Calderwood EPBC 2021 / 8981 Annual Compliance Report 2024 - 2025

Prepared for SRCP (Calderwood) Pty Ltd

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DOCUMENT TRACKING

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ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with assistance from Kaitlin Rideout and Taylah Taka from Stockland Pty Ltd.

Template 2.8.1

Contents

List of Figures

List of Tables

1. Introduction

1.1 Project background

The Action area for Calderwood Mod 4 residential subdivision and adjacent lands forms part of the Calderwood Urban Development Project (CUDP) located at Calderwood, approximately 20 km southwest of Wollongong. The proposed action includes a variety of lot sized dwellings, retail floor space and community parks, and covers 299.97 ha. The development will provide for urban residential living and is planned to consist of residential dwellings, associated infrastructure and community recreation areas. A majority of the Action area consists of land previously used for agricultural purposes and is dominated by exotic pasture grasses which has resulted from uses including cattle grazing.

On 4 April 2022, the then DAWE (now Department of Climate Change, Energy, Environment and Water, here in referred to as 'the Department' throughout this report) determined that the proposed action was a '*controlled action*' and that it would be assessed by Preliminary Documentation (PD Report) (Appendix A). A PD Report was prepared (Appendix B), and the proposed action was approved with conditions on 19 April 2023 (Appendix C).

Eco Logical Australia Pty Ltd (ELA) has prepared this compliance report on behalf of the proponent, SRCP (Calderwood) Pty Ltd, to assess compliance with the conditions for the period from April 2024 – April 2025 as set out in the EPBC Act conditions of the approval (EPBC 2021/8981).

1.2 Project status

1.2.1 Commencement of works

The proposed action commenced on 22 May 2023, including bulk earthworks within the approved Action Area. Table 1 and Appendix D shows the development staging and which stages are currently ongoing. Since the completion of the 2023-2024 compliance report, Stockland has undertaken test excavations for Stage 7A and is currently awaiting a Development Application (DA), however this development stage has not commenced.

Table 1: Development staging

Stage	Status
Stage 4	Not commenced
Town Centre East	Not commenced
Town Centre South	Completed
Town Centre North	Not commenced
Town Centre Core	Not commenced
Education Precinct	Underway
7A	Not commenced
7B	Not commenced
8-12	Not commenced

1.2.2 Prior to the commencement of the action

Prior to the commencement of the action, Vegetation Management Plans (VMP) and a Construction Environmental Management Plan (CEMP) were prepared as per the approval conditions. Further details are provided in Table 2.

1.2.3 Change of name

Stockland acquired the Calderwood Valley project from Lendlease Communities (Calderwood) Pty Ltd in December 2024. As the entity was acquired, all associated details remain the same (ABN, ACN), however there was a name change from Lendlease Communities (Calderwood) Pty Ltd to SRCP (Calderwood) Pty Ltd (Appendix E).

1.3 Reason for this report

This report has been prepared consistent with Conditions 12 - 15 of the approval (EPBC 2021/8981) which states:

> *12) The approval holder must prepare a compliance report for each 12-month period following the date of this approval, or as otherwise agreed to in writing by the Minister.*
>
> *13) Each compliance report must be consistent with the Department's Annual Compliance Report Guidelines (2014), or any subsequent official version.*
>
> *14) Each compliance report must include:*
>
> *a) Accurate and complete details of compliance and any non-compliance with the conditions, and the plans, and any incidents.*
>
> *b) One or more shapefile showing all clearing of protected matters, and/or their habitat, undertaken within the 12-month period at the end of which that compliance report is prepared.*
>
> *c) A schedule of all plans in existence in relation to these conditions and accurate and complete details of how each plan is being implemented.*
>
> *15) The approval holder must:*
>
> *a) Publish each compliance report on the website within 60 business days following the end of the 12-month period for which that compliance report is required.*
>
> *b) Notify the Department electronically, within 5 business days of the date of publication that a compliance report has been published on the website.*
>
> *c) Provide the weblink for the compliance report in the notification to the Department.*
>
> *d) Keep all published compliance reports required by these conditions on the website until the expiry date of this approval.*
>
> *e) Exclude or redact sensitive ecological data from compliance reports published on the website or otherwise provided to a member of the public.*

f) *If sensitive ecological data is excluded or redacted from the published version, submit the full compliance report to the Department within 5 business days of its publication on the website and notify the Department in writing what exclusions and redactions have been made in the version published on the website.*

Note: Compliance reports may be published on the Department's website.

This is the second compliance report prepared by ELA on behalf of the approval holders determining the compliance of the conditions set out by the Minister. The second annual reporting is due 19 April 2025 (i.e. at the end of the 12-month period following the date of this approval). The following sections outline compliance relevant to each condition and additional information relevant to the action.

