refuge Aquatic Habitat

A permanently inundated freshwater wetland area will be established adjacent to the road to manage stormwater runoff, as depicted in **Figure 3**. This area, integral to water sustainable urban design and biodiversity management, will measure approximately 15 to 20 meters in diameter. It will feature a sloped or stepped design with a compacted clay base of 0.3 meters, overlaid with topsoil to support aquatic vegetation planting.

To enhance habitat and ecosystem balance refuge habitat is recommended to be installed in the form of large rocks and, where available, hollow logs strategically placed along the water's edge to provide sunning spots and refuges for wildlife. Note that rock placement will be selective rather than encompassing the entire perimeter.

7.5 Pest Species

Rabbits have been observed onsite. Therefore, protection guards should be placed around plantings so that revegetation efforts within BMP lands is 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.

8.0 Regeneration Management

8.1 Site Preparation

The schedule of works and timing has been outlined in **Table 3**. Prior to the commencement of regeneration, the BMP Lands must be prepared. The following works have been recommended to assist in site preparation:

- Establishment of pathogens and diseases controls. Diseases which could affect the site include Myrtle Rust (*Puccinia psidii*), affecting Myrtaceous plants, including Melaleuca species; and Amphibian Chytrid fungus disease, Chytridiomycosis, caused by Chytrid fungus (*Batrachochytrium dendrobatidis*). Appropriate hygiene controls are to be employed to minimise the chances of any such introduction occurring. This may include a hygiene station equipped with sterilizing agents and cleaning equipment to clean boots, tools and machinery. Response plans are needed to be designed and implemented to mitigate impacts in the event of disease or pathogen outbreaks;
- All extant rubbish/waste is to be removed from BMP lands including farm fencing and structures. The need to remove such material should be assessed on a case-by-case basis as in some instances the material is inert, for example, concrete, rocks and timber posts. This material may inadvertently provide geomorphic stability;
- Clearly mark native vegetation for retention and approved removal;
- Install temporary fence around the BMP Lands, and clearly mark as a “No Go Area” prior to commencement of civil works;
- Fencing should have clearly visible signage erected at key entry points to BMP (**Appendix E**).
- Implement erosion and sediment control measures in accordance with specifications set out in the latest edition of the Landcom publication “Soils and Constructions – Volume 1” (The Blue Book);
- Construction of the natural channel;
- Establish monitoring and photo points;
- Vegetation clearing;
- Determine baseline data;
- Primary weed removal;
- Installation of ground habitat;
- Planting of Vegetation (see **Appendix C** for a detailed species list). 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; and
- Mulching and watering.

8.2 Vegetation Clearing

For the clearing phase, retained vegetation will be delineated by safety bunting flags, fencing and signage indicating environmental protection zone, which will still allow fauna to egress the development area as needed. Following the completion of clearing works, permanent delineation features such as logs should be installed to protect the retained vegetation during operational phase of the development;

- Vegetation clearing should be timed to avoid cold weather periods where overnight temperatures are forecast to be less than 12°C. Cold weather is likely to make it difficult for resident hollow dependent fauna to successfully relocate. This is particularly relevant for low body-weight species;
- A staged approach to clearing is to be undertaken to provide fauna the opportunity to disperse outside the area of impact. Staging to include Phase 1 Clearing: Underscrubbing, Phase 2 Clearing: Removal of non-habitat trees, and Phase 3 Clearing: Removal of habitat and connecting trees;
- All clearing works to be undertaken under the supervision of the Project Ecologist;
- Clearing should occur in a direction from previously disturbed lands towards retained lands;
- Implement clearing protocols, including pre-clearance surveys to identify habitat and vegetation to be retained;
- All clearing works to be attended by a suitable equipped and experienced ecologist to deal appropriately with any displaced fauna species;
- Any fauna rescued during vegetation clearing is to be assessed for injuries, and subsequently released to a suitable nearby location; this may require holding fauna until dusk for release in accordance with relevant animal ethics licencing and standards;
- If any fauna is injured during vegetation clearing, they are to be taken promptly to a nearby veterinarian or suitable wildlife carer contact;
- In addition, prior to clearing of any vegetation, an ecologist is to inspect the area for any signs of resident fauna requiring attention, and in particular nesting birds. Where such is identified, appropriate strategies are to be developed and instigated to minimise impacts.
- Pre-clearance surveys to include diurnal surveys, stagwatching and nocturnal surveys;
- Civil Construction staff to be inducted into pre-clearing and clearing protocols, and to identify environmental features for protection;
- Suitable logs from felled trees are to be emplaced along the cleared/retained boundary to create a physical barrier between Subject Site and the retained lands;
- All cleared vegetation is to be mulched on site and spread to help stabilise any exposed soil and minimise offsite movement of biomass. Fallen timber and hollow logs identified to be retained to be relocated into the retained lands.

8.3 Weed Management

Weed control works within each Management Zone are to be undertaken by a qualified bushland regeneration team using industry standards (summary provided in **Table 3**).

Any reproductive material of weeds, including weeds that can spread vegetatively or seeds, must be taken off site to be disposed of at an appropriate local waste collection service. No weed material with the potential of spreading may be stockpiled within the Subject Site, or the BMP Lands.

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 actions for these measures may be required. Weed control is required to occur in the following sequence:

1. **Primary Weeding** – Initial period of weeding within Management Zones.
2. **Consolidation** – After initial weeding, weed control zones will need monthly monitoring to remove regenerating weeds and those stimulated by disturbance, which compete with planted and regenerating native plants. Regular visits are crucial to prevent

weed recolonization, dominance, and inhibition of native species regeneration.

3. **Maintenance Weeding** – After six months, monthly maintenance will continue due to issues with woody weeds and other annual weeds in the area.

This interval will be evaluated based on-site condition during each monitoring period. Weed control works across the site are to be undertaken over the maintenance period of 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 results indicating management zones have reached targets set out in this BMP.

Establishment of monitoring point and compliance checking of other aspects within this rehabilitation plan will be the responsibility of the Project Ecologist working with the Civil Contractor.

The client will be responsible for the engagement of a suitably qualified Bush Regeneration Contractor to undertake weed control and planting works outlined in this rehabilitation plan (Table 3). The Project Ecologist will be responsible for the establishment of monitoring points within the BMP along with collection of baseline data that will be monitored against this over the five-year period of this rehabilitation plan with the overall targets. The Project Ecologist will be responsible for monitoring and reporting on weed management, and Regeneration Approach success.

Table 3 – Weed Control Activities

Activity	Minimum Requirement
Pre-works	Undertake baseline surveys to identify priority weeds present on site to be the focus of weed management activities. Priority weeds based on listings under the *Biosecurity Act 2015*, and notably problematic weeds on site have been identified, and listed in **Section 6.0**.
Primary Works	Effectively control priority species and areas through appropriate methods to eliminate highly competitive weeds from an area. Include high disturbance activities that could negatively impact later regeneration such as high-volume herbicide application, and physical removal of large trees which would pose safety hazards to the public or others if left to perish *in-situ*.
Secondary Works	Treat any regrowth from primary weed control and expand on control measures by targeting Priority species and expanding the primary control boundaries where desirable. Thin retained weeds to increase light penetration where appropriate. Generally, expand on and solidify primary work.
Maintenance Works	Maintain exclusion of weeds controlled during Primary and Secondary works. Prevent reinfestation of weeds progressively, and others as time permits.
Woody Trees & Shrubs	Where appropriate, remove trees via mechanical means (i.e., chainsaw or handsaw) and apply chemical to the cut stump. Material may be retained on-Site or disposed of appropriately off-Site. Retained material should be situated to provide additional ground habitat and slope stability but should not be left in such a way that would hamper natural regeneration or existing native plants. Care should be taken with species which have the capacity to regrow vegetatively such as *Erythrina x sykesii* (Coral Tree). Alternatively, trees and shrubs may be treated via frill or drill application of herbicide and left to perish *in-situ* as habitat.
Woody Thickets	Treat via cut or scrape and paint or high-concentration low-volume foliar herbicide control (i.e., splatter application). Material may be left *in-situ* (particularly after spraying) or broken up and rafted off the ground to perish (taking care to remove from expected high flow areas of the dam). Do not manually remove root stock in a manner that will encourage soil instability or erosion. Once dead, standing material may be broken down and left on the ground as mulch. Mechanical removal (i.e., brush cutter equipped with mulching blade or similar) may be used where practical and regrowth treated with foliar application of herbicide.
Vines and Creepers	Skirt from trees and vegetation to prevent smothering and leave material to perish *in-situ*. Cut or scrape and paint stems or runners. Foliar herbicide control where appropriate. Do not unduly expose soil via manual removal of plants where they may be providing soil stabilisation. Isolated manual removal as appropriate.
Ground Cover	Retain exotic species where they are providing ground stabilisation or habitat until such time as they hinder native species establishment or are no longer necessary. Relevant examples include retaining *Tradescantia fluminensis* (Trad) along drainage lines where removal would expose bare soil to erosion. Weed control is to focus on the patch removal of such weeds from around native regeneration or planting, with progressive removal of larger patches over time.
Retention of forage/habitat	Retain trees and shrubs that have evidence of occupation i.e., bird nest/possum dreys, until such time as other suitable habitat is available or the nest is abandoned. Retain manageable clumps of vegetation that can be easily removed at a later date for intermediate food and habitat supply within the semi-cleared and disturbed landscape, which will emerge between weed control and establishment of native plants.
	These retained features can be removed as they become redundant at the discretion of the Bush Regeneration Contractor (BRC).

9.0 Project Management

Establishment of monitoring points and compliance checking of other aspects within this BMP will be the responsibility of the Project Ecologist working with the Civil Contractor.

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

Bush Regenerator(s) or company(s) shall have the following qualifications:

- Australian Association of Bush Regenerators (AABR) Accreditation. The Bush Regenerators shall hold a current AQF3 qualification.
- Site Supervisor must have demonstrated minimum of 2 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.
- 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.