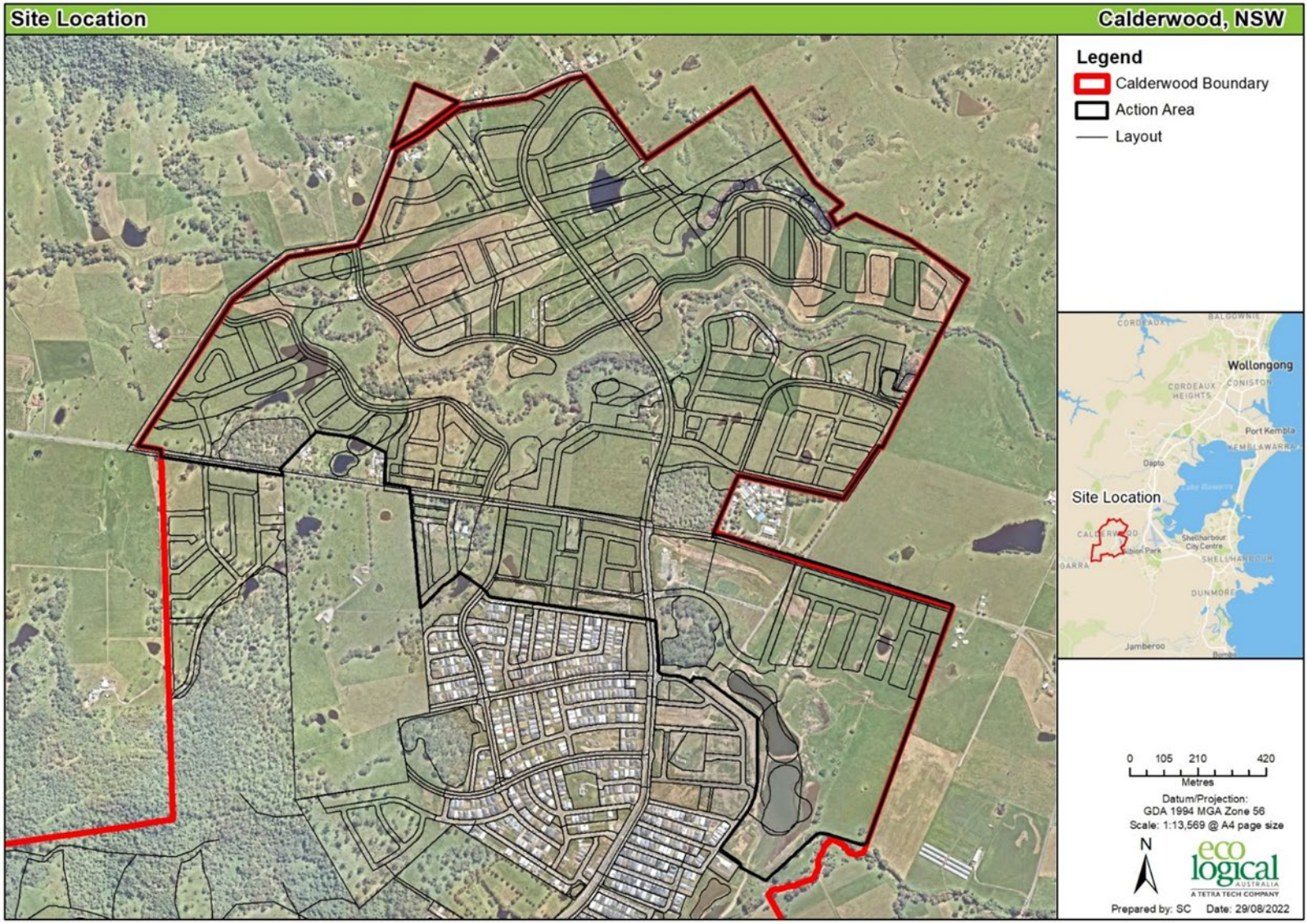

Figure 1: Location of the action area

2. Compliance reporting

Condition approvals for this action (EPBC 2021/8981), and their compliance status, are presented in Table 1**.** Note the Compliance Y / N column relates to reporting year 2024-2025.

Table 2: Compliance with conditions of approval

Condition No.	Condition	Compliance Y / N (Year 2024-25)	Date due	Details
1	In taking the Action, the approval holder must not clear outside the Action area.	Y	Ongoing	There have not been any non-compliances regarding clearing outside the Action area in the 2024 – 2025 reporting year (Appendix F).
2	The approval holder must not clear: a. Any Illawarra Forest outside of the Illawarra Forest impact areas, and b. More than of 0.28 hectares (ha) of Illawarra Forest.	Y	Ongoing	Stockland did not clear any Illawarra Forest outside of the Illawarra Forest impact areas during the 2024 - 2025 reporting year (Appendix F)
3	The approval holder must implement a Vegetation Management Plan (VMP) for the Illawarra Forest retained areas and the inner 15 m of all retained vegetation within the buffer zones. The environmental outcomes of implementing the VMP must be that the Illawarra Forest retention areas continue to meet the EPBC Act condition thresholds for listing as Illawarra Forest for the duration of this approval. The VMP must be consistent with the Environmental Management Plan Guidelines and must: a. include an analysis of the potential impacts of the Action on the Illawarra Forest retained areas including the facilitated impacts arising from the Action (specifically, the increase in activity which will occur, near Illawarra Forest retained areas as a result of the Action), b. detail management measures for the conservation management of the Illawarra Forest retained areas and the inner 15m of the retained vegetation in the buffer zones, including: i pest management	Y	Ongoing until the expiry of this approval (30 April 2038)	Eco Logical Australia (ELA) prepared VMPs on behalf of Stockland (Appendix G, Appendix H). The VMPs are compliant with Condition 3.

Condition No.	Condition	Compliance Y / N (Year 2024-25)	Date due	Details
	ii weed control, and iii revegetation measures and planting schedules, c. specify measurable, achievable and timebound performance criteria to achieve the environmental outcomes, d. detail the roles and responsibilities of those implementing the VMP, e. include a schedule of monitoring to assess the success of the VMP implementation against the environmental outcomes and performance criteria, and f. include a risk assessment of the VMP not achieving the environmental outcomes and/or performance criteria. The approval holder must implement the VMP until the expiry of this approval.			
4	The approval holder must implement a Construction Environment Management Plan (CEMP). The environmental outcomes of implementing the CEMP must be to avoid all avoidable potential impacts and to mitigate all unavoidable impacts to protected matters as a result of taking the Action. The CEMP must: a. include measures and specify the timing of installation of temporary and permanent fencing, to restrict access, along the boundaries of the inner 15 m of the retained vegetation in the buffer zones, b. detail the method, effort, and timing to identify and record the location of any hollow-bearing trees within the Action area, c. detail the method(s) which will be implemented to relocate any hollow-bearing trees cleared within the Action area to the Illawarra Forest retained areas without causing any harm to Illawarra Forest, d. include measures to install and maintain piped stormwater management infrastructure along all roads surrounding the Illawarra Forest retained areas and buffer zones to ensure stormwater falling or flowing on roads cannot flow into the Illawarra Forest retained areas, e. specify a de-watering plan for any farm dams removed from within the Action area,	Y	Ongoing until the expiry of this approval (30 April 2038)	ELA prepared a CEMP on behalf of Stockland (Appendix I). All conditions, excluding those related to artificial lighting measures and piped stormwater management, have been addressed in the CEMP (Appendix I). ELA has prepared dam-dewatering plans on behalf of Stockland (Appendix J). Stormwater pipes and structures have been installed along all roads surrounding the Illawarra Forest retained areas and buffer zones (Appendix K). The lighting measures which apply to the action area are standard street lighting designs as per Council specifications. These lighting designs were submitted 2 years prior to the

Condition No.	Condition	Compliance Y / N (Year 2024-25)	Date due	Details
	f. include a fauna pre-clearance protocol to ensure fauna are afforded the opportunity to safely vacate any tree or area within the Action area prior to that tree or area being cleared, g. detail the lighting measures to prevent artificial lighting impacts to fauna within the Illawarra Forest retained areas during the operational phase, h. specify measurable, achievable and timebound performance criteria to achieve the environmental outcomes, and i. include the methods, effort, and a schedule of monitoring to determine whether the performance criteria and environmental outcomes have been or are likely to be achieved and to detect any non-compliance with the commitments made in the CEMP, j. detail measures to manage potential indirect impacts to the Illawarra Forest retained areas and the inner 15m of the retained vegetation in the buffer zones. The approval holder must implement the CEMP until the expiry of this approval.			approval. The stages which have been completed and are currently under construction are being constructed as per these designs (Appendix D).
5	The approval holder must notify the Department electronically of the date of commencement of the Action, within 5 business days of commencement of the Action.	Y	Within 5 business days of commencement of the Action. i.e. 29 May 2023	Stockland notified the Department that the Action commenced on 22 May 2023 with a letter dated 25 May 2023 (Appendix L).
6	If the commencement of the Action does not occur within 5 years from the date of this approval, then the approval holder must not commence the Action without the prior written agreement of the Minister.	Y	19 April 2028 i.e. within 5 years from the date of approval	The Action commenced on 22 May 2023.
7	The approval holder must maintain accurate and complete compliance records.	Y	Ongoing	Stockland maintains and stores records internally. Stockland will publish the annual compliance reports on their website.

Condition No.	Condition	Compliance Y / N (Year 2024-25)	Date due	Details
8	If the Department makes a request in writing, the approval holder must provide electronic copies of compliance records to the Department within the timeframe specified in the request. Note: Compliance records may be subject to audit by the Department, or by an independent auditor in accordance with section 458 of the EPBC Act, and/or be used to verify compliance with the conditions. Summaries of the results of an audit may be published on the Department's website or through the general media.	N/A	N/A	Electronic copies of compliance records were not requested by the Department during the 2024-2025 reporting period.
9	The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the Department's *Guidelines for biological survey and mapped data* (2018), or any subsequent official version or as otherwise specified by the Minister in writing.	N/A	Ongoing	As specified in the VMP, monitoring will be implemented at the end of the establishment works (Appendix G, Appendix H). This monitoring data will be included in the progress reports which are due at the end of the establishment works (two years after the commencement of the action).
10	The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the Department's *Guide to providing maps and boundary data for EPBC Act projects* (2021), or any subsequent official version or as otherwise specified by the Minister in writing.	N/A	Ongoing	As above.
11	The approval holder must submit all monitoring data (including sensitive ecological data), surveys, maps, other spatial and metadata and all species occurrence record data (sightings and evidence of presence) electronically to the Department within 12 months of the approval.	N/A	19 April 2024 i.e. within 12 months of the approval	The only monitoring data required is the photo monitoring and vegetation surveys that is to be undertaken as outlined in the VMP (Appendix G, Appendix H). This monitoring will occur at the end of the establishment works, as noted above.