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 against this over the three-year period of this BMP with the overall targets. The Project Ecologist will be responsible for monitoring and reporting on weed management, and Regeneration Approach success.

9.1 Monitoring

Monitoring will occur at commencement and biannual basis at monitoring points

9.1.1 Baseline Data

Baseline data is collected at commencement of the BMP refer.

Indicative monitoring points have been identified within the BMP Lands (refer **Figure 3)**. The final location of the monitoring points is to be determined when commencing works, as environmental conditions change over time and the indicative locations may not be reflective of the communities at the time of commencement.

Baseline data will cover:

- Species diversity (both native and exotic);
- Species Abundance (both native and exotic);
- Overall health of the BMP Lands;
- Photos in north, east, south and west aspects; and
- Record incidental fauna.
- Presence/absence of Survey for exotic Mosquito Fish (*Gambusia affinis)* within pond and pools using the dip netting technique

The Monitoring Points established for the baseline surveys will then be monitored on a biannual basis, as per **8.1 Monitoring**.

9.1.2 Biannual Monitoring

The following tasks are scheduled every six (6) months from the start, continuing for up to three years or until the targets are achieved, whichever comes later:

- Weed species, coverage and location;
- Native species, coverage and location;
- Effectiveness of weed control methods;
- Photo records at monitoring points at each aspect (north, east, south, west);
- General health of each Management Zone
- Survey for Gambusia within Ponds using the dip netting technique
- Incidental fauna use of site; and
- Evaluation of management effectiveness.

9.2 Reporting

A baseline report is prepared at the beginning of the BMP and submitted to Council. Subsequently, annual status reports are to be prepared and submitted to the consent authority throughout the duration of the BMP. A final report will be prepared at the conclusion of the BMP, detailing the fulfillment of BMP conditions.

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

As part of adaptive management, the reports will include evaluations and recommendations relating to all areas covered in the monitoring schedule and address any other problems or deficiencies found during monitoring. If required, the report should also outline any changes that are required to planned works to ensure better ecological outcomes.

Regeneration of the BMP Lands will occur over a period of five (5) years or until the Year five (5) overall targets are achieved. Once the targets are met, the BMP lands will transition to a state of natural regeneration. Management of the site thereafter will adhere to the requirements of the *Biosecurity Act 2015* and *Biosecurity Regulations 2017*.

9.2.1 Future Management Actions

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 for an immediate and concise action plan is generated to ensure targets can be achieved.

Table 4 – Intervention: Handling Unexpected Outcomes

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					

Table 5 – 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
VMP Lands Preparation	Installation / removal of temporary 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 VMP																			
	Installation / removal of sediment and erosion control	Installed at the beginning of Year 1 and monitored throughout the duration of the VMP																			
	Realignment of watercourse and construction of ponds and hibernacula																				
	Relocation of logs to BMP Lands																				
Weed control	Primary weeding all MZs (Monthly)																				
	Consolidation (Secondary and Tertiary) weeding (Monthly)																				
	Maintenance Weeding (to be adjusting according to findings from monitoring)																				
Revegetation	Buffer Planting along VMP Lands boundary (MZ4)																				
	Initial canopy planting (MZ4)																				
	Consolidation and replacement planting (All zones)																				
	Direct Seeding of groundcovers (if required). (MZ1,2,4,5 and 6)																				
	Shrub (MZ2,3,4,6) and grasses, macrophytes (MZ1,5) planting																				
	Replacement of dead plants if required																				
Project Management	Set up Monitoring Plots and collect baseline data																				
	Survey for Gambusia within Ponds (dip netting)																				
	Vegetation Cover, Dispersion Area and Hibernacula monitoring (Spring and autumn)																				
	Reporting (to be submitted to MCC within a month of second bi-annual monitoring event)																				**Final**

10.0 References

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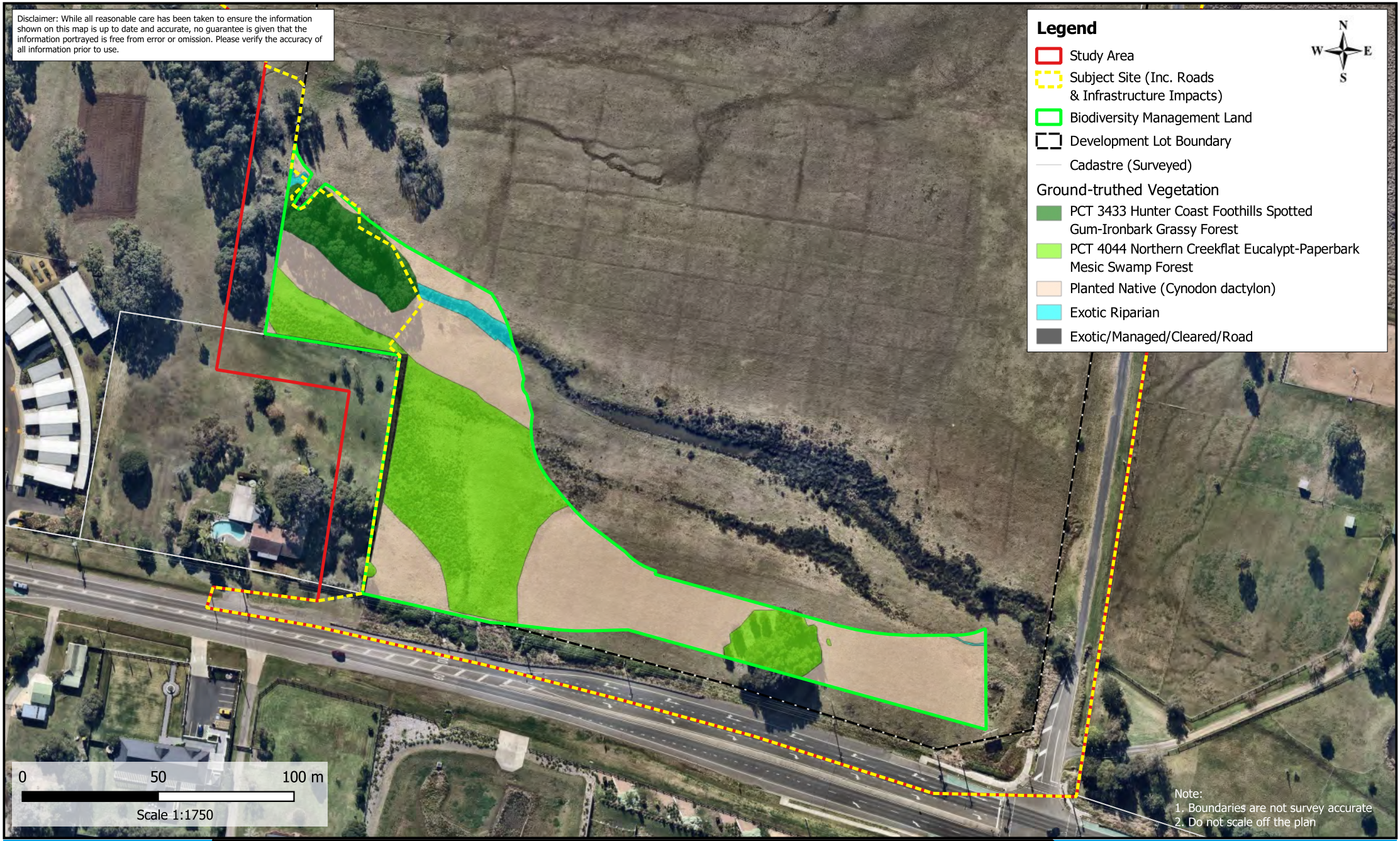
Figure 1 - Site Map

Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd
C/- ADW Johnson Pty Ltd

AEP ref: 2699.04
BOAMS: 00048759



AEP

Figure 2 - Ground-truthed Vegetation — Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd — AEP ref: 2699.04
C/- ADW Johnson Pty Ltd — BOAMS: 00048759