Condition No.	Condition	Compliance Y / N (Year 2024-25)	Date due	Details
12	The approval holder must prepare a compliance report for each 12-month period following the date of this approval, or as otherwise agreed to in writing by the Minister.	Y	19 April 2025 i.e. at the end of the 12-month period following the date of the approval (19 April 2023)	The 2024-2025 Annual compliance report was prepared by ELA with assistance from Stockland. The 2024-2025 annual compliance report was submitted within the specified time frame.
13	Each compliance report must be consistent with the Department's *Annual Compliance Report Guidelines* (2014), or any subsequent official version.	Y	Ongoing	The Annual Compliance Report Guidelines have been referred to while preparing the 2024-2025 compliance report.
14	Each compliance report must include: a. Accurate and complete details of compliance and any non-compliance with the conditions and the plans, and any incidents. b. One or more shapefile showing all clearing of any protected matters, and/or their habitat, undertaken within the 12-month period at the end of which that compliance report is prepared. c. A schedule of all plans in existence in relation to these conditions and accurate and complete details of how each plan is being implemented.	Y	Ongoing	a. Stockland maintains and stores records internally. b. The relevant shapefiles have been included in the submission of the 2024-2025 Annual compliance report. c. The schedule of all plans can be found throughout the appendices of this report (Appendix B, Appendix D, Appendix G, Appendix H, Appendix I).
15	The approval holder must: a. Publish each compliance report on the website within 60 business days following the end of the 12-month period for which that compliance report is required. b. Notify the Department electronically, within 5 business days of the date of publication that a compliance report has been published on the website. c. Provide the weblink for the compliance report in the notification to the Department. d. Keep all published compliance reports required by these conditions on the website until the expiry date of this approval.	Y	a. Within 60 business days following each 12-month period b. within five business days of the date of publication d. Until 30 April 2038 f. within five business days of publication	Stockland published the 2024-2025 compliance report within the specified time frame. The 2024-2025 Annual compliance report has been prepared by ELA with assistance from Stockland. Stockland will publish the annual compliance reports on their website.

Condition No.	Condition	Compliance Y / N (Year 2024-25)	Date due	Details
	e. Exclude or redact sensitive ecological data from compliance reports published on the website or otherwise provided to a member of the public. f. If sensitive ecological data is excluded or redacted from the published version, submit the full compliance report to the Department within 5 business days of its publication on the website and notify the Department in writing what exclusions and redactions have been made in the version published on the website. Note: compliance reports may be published on the Department's website.			
16	The approval holder must notify the Department electronically, within 2 business days of becoming aware of any incident and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a plan.	N/A	Within two business days of becoming aware of the incident or non-compliance	Incidents have not occurred during the 2024-2025 reporting period.
17	The approval holder must specify in the notification: a. Any condition or commitment made in a plan which has been or may have been breached. b. A short description of the incident and/or potential non-compliance and/or actual noncompliance. c. The location (including co-ordinates), date, and time of the incident and/or potential noncompliance and/or actual non-compliance. Note: If the exact information cannot be provided, the approval holder must provide the best information available.	N/A	Within two business days of becoming aware of the incident or non-compliance	As above.
18	The approval holder must provide to the Department in writing, within 12 business days of becoming aware of any incident and/or potential non-compliance and/or actual noncompliance, the details of that incident and/or potential non-compliance and/or actual noncompliance with the conditions or commitments made in a plan. The approval holder must specify:	N/A	Within 12 business days of becoming aware of the incident or non-compliance	As above.

Condition No.	Condition	Compliance Y / N (Year 2024-25)	Date due	Details
	a. Any corrective action or investigation which the approval holder has already taken. b. The potential impacts of the incident and/or non-compliance. c. The method and timing of any corrective action that will be undertaken by the approval holder.			
19	The approval holder must ensure that an independent audit of compliance with the conditions is conducted for every five-year period following the commencement of the Action until this approval expires, unless otherwise specified in writing by the Minister.	N/A	20 May 2028	The Action commenced on 22 May 2023. An independent audit was not required during the 2024-2025 compliance period as Stockland is within the five-year period following commencement of the Action.
20	For each independent audit, the approval holder must: a. Provide the name and qualifications of the nominated independent auditor, the draft audit criteria, and proposed timeframe for submitting the audit report to the Department prior to commencing the independent audit. b. Only commence the independent audit once the nominated independent auditor, audit criteria and timeframe for submitting the audit report have been approved in writing by the Department. c. Submit the audit report to the Department for approval within the timeframe specified and approved in writing by the Department. d. Publish each audit report on the website within 15 business days of the date of the Department's approval of the audit report. e. Keep every audit report published on the website until this approval expires.	N/A	20 May 2028	As above.
21	Each audit report must report for the five-year period preceding that audit report.	N/A	20 May 2028	As above.
22	Each audit report must be completed to the satisfaction of the Minister and be consistent with the Department's *Environment Protection and Biodiversity*	N/A	20 May 2028	As above.

Condition No.	Condition	Compliance Y / N (Year 2024-25)	Date due	Details
	Conservation Act 1999 Independent Audit and Audit Report Guidelines (2019), or any subsequent official version.			
23	The approval holder must notify the Department electronically 60 business days prior to the expiry date of this approval, that the approval is due to expire.	N/A	15 March 2038 i.e. within 60 business days prior to the expiry of this approval (30 April 2038)	The Approval has not expired.
24	Within 20 business days after the completion of the Action, and, in any event, before this approval expires, the approval holder must notify the Department electronically of the date of completion of the Action and provide completion data.	N/A	Within 20 business days after the completion of the Action	The Action has not been completed.

3. Conclusion

Eco Logical Australia Pty Ltd, on behalf of SRCP (Calderwood) Pty Ltd, has prepared this Compliance Report to fulfil Conditions 12-15 of the approval (EPBC 2021/8981). No non-compliances occurred in the 2024-2025 reporting year. All associated documentation has been provided as appendices to this report.

Appendix A Decision on referral – Calderwood Mod 4 Residential Development NSW (Department of Agriculture, Water and the Environment 4 April 2022)

Australian Government
Department of Agriculture,
Water and the Environment

EPBC Ref: 2021/8981

Mr George Popovic
Senior Development Manager
Lendlease Communities (Calderwood) Pty Limited
Level 2, 88 Phillip Street
PARRAMATTA NSW 2150

Dear Mr Popovic

Decision on referral
Calderwood Mod 4 Residential Development, NSW

Thank you for submitting a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This is to advise you of my decision about the proposed action to develop a residential and commercial subdivision, including associated ancillary infrastructure in Calderwood Valley, NSW.

As a delegate of the Minister for the Environment, I have decided under section 75 of the EPBC Act that the proposed action is a controlled action. As such, it requires assessment and a decision on whether or not it should be approved under the EPBC Act. A copy of the document recording this decision is attached and will be published on the department's website.

The information that I have considered indicates that the proposed action is likely to have a significant impact on listed threatened species and communities (section 18 & section 18A), specifically the critically endangered Illawarra and south coast lowland forest and woodland ecological community. Based on the information in the referral, and in the further information provided to the department, the proposed action will result in the clearance of up to 0.54 ha of habitat critical to the survival of the ecological community, with the potential for further indirect impacts.

The department also considers that further information is required to determine whether the proposed action will have a significant impact on the endangered Illawarra Greenhood (*Pterostylis gibbosa*).

Please note that this decision only relates to the potential for significant impacts on matters protected by the Australian Government under Chapter 2 of the EPBC Act.

Assessment approach

I have also decided that the project will be assessed by preliminary documentation. Each assessment approach requires different levels of information and involves different steps. All levels of assessment include a public consultation phase, *in which any third parties can comment on the proposed action.*

While I have determined that your project will be assessed by preliminary documentation, some further information will be required to be able to assess the relevant impacts of the action. You should expect to receive a letter from the department within 10 business days of the payment of Stage 1 fees, outlining the information required.

The project manager will contact you shortly to discuss the assessment process.

Indigenous communities may also need to be consulted during the assessment process. For more information on how and when indigenous engagement should occur during environmental assessments, please refer to the indigenous engagement guidelines at https://www.awe.gov.au/environment/epbc/publications/engage-early.

The department received comments on the referral from the National Indigenous Australians Agency (NIAA) on behalf of the Minister for Indigenous Australians, the Hon Ken Wyatt AM MP. Details of those comments, along with recommendations for Lendlease, are outlined at Appendix A. I have also written to the Minister for Indigenous Australians advising him of my decision.

Cost Recovery

Please note, under subsection 520(4A) of the EPBC Act and the *Environment Protection and Biodiversity Conservation Regulations 2000* your assessment is subject to cost recovery. Please find attached a copy of the fee schedule for your proposal. An invoice for Stage 1 will be sent to you shortly. Fees will be payable prior to each stage of the assessment proceeding. Further details on cost recovery are available on the department's website at https://www.awe.gov.au/environment/epbc/cost-recovery.

If you disagree with the fee schedule provided, you may apply under section 514Y of the EPBC Act for reconsideration of the method used to work out the fee. The application for reconsideration must be made within 30 business days of the date of this letter and can only be made once for a fee. Further details regarding the reconsideration process can be found on the department's website at https://www.awe.gov.au/environment/epbc/environment-assessment-and-approvals/assessment-and-approval-process/refer-proposed-action.

Details on the assessment process for the project and the responsibilities of the proponent are set out in the enclosed fact sheet. Further information is available from the department's website at https://www.awe.gov.au/environment/epbc/referral-and-assessment-process.

Please also note that once a proposal to take an action has been referred under the EPBC Act, it is an offence under section 74AA to take the action while the decision-making process is on-going (unless that action is specifically excluded from the referral or other exemptions apply). Persons convicted of an offence under this provision of the EPBC Act may be liable for a penalty of up to 500 penalty units. The EPBC Act is available online at https://www.awe.gov.au/environment/epbc/about.

The department has recently published an *Environmental Impact Assessment Client Service Charter* (the Charter) which outlines the department's commitments when undertaking environmental impact assessments under the EPBC Act. A copy of the Charter can be found at https://www.awe.gov.au/environment/epbc/publications.