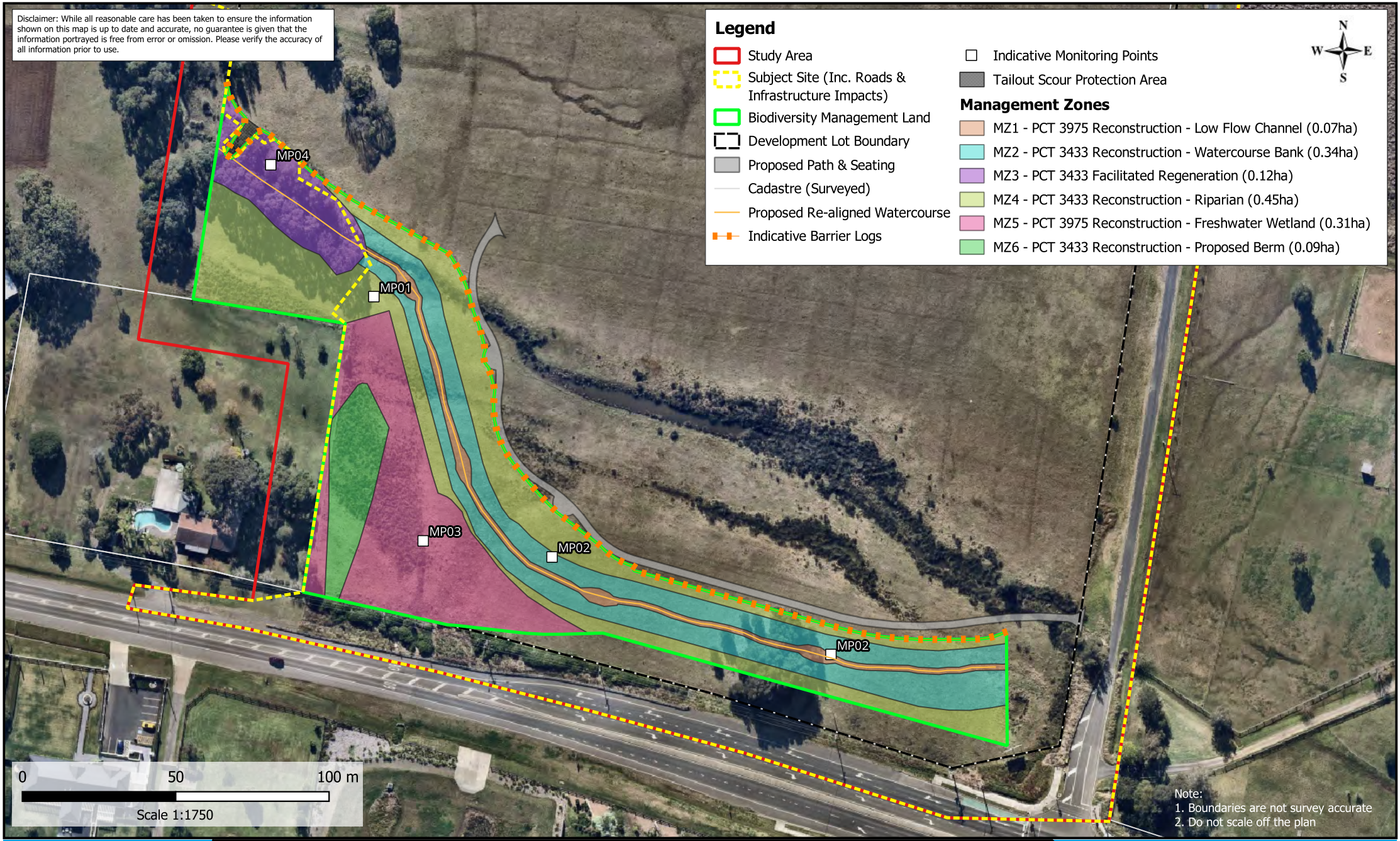


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Figure 3 - Management Zones & Monitoring Points Date: July 2024

Location: 898 New England Hwy, 25 & 39 Wyndella Rd, Lochinvar NSW

Client: Lochinvar Developments Pty Ltd AEP ref: 2699.04
C/- ADW Johnson Pty Ltd BOAMS: 00048759

Appendix A – Flora and Priority Weeds within BMP lands

Family Name	Scientific Name	Common Name	Priority weed under Biosecurity Act 2015 Hunter Regional Strategic Weeds Management Plan
Aizoaceae	***Galenia pubescens****	**Galenia**	**Regional Priority - Containment**
Apiaceae	*Foeniculum vulgare**	Fennel	General Biosecurity Duty
Apiaceae	*Centella asiatica*	Swamp Pennywort	
Apiaceae	*Cyclospermum leptophyllum**	Slender Celery	General Biosecurity Duty
Apocynaceae	*Parsonsia straminea*	Common Silkpod	
Apocynaceae	*Araujia sericifera**	Mothvine	General Biosecurity Duty
Apocynaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush	General Biosecurity Duty
Asteraceae	*Bidens pilosa**	Cobbler's Pegs	General Biosecurity Duty
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane	General Biosecurity Duty
Asteraceae	*Oncosiphon piluliferum**		General Biosecurity Duty
Asteraceae	*Onopordum acanthium subsp. Acanthium**	Scotch Thistle	General Biosecurity Duty
Asteraceae	*Silybum marianum**	Variegated Thistle	General Biosecurity Duty
Asteraceae	*Hypochaeris radicata**	Flatweed	General Biosecurity Duty
Asteraceae	*Senecio madagascariensis**	Fireweed	General Biosecurity Duty
Casuarinaceae	*Casuarina glauca*	Swamp Oak	
Convolvulaceae	*Dichondra repens*	Kidney Weed	
Cyperaceae	*Baumea juncea*		
Cyperaceae	*Cyperus sesquiflorus**		General Biosecurity Duty
Cyperaceae	*Cyperus spp.*		
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-rush	
Cyperaceae	*Carex appressa*	Tall Sedge	
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge	General Biosecurity Duty
Fabaceae	*Trifolium repens**	White Clover	General Biosecurity Duty
Gentianaceae	*Centaurium erythraea**	Common Centaury	General Biosecurity Duty
Juncaceae	***Juncus acutus****		**Regional Priority - Asset Protection**
Juncaceae	*Juncus cognatus**		General Biosecurity Duty
Juncaceae	*Juncus usitatus*	Common Rush	
Lobeliaceae	*Lobelia purpurascens*	Whiteroot	
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	General Biosecurity Duty
Myrtaceae	*Eucalyptus punctata*	Grey Gum	
Myrtaceae	*Eucalyptus spp.*		
Myrtaceae	*Corymbia maculata*	Spotted Gum	

Family Name	Scientific Name	Common Name	Priority weed under Biosecurity Act 2015 Hunter Regional Strategic Weeds Management Plan
Myrtaceae	*Eucalyptus microcorys*	Tallowwood	
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	
Myrtaceae	*Melaleuca bracteata*	Black Tea-tree	
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark	
Oleaceae	***Olea europaea subsp. cuspidata****	**African Olive**	**Regional Priority - Containment**
Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water Primrose	
Phormiaceae	*Dianella caerulea*	Blue Flax-lily	
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	
Plantaginaceae	*Plantago lanceolata**	Ribwort	
Poaceae	*Cynodon spp.**		General Biosecurity Duty
Poaceae	*Setaria pumila**	Pale Pigeon Grass	General Biosecurity Duty
Poaceae	*Paspalum dilatatum**	Paspalum	General Biosecurity Duty
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass	General Biosecurity Duty
Poaceae	*Andropogon virginicus**	Whisky Grass	General Biosecurity Duty
Poaceae	*Austrostipa ramosissima*	Stout Bamboo Grass	
Poaceae	*Bothriochloa macra*	Red Grass	
Poaceae	*Briza maxima**	Quaking Grass	
Poaceae	*Briza minor**	Shivery Grass	
Poaceae	*Briza subaristata**		
Poaceae	*Chloris gayana**	Rhodes Grass	
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	
Poaceae	*Rytidosperma pallidum*	Silvertop Wallaby Grass	
Poaceae	*Megathyrsus maximus**	Guinea Grass	General Biosecurity Duty
Poaceae	*Bromus spp.**	A Brome	General Biosecurity Duty
Poaceae	*Poa spp.**		General Biosecurity Duty
Poaceae	*Ehrharta erecta**	Panic Veldtgrass	General Biosecurity Duty
Poaceae	*Sporobolus elongatus*	Slender Rat's Tail Grass	
Poaceae	*Lachnagrostis aemula*	Blown Grass	
Poaceae	*Themeda triandra*	Kangaroo Grass	
Poaceae	*Lolium rigidum**	Wimmera Ryegrass	General Biosecurity Duty

Family Name	Scientific Name	Common Name	Priority weed under Biosecurity Act 2015 Hunter Regional Strategic Weeds Management Plan
Polygonaceae	*Rumex brownii*	Swamp Dock	
Polygonaceae	*Persicaria spp.**	Knotweed	General Biosecurity Duty
Primulaceae	*Lysimachia arvensis var. caerulea**	Blue Pimpernel	General Biosecurity Duty
Proteaceae	*Hakea bakeriana*		
Pteridaceae	*Cheilanthes sieberi*	Rock Fern	
Ranunculaceae	*Ranunculus inundatus*	River Buttercup	
Restionaceae	*Empodisma minus*	Spreading Rope-rush	
Solanaceae	*Solanum nigrum**	Black Nightshade, Black-berry Nightshade	General Biosecurity Duty
Solanaceae	*Solanum seaforthianum**	Climbing Nightshade	General Biosecurity Duty
Verbenaceae	*Verbena bonariensis**	Purpletop	General Biosecurity Duty

Appendix B – Regeneration Species List

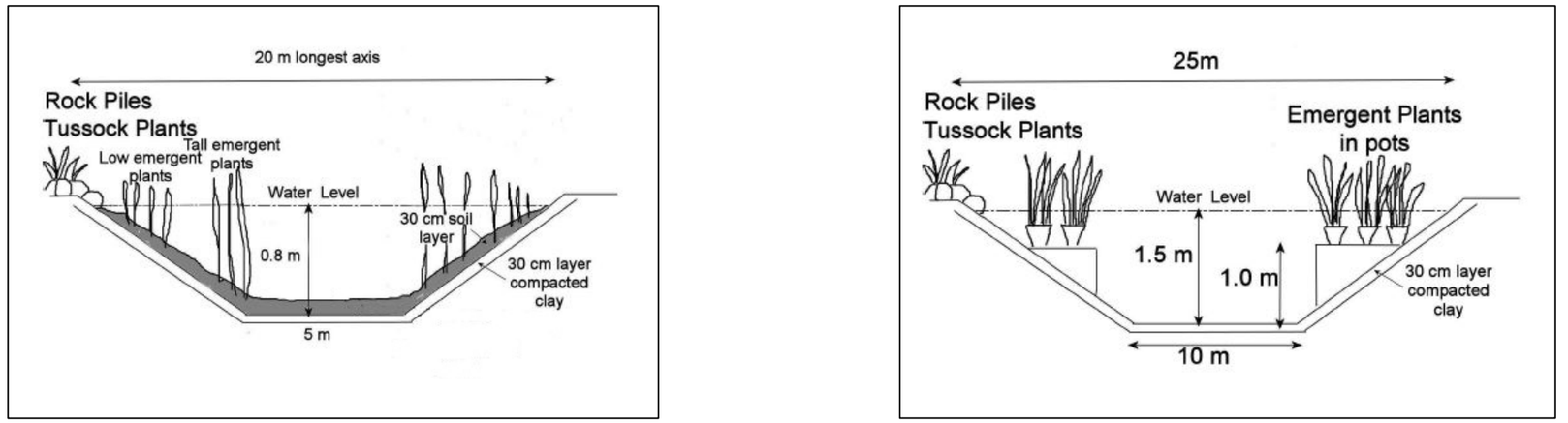
Species List – Approximate densities and species for regeneration.