If you have any questions about the referral process or this decision, please contact the project manager, Claire Fitzgerald, by email to Claire.Fitzgerald@environment.gov.au, or telephone (02) 6274 2794 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Kate Gowland
A/g Assistant Secretary
Environment Assessments (NSW and ACT) Branch
4/04/2022

Appendix A - National Indigenous Australians Agency comments on referral

The department received comments on the referral from the National Indigenous Australians Agency (NIAA) on behalf of the Minister for Indigenous Australians. The NIAA noted that:

- The proposed action will potentially impact 39 Aboriginal archaeological sites.
- While Lendlease Calderwood has engaged relevant Aboriginal stakeholders in their Aboriginal Heritage Assessment, the assessment does not clearly identify the Traditional Owners that were consulted or how they will be engaged on an ongoing basis.
- They agree with the heritage consultants that Lendlease Calderwood should apply for relevant Aboriginal Heritage Impact Permits as required by the *National Parks and Wildlife Act 1974.* This is particularly important given the damage cause to an Indigenous heritage area of the site by a contractor employed by Lendlease Calderwood in 2017.
- They recommend that as a matter of priority Lendlease Calderwood engages with all Traditional Owners and Indigenous stakeholders. This engagement should include the Illawarra Local Aboriginal Land Council as a significant stakeholder having cultural and land interests in the Calderwood Valley and surrounds.
- Consultation should include joint development of protocols for identifying, protecting and managing any tangible and intangible cultural heritage values, including culturally significant fora and fauna sites. The engagement and protocols should apply throughout the life of the project, including the construction phase.
- They recommend that Lendlease Calderwood works with the Traditional Owners to identify and implement measures to ensure all staff, contractors and sub-contractors undergo cultural awareness training and be apprised of the importance of tangible and intangible cultural heritage values within the landscape. This should include Lendlease Calderwood identifying and acknowledging the ongoing impact to Traditional Owners resulting from the 2017 incident.
- Lendlease Calderwood should engage with the native title group for the area, the South Coast People, who can be contacted via NTSCorp, the NSW representative body.
- They encourage the engagement of Indigenous employees and businesses. Including agencies such as Supply Nation, local Job Active providers and Vocational Training and Employment Centres to identify suitable Indigenous businesses and individuals to support project implementation and engage their participation in the project.

Appendix B Calderwood Urban Development Project Mod 4 Preliminary Documentation EPBC 2021/8981 (Eco Logical Australia 12 October 2022)

Calderwood Urban Development Project Mod 4 Preliminary Documentation EPBC 2021/8981

Prepared for Lendlease Communities (Calderwood) Pty Ltd

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Prepared by	Alex Gorey and James King
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Contents

List of Figures

List of Tables

Abbreviations

Abbreviation	Description
ABL	Australian Bat Lyssavirus
APZ	Asset Protection Zone
BC Act	NSW *Biodiversity Conservation Act 2016*
BSA	Biodiversity Stewardship Site Agreement (under the BC Act)
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DAWE	Department of Agriculture, Water and Environment (Now DCCEEW)
DCCEEW	Department of Climate Change, Energy, Environment and Water (formerly DAWE)
DNG	Derived Native Grassland
DPE	NSW Department of Planning and Environment (formerly DPIE)
DPIE	NSW Department of Planning, Industry and Environment (Now DPE)
EMP	Environmental Management Plan
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
HBT	Hollow Bearing Tree
LEP	Local Environment Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
OEH	former NSW Office of Environment and Heritage (now part of DPE)
PD Report	EPBC Act Preliminary Documentation Assessment Report
PBFD	Psittacine Beak and Feather Disease
PMST	Protection Matters Search Tool
PoM	Plan of Management
RFEF	River-flat Eucalypt Forest
RMS	NSW Roads and Maritime Services
SEPP	NSW State Environmental Planning Policy
ISCLFW	Illawarra and South Coast Lowland Forest and Woodland
TEC	Threatened Ecological Community
TSC Act	now repealed NSW *Threatened Species Conservation Act 1995 (replaced by BC Act)*
WSUD	Water Sensitive Urban Design

Executive Summary

Purpose and scope of this report

On 2 March 2010, the Calderwood Urban Development Project (CUDP) was referred to the Commonwealth (EPBC 2010 / 5381). The Commonwealth determined that the proposed action was not a controlled action on 30 March 2010 and further assessment and approval under the EPBC Act was not required. Since this decision was made, Lendlease Communities (Calderwood) (LLC) lodged a modification (Mod 4) to the existing transitional Part 3A Concept Plan approval for NSW DPIE approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act). Mod 4 was approved on 21 May 2021. As a result, limited areas of the CUDP now differ to the previously referred action. To take a precautionary approach and as a matter of abundant caution, LLC submitted a referral to the then Department of Agriculture, Water and Environment for the portion of the CUDP subject to Mod 4 (EPBC 2021/8981).

On 4 April 2022, the then DAWE (now Department of Climate Change, Energy, Environment and Water) determined that the proposed action is a '*controlled action'* and that it will be assessed by preliminary documentation (PD Report). This document is the EPBC Act Preliminary Documentation Assessment Report for the proposed development and has been provided to DCCEEW to enable further assessment and approval under the EPBC Act (EPBC Ref: 2021/8981).

Project proponent

The designated proponent for the Calderwood residential development is Lendlease Communities (Calderwood) Pty Limited.