It should be noted that not all the listed species below are easily obtainable, substitutions to be made on the advice of bush regeneration contractor or Project Ecologist.

Canopy	Density	Shrubs	Density	Ground Cover	Density
Management Zone 1 and 5 – PCT 3975					
Not Applicable in this Management Zone	N/A	Not Applicable in this Management Zone	N/A	*Paspalum distichum*	6 to 8 /1m^2
				Typha orientalis	
				Eleocharis sphacelata	
				Juncus polyanthemus	
				Bolboschoenus caldwellii	
				Juncus usitatus	
				Carex appressa	
				Phragmites australis	
				Eleocharis acuta	
				Juncus gregiflorus	
				Persicaria decipiens	
				Cycnogeton microtuberosum	
				Ludwigia peploides subsp. Montevidensis	
				Alisma plantago-aquatica	
				Cycnogeton procerum	
Management Zone 2, 3, 4 and 6 - PCT 3433					
Eucalyptus punctata	1/20 m^2	*Bursaria spinosa*	1/10m^2	*Paspalidium distans*	5/m^2 or Direct Seeding
Eucalyptus umbra		*Persoonia linearis*		*Aristida vagans*	
Eucalyptus globoidea		*Leptospermum polygalifolium*		*Microlaena stipoides*	
Corymbia maculata		*Melaleuca nodosa*		*Themeda triandra*	
Eucalyptus fibrosa		*Acacia ulicifolia*		*Cymbopogon refractus*	
		Leucopogon juniperinus		*Lomandra confertifolia*	
		Breynia oblongifolia		*Entolasia stricta*	
		Dillwynia retorta		*Lepidosperma laterale*	
		Callistemon linearis		*Dichelachne micrantha*	
		Melaleuca styphelioides		*Echinopogon caespitosus*	
		Polyscias sambucifolia		*Fimbristylis dichotoma*	
		Pultenaea villosa		*Juncus usitatus*	
		Melaleuca decora		*Lomandra longifolia*	
				Panicum simile	
				Commelina cyanea	

Canopy	Density	Shrubs	Density	Ground Cover	Density
				Dianella revoluta	
				Pomax umbellata	
				Dianella caerulea	
				Poa labillardierei var. labillardierei	
				Entolasia marginata	

Appendix C – Aquatic Habitat and Hibernacula Examples



Example Pond designs - Breeding ponds to the left, Refuge ponds on the right (Ecological, Arncliffe Habitat Creation Plan).

Example Pond designs - Breeding ponds to the left, Refuge ponds on the right (Ecological, Arncliffe Habitat Creation Plan).

Example of a hibernacula made from bricks and wood and grass material (AggNet – Brickworth, UK)

Appendix D – 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 E – CVs

Staff	Title/Qualification	Tasks
Natalie Black	Senior Environmental Manager BSc (Hons), Master Planning, Cert IV (TA) BAAS: 19076	Report review
Emma O'Dwyer	Ecologist BEnvSc. Hons EnvSc	Field surveys and report
Bryce Dedal	Ecologist BEnvSc. Cert IV CLM	Report
Alissa Rogers	Ecologist BParkMgt. Cert IV CLM	Report and mapping
Angela Metcalfe	Ecologist / Spatial Analyst BEnvSc. Hons (Earth Science) GradCert GeospSc (completion in 2025)	Report and mapping amendments following client feedback and changes in development plans

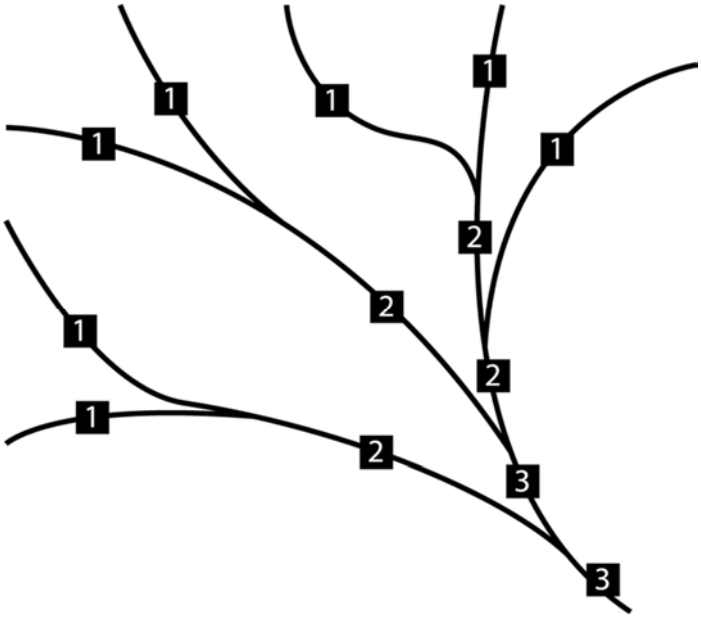
Appendix C – Glossary of Terms

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

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

	• has an erosional gully wall scarp, or clear erosional cut. • some exceptions, such as the expanding, shrink-swell, cracking clays (i.e. Vertosols† and friable Black Dermosols, or 'blacksoil', and 'reactive clays') that may have convex walls and a head 'ramp' need considering for evidence of other active erosion present in these cases, e.g. piping, tunnels or slumping; • has the head (head scarp, head wall), or heads, marking the upstream boundary of concentrated water flow and sediment transport between definable banks; f. has a cross-sectional shape (U-shaped, V-shaped, trapezoidal, slot, or tiered‡) that is permanently recognizable without flow; g. has a straight bed long-profile, rather than a curved one (of stream channels); h. has a dominant proportion of a 'hard margin' (a comparatively sharp break of slope from the unbroken land surface to the incisional feature, that represents a gully head scarp and wall scarp of active erosion, commonly referred to as a rim, edge or scarp), active or otherwise, or equivalent; i. has active erosional walls of at least moderately steep gradient (~ 30o; ~ 60 %), and gully walls are dominantly bare soil materials; j. are autonomous – having the active sediment source predominantly within the gully (a clear autocthonous, or 'internal', erosional zone); k. may have land upslope of the head, or beyond, that may be a drainage depression (swale), or marshland in keeping with the incisional caveats above; l. k. is typically driven by proximal ephemeral flows (i.e. associated with rainfall directly in the gully and in the gully catchment).
Headwater	Source of a river of stream.
High Bank	The upper most extent of the bank.
Inside Bend	Inside bank of a meander subject to deposition from slow flow.
Instream Habitat	Any area occupied, or periodically or occasionally occupied, by fish or marine vegetation (or both), and includes any biotic or abiotic component.
Lake	(a) a wetland, a lagoon, a saltmarsh and any collection of still water, whether perennial or intermittent and whether natural or artificial, and (b) any water declared by the regulations to be a lake, whether or not it also forms part of a river or estuary, but does not include any water declared by the regulations not to be a lake.
Land	includes any water source, and also includes the land on or in which any water source is situated.
Levee	Raised elongate asymmetrical ridge that borders the channel. Composed almost entirely of suspended load sediments (dominantly silt, often sandy).
Meander	The winding of a stream channel, usually in an erodible alluvial valley. A series of sine-generated curves characterized by curved flow and alternating banks and shoals.
Outside Bend	Outside bank of a meander subject to erosion from high flow.
Overland Flow	4A Meaning of "overland flow water" (1) In this Act, overland flow water means water (including floodwater, rainfall run-off and urban stormwater) that is flowing over or lying on the ground as a result of— (a) rain or any other kinds of precipitation, or (b) rising to the surface from underground, or (c) any other process or action of a kind prescribed by the regulations.

	(2) Water is flowing over the ground for the purposes of subsection (1) even if it flows over the ground by means of artificial structures such as roads, canals or road gutters. (3) However, subsection (1) does not include— (a) water that is collected from a roof (including water collected from a roof using a rainwater tank), or (b) water that is flowing over or lying on the bed of a river, lake or estuary, or (c) water flowing over or lying on the ground in such circumstances as may be prescribed by the regulations.
Oxbow	An abandoned meander in a river or stream, caused by cutoff. Used to describe the U-shaped bend in the river or the land within such a bend of a river.
Pools	A reach of a stream that is characterized by deep, low-velocity water and a smooth surface.
Riffles	Topographic highs along an undulating reach-scale longitudinal profile.
Rip Rap	Run of quarry rock placed over a bedding layer of cobbles used to stabilise and rehabilitate disturbed areas including topsoil, revegetation and regeneration. Must be able to withstand the velocities of runoff or discharge from site.
Riparian Corridor	A riparian corridor (RC) forms a transition zone between the land, also known as the terrestrial environment, and the river or watercourse (aquatic environment). Riparian corridors perform a range of important environmental functions
Riparian Vegetation	The plants growing on the water's edge, the banks of rivers and creeks and along the edges of wetlands
River	As defined in the Dictionary of the *Water Management Act, 2000:* (a) any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and (b) any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and (c) anything declared by the regulations to be a river, whether or not it also forms part of a lake or estuary, but does not include anything declared by the regulations not to be a river.
Bar	Deposited sediment accumulation from altered in-stream flow due to variation in channel geomorphology.
Segment ID	Assigned segment identification number to potential watercourse.
Snag	Term used to describe 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.
Study Area	The Study Area comprises applicable land, any mapped hydrolines that occur within that land, any mapped upstream tributaries, and waterfront land associated with the mapped hydrolines.
Subject Site	The Subject Site comprises the mapped hydrolines and associated waterfront land that occurs within the applicable land boundary.
Survey Point	The location of a watercourse assessment with the Waterfront Land Tool.
The Strahler System	As defined in *Schedule 2* - Water Management (General) Regulation 2018: The method of determining the stream order of a watercourse shown on a topographic map is the Strahler system. The Strahler system is as follows—