The contact for the Commonwealth assessment of the proposed action is:

Mark Anderson

Senior Development Manager, Communities

Level 14, Tower Three, International Towers Sydney

Exchange Place, 300 Barangaroo Avenue, Barangaroo NSW 2000

M 0419 148 853 | mark.anderson@lendlease.com

Site context

The action area forms part of the Calderwood Urban Development Project (CUDP) and is in the Calderwood Valley, in the Illawarra Region of NSW; approximately 20 km south west of Wollongong. The Calderwood Valley is bound by rural land to the north, east and west, the remaining stages of the CUDP to the south and to the south and south east, the existing suburbs of Tullimbar and Albion Park. Marshall Mount Creek runs through the centre of the action area. Existing main roads include Calderwood Road, Marshall Mount Road and Escarpment Drive. The action area is 299.97 ha and mostly comprises land previously used for agricultural purposes and is dominated by exotic pasture grasses. The action area also contains remnant patches of native vegetation along Marshall Mount Creek, and in

three discrete patches across the action area. There are small patches of vegetation that have been opportunistically retained as part of the rural landscape and are generally in poor to moderate condition with some areas suffering from significant weed encroachment.

Matters of National Environmental Significance

From the information provided in the referral, DAWE(now DCCEEW) considered that the following Matters of National Environmental Significance (MNES) were likely to be significantly affected by the proposed action:

Threatened ecological communities:

- Illawarra and South Coast Lowland Forest and Woodland

Flora:

- *Pterostylis gibbosa* (Illawarra Greenhood).

In addition to the species listed in the PD requirements, two fauna species have been assessed in this report:

Pteropus poliocephalus (Grey-headed Flying-fox)

Chalinolobus dwyeri (Large-eared Pied Bat)

Description of the proposed action

This Preliminary Documentation covers the stages affected by Mod 4, being stages:

- 4
- Town Centre East
- Town Centre South
- Town Centre North
- Town Centre Core
- 7A, 7B and 8-12.

For the purposes of this report, the aforementioned stages will be referred to as the 'action area'. The proposed action encompasses the action area, which will be completed over approximately 10 years. Development will deliver a variety of lot sizes and dwelling types based upon current market demand for smaller housing / lot sizes; as well as a town centre with commercial and retail floor space and community parks. The majority of existing native vegetation will be retained within the action area, namely the existing patches of Illawarra and South Coast Lowland Forest and Woodland and the native vegetation along Marshall Mount Creek (Appendix C, Figure 4, page 4). To facilitate the residential development, extensions and upgrades of associated supporting infrastructure and services will be required. More specifically, the proposed action will involve:

- site preparation (earthworks and grading and associated noise, light and dust disturbance)
- residential lots in proximity to the existing township already completed at the CUDP
- town centre with large commercial and retail floor space
- utilities and services
- roads, bridge and pathways

- car parks
- local parks / open space
- ancillary infrastructure
- conservation land protection.

To facilitate these works, clearing of native vegetation will be required. Impacts to MNES as a result of result of clearing is described in this report.

Avoidance and mitigation of MNES

The design of the proposed action has followed the Significant Impact Guidelines for MNES (DotE 2013), which identifies important factors that must be considered when assessing the potential impacts on threatened species, populations, or ecological communities, or their habitats; namely to avoid, mitigate and finally to offset any residual impacts.

The proposed development footprint has undergone several iterations to avoid and minimise impacts to Illawarra and South Coast Lowland Forest and Woodland, which has resulted in an overall reduction in impacts from 0.72 ha to 0.28 ha. The efforts to avoid and minimise direct impacts has reduced the proposed impacts to Illawarra and South Coast Lowland Forest and Woodland by > 50%.

Conservation outcomes for MNES

Overall, approximately 93.3 % of all native vegetation will be retained in the action area as part of the E3 – Environmental Management or E2 -Environmental Conservation lands. Some 93.3 % of the good condition Illawarra and South Coast Lowland Forest and Woodland is proposed for retention, with the development footprint concentrated on previously cleared agricultural land.

Social and economic factors

The proposed action would contribute to the following to social amenities within the locality:

- Mixed interactive dwellings
- Community facilities
- Libraries
- Open space
- Schools
- Childcare.

The contribution to social amenities has been based on Council requirements and the estimated population size (Elton Consulting 2018). Indicatively, the contribution would include:

- An additional 300sqm of community centre space bringing the total size of the community facility required to serve the needs of the Calderwood population to 1,200sqm
- An additional 220sqm of library space, bringing the total library floor space contributions to 845sqm
- Based on a population of 16,750 people and applying the 2.83ha per 1000 people standard, the CUDP population would create demand for a total of 47.4ha, an additional 14.2ha to what was

included in the Approved Concept Plan. Using the 50/50 split between active and passive open space, this would comprise:

  - > 23.7ha for district sporting grounds (active open space)
  - > 23,7ha for local, district and city-wide parks (passive open space).
- Two primary schools (one 3ha site, another 2ha site) and one high school of 6ha
- Childcare centres to provide places for approximately 105 children.

The detail underpinning the analysis is contained in a full report accompanying this letter.