	(a) Any watercourse that has no other watercourses flowing into it is classed as a first order stream. (b) If 2 streams join, the resulting stream is— (i) the same order as the highest order of the 2 streams, or (ii) if the 2 streams are of the same order, the order greater than that of the 2 streams. For example, in the diagram below— (a) If 2 first order streams join, the stream becomes a second order stream (2). (b) If a second order stream is joined by a first order stream, it remains a second order stream. (c) If 2 second order streams join they form a third order stream (3). (d) If a third order stream is joined by a first or second order stream, it remains a third order stream. (e) If 2 third order streams join they form a fourth order stream. 
Vegetated Riparian Zone	The required width of the VRZ measured from the top of the high bank on each side of the watercourse.
Vegetation Management Plan	Details how the restoration or rehabilitation of the riparian corridor will be carried out. The main objective of a VMP is to provide a stable watercourse and riparian corridor which will emulate local native vegetation communities.
Water Source	means the whole or any part of— (a) one or more rivers, lakes or estuaries, or (b) one or more places where water occurs on or below the surface of the ground (including overland flow water flowing over or lying there for the time being), and includes the coastal waters of the State.
Waterfront Land	Land within 40m of a river, stream, creek, wetlands, estuary
Waterfront Land	As defined in the Dictionary of the *Water Management Act 2000*: (a) the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river, or

	(a1) the bed of any lake, together with any land lying between the bed of the lake and a line drawn parallel to, and the prescribed distance inland of, the shore of the lake, or (a2) the bed of any estuary, together with any land lying between the bed of the estuary and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the estuary, or (b) if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters, where the prescribed distance is 40 metres or (if the regulations prescribe a lesser distance, either generally or in relation to a particular location or class of locations) that lesser distance. Land that falls into 2 or more of the categories referred to in paragraphs (a), (a1) and (a2) may be waterfront land by virtue of any of the paragraphs relevant to that land.
Waterfront Land Maps	CAA exemptions can only apply within certain waterfront land shown in maps that include shaded areas such as: • Botany Bay and Georges River area, • Brisbane Water area, • Hunter River area, • Lake Macquarie area, • Lake Mulwala area, • Port Hacking area, • Port Jackson (Sydney Harbour) area, • Port Stephens area, • Tuggerah Lakes area, and, • Wallis Lakes area These can be found within the WFLT.
WaterNSW	WaterNSW is a State-Owned Corporation established under the *Water NSW Act 2014* and operates under an Operating Licence.
Western Land Map	NRAR Map – Western land map within the WFLT that includes shaded local government areas in inland NSW areas.
Wetlands	Includes marshes, mangroves, swamps, or other areas that form a shallow body of water when inundated intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities.
Woody Debris	Consists of large masses of trees or shrubs that have fallen or been washed into rivers and streams, and onto floodplains. Once instream, they become waterlogged and rest in the streambed providing both habitat and refuges for aquatic fauna

Appendix D – Waterfront Land eTool

From: Google Forms
To: Brendon Young
Subject: Waterfront land e-tool
Date: Friday, 12 July 2024 2:58:56 PM

Google Forms

Thanks for filling in Waterfront land e-tool

Here's what was received.

Edit response

Waterfront land e-tool

Version 1 - 2020

Email *

brendon@andersonep.com.au

Is this the right e-tool for me?

This waterfront land e-tool has been developed to help controlled activity applicants and consultants determine if a controlled activity approval is required under the provisions of the Water Management Act 2000. The tool can be used to help identify:

• if there is waterfront land
• the location of top of bank of the waterfront land and
• if an exemption applies for works within certain mapped areas under clause 36 of Schedule 4 of the
Regulation

The e-tool is recommended for use by people who are familiar with environmental assessment and suitably qualified consultants. Members of the general public who are planning works near waterfront land should seek professional advice.

The e-tool must be completed separately for each individual mapped or visible watercourse on, or near, your property. If you have multiple

properties or multiple watercourses on or near your property, submit your response for the first assessment and then re-start the tool from the beginning to assess another watercourse or property. This will ensure each property and watercourse receives its own separate emailed result outcome that you can keep as a record.

Using the tool

Some of the questions in this e-tool can be answered using materials online. Depending on your circumstances, you may also need to the visit the site of the proposed work in person to gather supporting evidence.

There is a PDF version of the tool available that you can download and take into the field at: https://water.nsw.gov.au/__data/assets/pdf_file/0009/367272/waterfront-land-tool.pdf

The e-tool must be completed separately for each individual mapped or visible watercourse on the property. Each watercourse assessed with the e-tool will then receive a separate emailed result outcome.

Stopping and returning

You can choose to exit the tool at certain questions where field work is recommended. You will be asked if you wish to exit, and, if you agree, be emailed a link that you can use to return to the tool later to complete the rest of the questions.

If you close the tool anywhere else - without completing it and clicking the 'Submit' button - your data will not be retained. Please ensure you only close the tool when prompted if you wish to retain your answers.

Supporting evidence

When you complete the tool, you will receive email confirmation containing your answers, which you must keep as a record of your decision-making. You must also keep all reference material and information used–including maps, photos and observations to answer the tool questions. You will be prompted throughout the tool about what information to keep.

NSW Department of Climate Change, Energy, the Environment and Water may request copies of the Waterfront land tool answers and supporting documents from landholders where works are carried out without a controlled activity approval under the Water Management Act 2000.

The Waterfront land e-tool will store your email address so you can be emailed a record of your answers on completion. It will also record your answers but it will not identify your location or any other personal details. If you do not wish to supply your email address, please use the hard copy version of the tool at:
https://water.nsw.gov.au/__data/assets/pdf_file/0009/367272/waterfront-land-tool.pdf

More information

• about this e-tool, contact NSW Department of Climate Change, Energy, the Environment and

Water via email:
waterlicensing.servicedesk@dpie.nsw.gov.au
• about controlled activity approvals, visit
https://water.dpie.nsw.gov.au/licensing-and-trade/controlled-activity-approvals

Disclaimer

• This tool is intended for guidance purposes only and cannot be used as evidence of compliance with the Water Management Act 2000.
• Users of this tool will be responsible for making their own assessment of the material and should verify all relevant representations, statements and information with their own professional advisers.
• This tool only applies controlled activities on waterfront land—it does not apply to water access licences or water supply work and/or water use approvals.
• This is not an approval to undertake work on waterfront land and you will still need to obtain relevant approvals as required under the Water Management Act 2000 (WM Act).
• The use of this tool does not remove the obligation to obtain approval under any other relevant legislation.
• Users should also refer to the disclaimer on the department's website at:
https://www.industry.nsw.gov.au/disclaimer

Description or Reference

Please enter a description or reference number below for the property or watercourse you are going to assess. This will allow you to easily identify this assessment from any other assessments you undertake using the tool. *

2699 Lochinvar

Question 1 - Department of Planning and Environment—Water waterfront land maps

After answering the question, click next at the bottom of the screen.

Is your property located on a watercourse, lake or estuary within the area marked in orange in any of the Department of Planning and Environment—Water waterfront land maps below? *

- ◯ Yes, Botany Bay

- ○ Yes, Brisbane Water
- ○ Yes, Hunter River
- ○ Yes, Lake Macquarie
- ○ Yes, Lake Mulwala
- ○ Yes, Port Hacking
- ○ Yes, Port Jackson
- ○ Yes, Port Stephens
- ○ Yes, Tuggerah Lakes
- ○ Yes, Wallis Lakes
- ◉ No, none of the above

Using the maps below

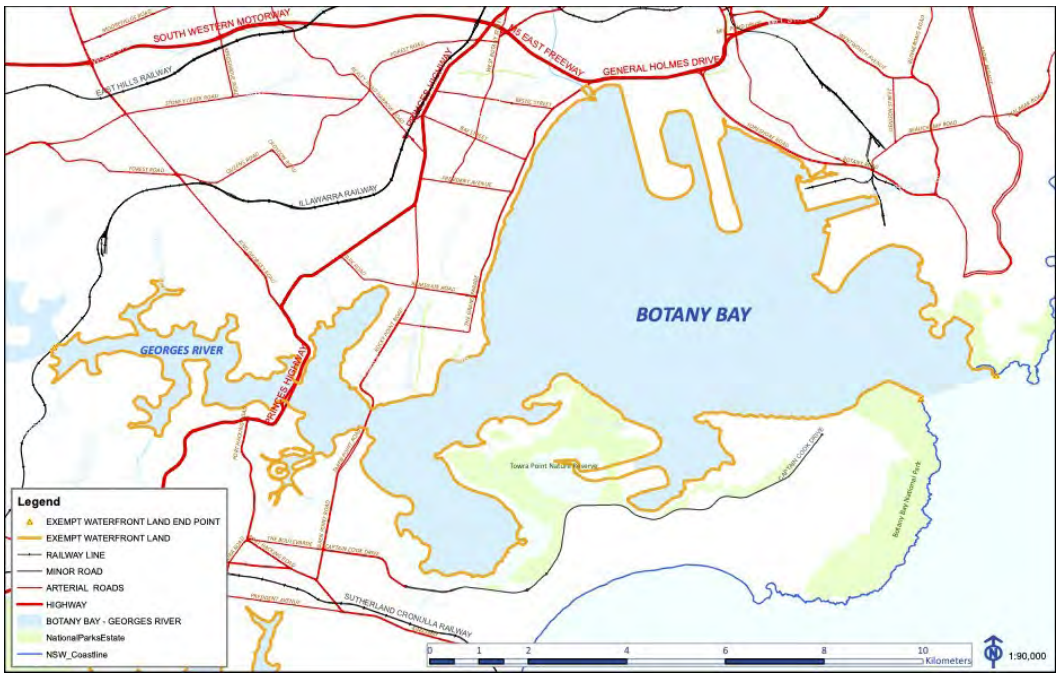
Using your browser zoom in to any of the maps below to help you identify the location of your property.

Alternatively you can access the maps at the below link:
https://www.dpie.nsw.gov.au/water/licensing-and-trade/controlled-activity-approvals/controlled-activity-exemptions

What supporting evidence do I need?

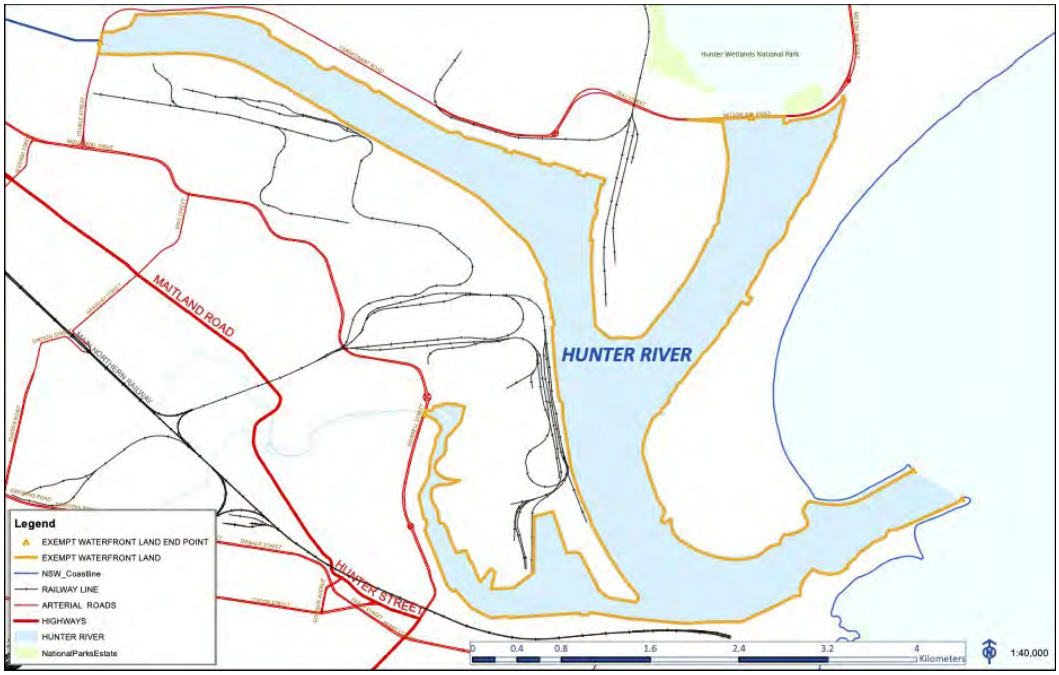
• Saved or printed screenshot of aerial photo of your property
• Saved or printed copy of any maps to identify property boundary
• Saved or printed screenshot of the location of your property on the waterfront land map

Botany Bay



Brisbane Water

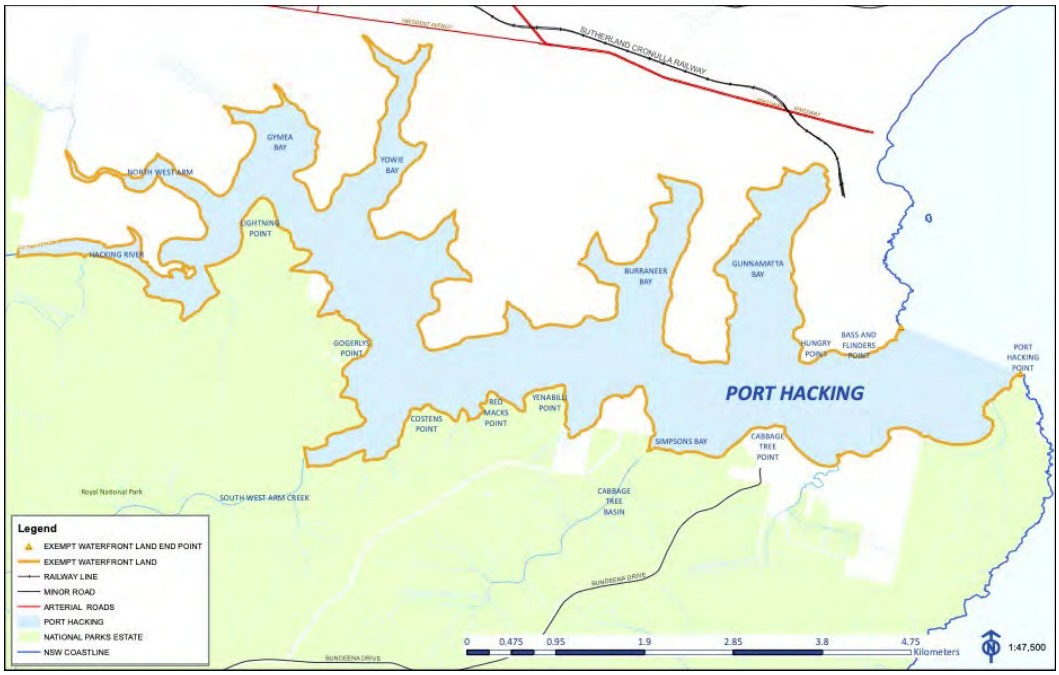
Hunter River



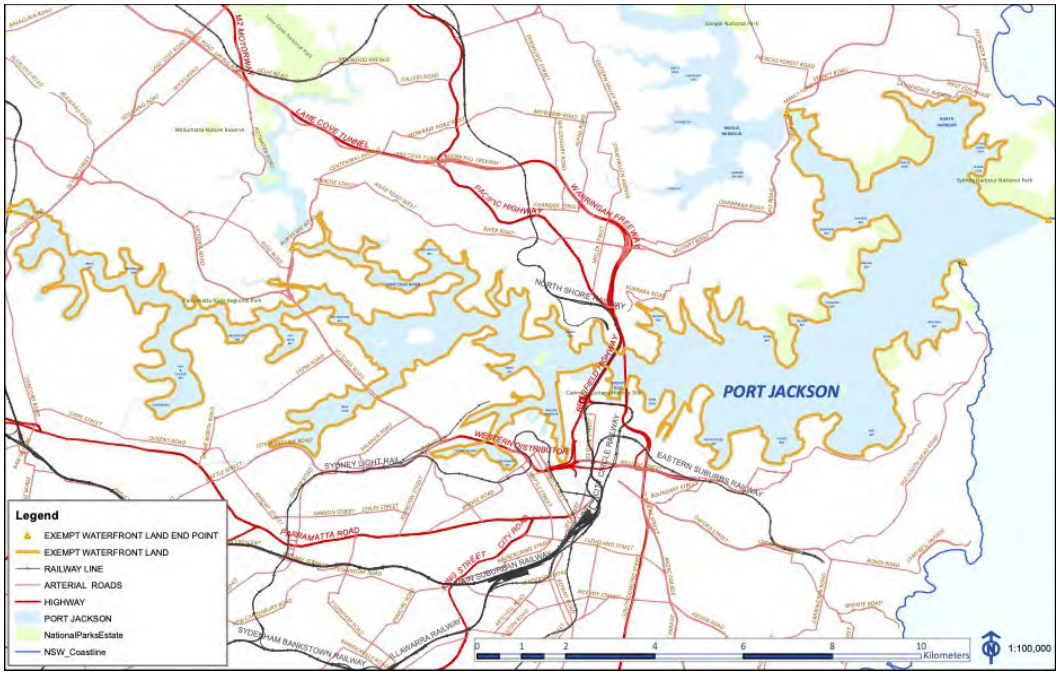
Lake Macquarie

Lake Mulwala

Port Hacking



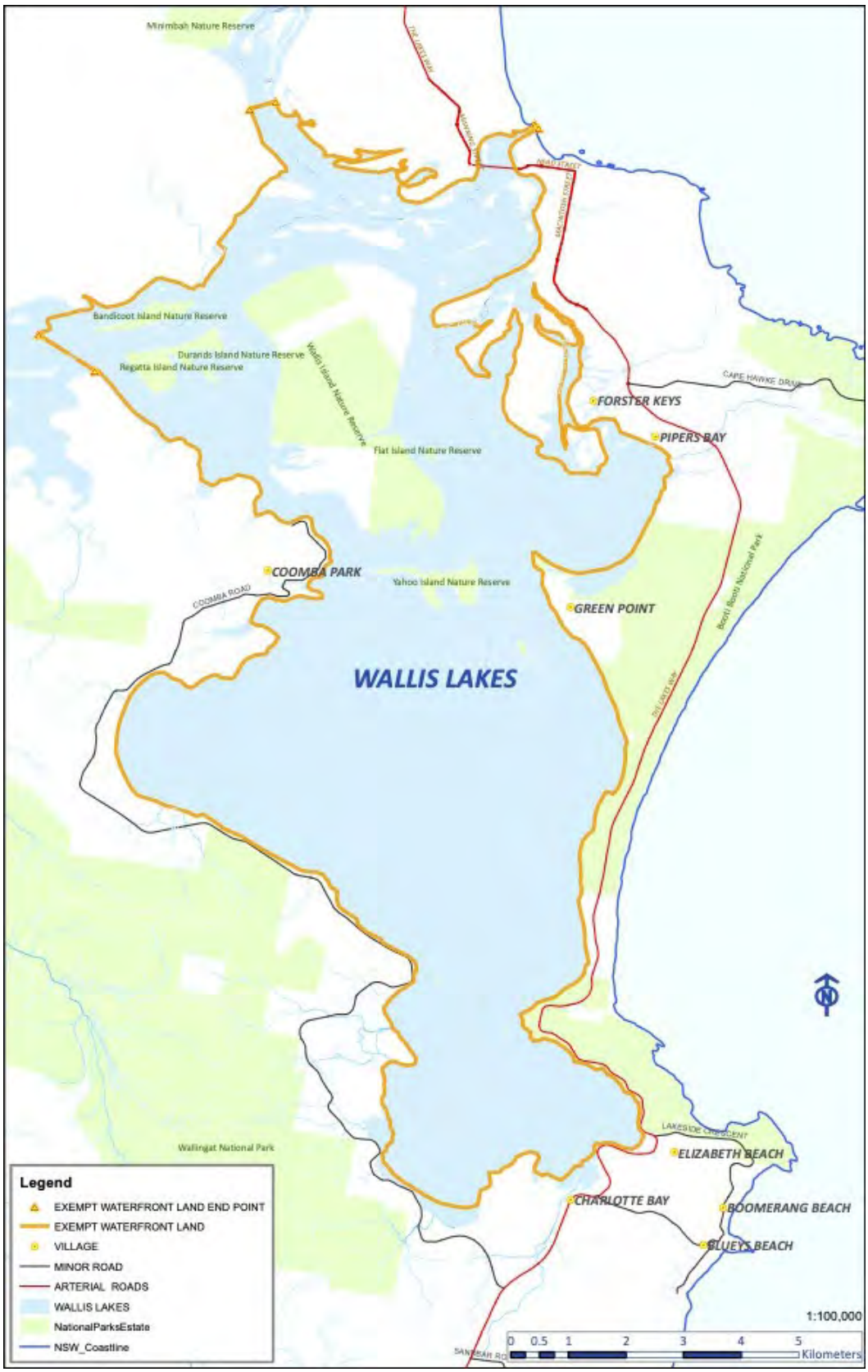
Port Jackson



Port Stephens

Tuggerah Lakes

Wallis Lakes



Question 2a - Hydro Line spatial data map

Open the link provided below for the Hydro Line spatial data map and

enter your property address.

Is there a blue line on your property or within 40m of the proposed work? *

- (●) Yes
- ( ) No

What supporting evidence do I need?

- Saved or printed screenshot of aerial photo of your property
- Saved or printed copy of any maps to identify property boundary
- Saved or printed screenshot of the location of your property on the Hydro Line spatial data map

The Hydroline spatial data is used to determine the Strahler stream order of a watercourse.
https://trade.maps.arcgis.com/apps/webappviewer/index.html?id=07b967fd0bdc4b0099fc5be45b6d1392

Collecting evidence in the field

For this part of the tool, you may need to go to your site to collect evidence and answers.

What to take into the field

The following equipment will be required to complete field work:
- Digital camera
- Note taking equipment - notebook or computer
- Measuring tape or equipment able to measure 50m
- Saved or printed screenshot of aerial photo of your property and the watercourse

If you can't do the field work right now, you can save your answers

To save your answers so far in the e-tool, select 'Yes, save my answers' below and click 'Submit' on the next page.

You will then be emailed a copy of the answers and a link you can use to return to the e-tool when in the field or after your field work is completed.

The link is at the top of the email 'Edit response'.

This is the only point in the tool where you can stop and return to your answers

If you close the tool anywhere else - other than the final 'Submit' page - the data you have entered so far will not be retained.

Can't take this tool into the field?

A PDF version is available at:
https://water.nsw.gov.au/__data/assets/pdf_file/0009/367272/waterfront-land-tool.pdf

Would you like to save your answers? *

- ○ Yes, save my answers so I can return here later
- ◉ No, keep going, I'm ready to answer the field-based questions

Question 3 - Determining stream order

Read the Determining stream order fact sheet at the below link.

Then open the link below to the Hydro Line spatial data map.

Zoom out from your property on the map to work out the stream order of your watercourse.

What is the stream order? *

- ○ 1st or 2nd order stream
- ◉ 3rd order or greater stream

Determining Strahler stream order fact sheet

https://www.industry.nsw.gov.au/__data/assets/pdf_file/0020/172091/Determining-Strahler-stream-order-fact-sheet.pdf

The Hydro Line spatial data is used to determine the Strahler stream order of a watercourse
trade.maps.arcgis.com/apps/webappviewer/index.html?id=07b967fd0bdc4b0099fc5be45b6d1392

What supporting evidence do I need?

- Saved or printed screenshot of aerial photo of your property
- Saved or printed copy of any maps to identify property boundary
- Saved or printed screenshot of the location of your property on the Hydro Line spatial data map
- Saved or printed screenshot of annotated Hydro Line spatial data map showing the determination of Strahler stream order

Question 8 - Determining the high bank

Using the photos and diagrams below, locate the high bank of the watercourse type identified in Question 4b.

Are the proposed works within 40m of the high bank? *

- (●) Yes
- ( ) No

After answering the question, click next at the bottom of the screen.

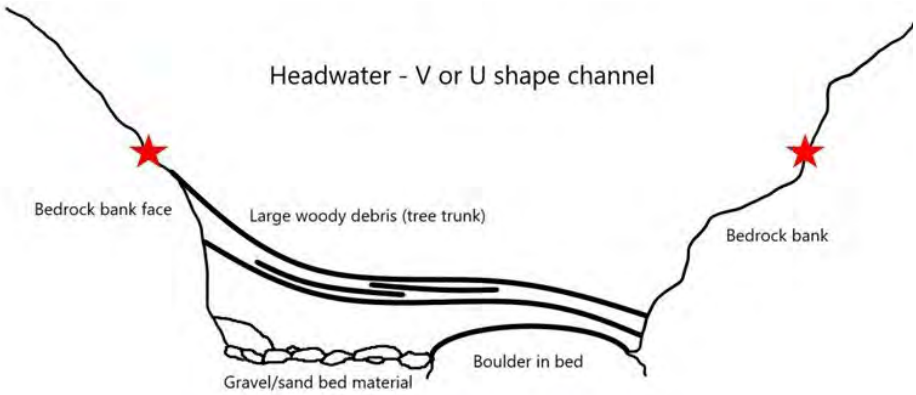
Using photos and diagrams below
Use your browser to zoom in to the photos and diagrams below.

What supporting evidence do I need?

- Record of the measurement from high bank to the nearest location of the proposed works
- Annotated aerial photo of the property showing:
  - o location of the proposed works
  - o location of the watercourse, lake or wetland, and
  - o measured distance to the high bank.
- Current site photos looking up and downstream. Photos should be taken within one month of completing this tool and include a date stamp or metadata and

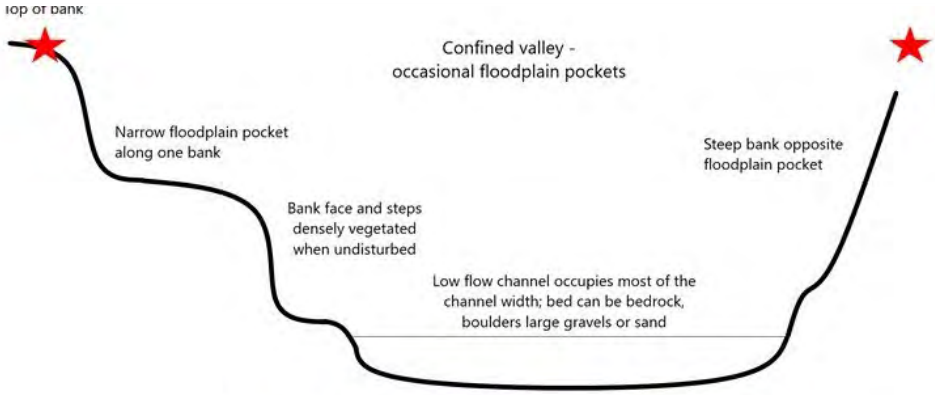
a short location description.
• Saved or printed screenshot of the watercourse type from the Department of Planning and Environment—Water Guide— Determining the high bank of a watercourse
• Written observations of the watercourse including bed, bank and erosion features and flow conditions
• Saved or printed screenshot of aerial photo of your property and the watercourse

Type 1 - Confined Valley Headwater



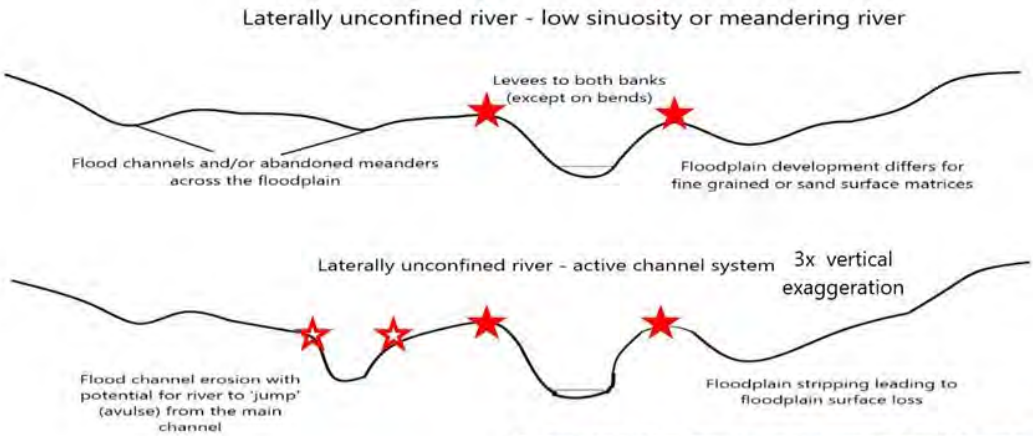
★ Top of High Bank

Type 2 - Confined Valley Floodplain Pockets



★ Top of High Bank

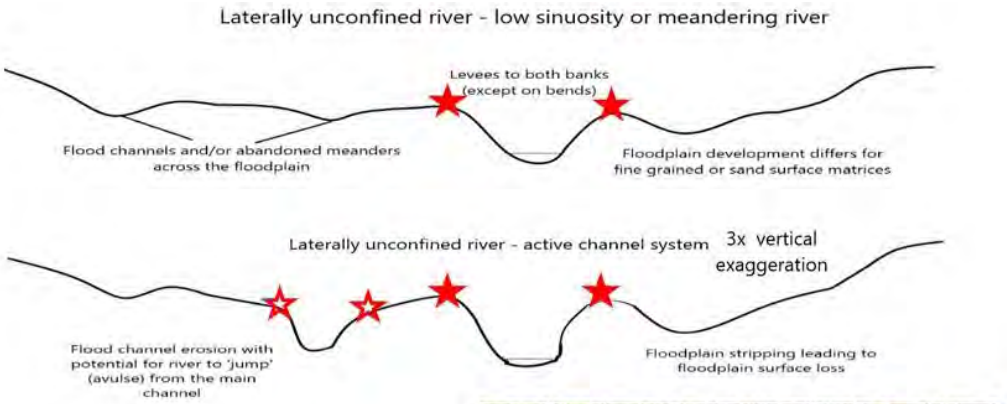
Type 3a - Laterally Unconfined Continuous - Bank Confined



★ Top of High Bank

☆ Top of High Bank when the flood channel has regular flows and/or, river features and/or is a mapped watercourse.

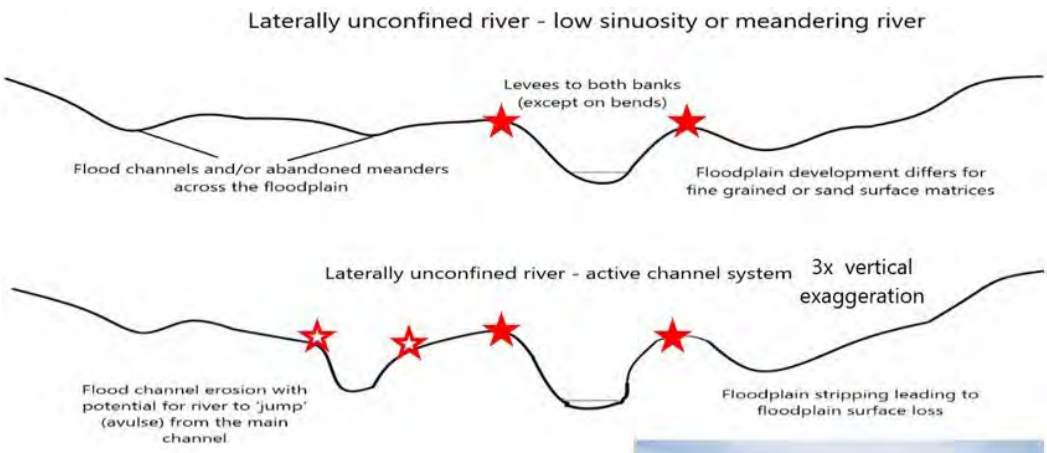
Type 3b - Laterally Unconfined Continuous - Low Sinuosity



★ Top of High Bank

☆ Top of High Bank when the flood channel has regular flows and/or, river features and/or is a mapped watercourse.

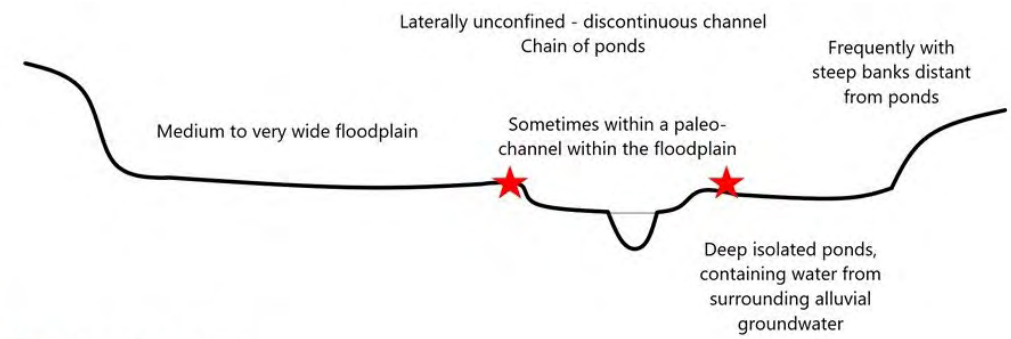
Type 3c - Laterally Unconfined Continuous - Meandering



★ Top of High Bank

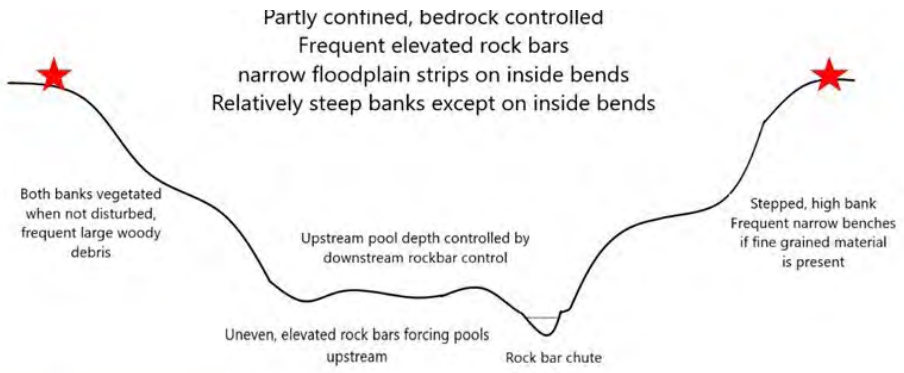
☆ Top of High Bank when the flood channel has regular flows and/or, river features and/or is a mapped watercourse.

Type 4 - Laterally Unconfined Discontinuous



★ Top of High Bank

Type 5 - Partly Confined Valley



★ Top of High Bank

Lakes

★ Top of High Bank is defined by the Mean High Water Mark (MHWM). This is determined by survey.

Wetlands

★ Top of High Bank is defined by the edge of the frequently wet area. This can be identified by a shore area, a change in vegetation type or soil type.

Result 14 - Controlled activity approval likely required

Based on your answers, the result is:

CONTROLLED ACTIVITY APPROVAL LIKELY REQUIRED

Statements

When completing the e-tool you provided the following answers:

- One or more of the following features are on this property or a neighbouring property:
    - o watercourse
    - o lake
    - o wetland
    - o mapped Strahler 3rd order or greater hydro line as defined by the Hydro Line spatial data map
- The proposed works are located within 40m of the high bank of the watercourse

Are ALL of the above statements correct? *

- (●) Yes
- ( ) No (restart tool)

Record keeping and Disclaimer

Please ensure you keep the electronic and/or printed copies of all supporting evidence required for questions answered in this tool and the confirmation email you receive after clicking submit.

NOTE:

- The results given by this tool are generated using the answers you have provided. If any answers are incorrect or incomplete, the result produced may be incorrect.
- This tool is intended for guidance purposes only and cannot be used as evidence of compliance with the Water Management Act 2000.
- Users of this tool will be responsible for making their own assessment of the material and should verify all relevant representations, statements and information with their own professional advisers.
- This is not an approval to undertake work on waterfront land and you will still need to obtain relevant approvals as required under the Water Management Act 2000 (WM Act).
- The use of this tool does not remove the obligation to obtain approval under any other relevant legislation.
- Users should also refer to the disclaimer on the department's website at industry.nsw.gov.au/disclaimer.

If ANY of your assessments identify that a controlled activity approval is required for your proposed works, you must complete the following tasks:

- Confirm if an exemption applies to your site or proposed works by using the Department's Controlled activity exemption e-tool at: https://forms.office.com/pages/responsepage.aspx?id=IYjvljkqHEe4mmewgz3TuaJ8VvZiyYZKiR3x1NniFCZUQ0lWTUZRUVpWMFhHTlBEM05aNFVOVlFSOC4u or refer to exemption

information here: https://www.dpie.nsw.gov.au/water/licensing-and-trade/controlled-activity-approvals/controlled-activity-exemptions

• For matters requiring a development application (DA) from Council, you should lodge your DA as Integrated Development.

• For matters NOT requiring a DA, please refer to the Department of Planning and Environment—Water website for instructions on how to apply for a Controlled Activity Approval: https://www.dpie.nsw.gov.au/water/licensing-and-trade/controlled-activity-approvals/how-to-apply

You MUST click Submit to be emailed a copy of your answers and your result.

Reminder: The e-tool must be completed separately for each individual mapped or visible watercourse on, or near, your property. If you have multiple properties or multiple watercourses on or near your property, submit your response for the first assessment and then re-start the tool from the beginning to assess another watercourse or property. This will ensure each property and watercourse receives its own separate emailed result outcome that you can keep as a record.

Feedback

Please let us know whether you found this tool helpful and what we could do to make it better. Your comments will help us to improve the tool further.

Thankyou for your feedback.

How helpful was this tool?

Very helpful

Additional feedback about this tool

.....

If you have a question or require further information regarding your specific circumstances, please email waterlicensing.servicedesk@dpie.nsw.gov.au

If you wish to undertake another assessment, please click 'Submit' below and then select 'Submit another response'.

Create your own Google Form
Report Abuse

Appendix E – Author CVs

BRENDON YOUNG
Project Manager

Profile Summary

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

Academic Qualifications

Charles Sturt University

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

University of Tasmania

- Bachelor of Applied Science (Fisheries) with Honours

Training, Licences and Professional Memberships

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

Professional Experience

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

Relevant Project Experience

Ecological Surveys

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

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

University

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

Ecological Assessment

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

Ecological Monitoring

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

Publications

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

NATALIE BLACK

Senior Ecologist

Profile Summary

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

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

Academic Qualifications

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

Training, Licences and Professional Memberships

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

Professional Experience

Senior Environmental Manager / Works Coordinator 2019 – Present

Anderson Environment & Planning

Newcastle NSW

Principal Environmental Planner 2010 - 2019

Black Earth

Newcastle NSW

Senior Lecture 2010 - 2019

Hunter TAFE

Range of Hunter Campuses

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

Relevant Project Experience

Ecological Survey examples

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

Ecological Assessment examples

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

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

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

Ecological Offsets and Monitoring

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

Planning – Approved Review of Environmental Factors

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

Bushfire Threat Assessments

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