The expected economic contributions of the proposed action are (Delfin Lendlease 2010):

- the project will inject (directly) an estimated $2.9 billion into the local economy during the construction period in the form of payments to goods and service providers;
- 'leakages' or losses of these payment and jobs will be minimised by preferring the use of local construction inputs and labour where possible;
- direct construction expenditures and expenditures by incoming residents will create an additional PV$6.3 billion in net value for the Shellharbour Local Government Area (LGA) economy over the project period. Any cost to government should be viewed in the context of the size of the economic impacts and public benefits;
- the local construction sector will enjoy a large proportion of the additional value created during the initial phases, while the services and retailing sectors become the main beneficiaries as residents move in;
- the Project will assist in maintaining existing employment positions, particularly in the construction sector, and create an additional 7,925 full time equivalent (FTE) positions, with around 5,260 of these located in the Shellhabour LGA. This yields a high job containment ratio of over 60% for the development;
- the proponent's pro-active employment initiatives will further contribute to the employment of Shellharbour residents;
- the significant market entry level housing component would help reduce housing stress and encourage economic activity by attracting and retaining a skilled and younger labour force and increasing disposable incomes of residents; and
- the increase in housing mix and affordability would generate a range of benefits to residents including, but not limited to, better access to employment, training and educational resources, while the community would also benefit through impacts such as improved local amenity.

1. Scope of this report

On 2 March 2010, the Calderwood Urban Development Project (CUDP) was referred to the Commonwealth (EPBC 2010 / 5381). The Commonwealth determined that the proposed action was not a controlled action on 30 March 2010 and further assessment and approval under the EPBC Act was not required. Since this decision was made, Lendlease Communities (Calderwood) (LLC) lodged a modification (Mod 4) to the existing transitional Part 3A Concept Plan approval for NSW DPIE approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act). Mod 4 was approved on 21 May 2021. As a result, limited areas of the CUDP now differ to the previously referred action. To take a precautionary approach and as a matter of abundant caution, LLC submitted a referral to the then Department of Agriculture, Water and Environment for the portion of the CUDP subject to Mod 4 (EPBC 2021/8981).

On 4 April 2022, the then DAWE (now Department of Climate Change, Energy, Environment and Water) determined that the proposed action is a '*controlled action*' and that it will be assessed by preliminary documentation (PD Report). Appendix B includes a copy of this determination and the additional assessment requirements that this assessment report is required to address are provided as Appendix C.

This document is the EPBC Act Preliminary Documentation Assessment Report for the proposed development and has been provided to DCCEEW to enable further assessment and approval under the EPBC Act (EPBC Ref: 2021/8981).

The names, qualifications, experience and roles of the ecologists who prepared the report are provided in Appendix D.

From the information provided in the referral, DAWE (now DCCEEW) considered that the following Matters of National Environmental Significance (MNES) were likely to be significantly affected by the proposed action:

Threatened ecological communities:

- Illawarra and South Coast Lowland Forest and Woodland

Flora:

- *Pterostylis gibbosa* (Illawarra Greenhood).

The additional information requested by the then DAWE that has been addressed in this report is summarised in Table 1.

The purpose of this Preliminary Documentation is to address the further information requested by the DAWE (Appendix C). This document includes the information contained in the referral document, where still relevant, and other relevant background studies, to provide all the relevant information in one report.

Table 1: Additional information requested by DAWE

Information requested by DAWE	Section
Description of the action, including • Location of works • Description of works • Timing and duration • Feasible alternatives • Consultation • State legislation assessment requirements • Planning schemes or policies relevant to the action area • How the action relates to any other action	Section 2
Species / communities for which further information is required The Department considers the following species and communities are likely to be significantly affected by the proposed action. Detailed information is required on the relevant impacts, proposed management and mitigation measures, and proposed offsetting measures for each of these species and communities: • Illawarra and South Coast Lowland Forest and Woodland – critically endangered • *Pterostylis gibbosa* (Illawarra Greenhood) – endangered	Sections 4, 5, 6 and 7
Impact Assessment • Potential impacts (direct, indirect, facilitated, cumulative) • Quantitative assessment of impacts • Assessment of impacts at the local and regional scale	Sections 5, 6 and 7
Avoidance and mitigation measures The PD must include a description of all proposed avoidance, mitigation and management measures to address each of the identified impacts for the above mentioned listed threatened species and communities, including any proposed environmental management plans.	Section 8
Koala Management Plan Your preliminary documentation must provide details of the proposed Koala Management Plan, as part of a Construction Environmental Management Plan, for the proposed action.	Section 8 and Appendix J
Offsets Significant residual impacts (i.e. after any avoidance and mitigation measures have been considered) on any listed threatened species or community must be offset in accordance with the Department's EPBC Environmental Offsets Policy 2012 and offset assessment guide, or other endorsed offset framework (see separate heading below).	Section 8
Social and economic matters Consider the following: • consideration of both costs (e.g. disruption to existing community infrastructure or environmental features) and benefits (e.g. increased housing or employment) • consideration of different scales of impact where relevant (e.g. local, regional, and national) • estimated capital value and ongoing economic value, using specific dollar or other numerical values where relevant. • Discussion of public consultation undertaken to date • Discussion of any contributions	Section 2.6
Environmental history of the person proposing to take the action Your preliminary documentation must provide details of any proceedings under a Commonwealth, state or territory law for the protection of the environment, or the conservation and sustainable use of natural resources, against the person proposing to take the action (or if the person is a corporation, its executive	Section 2.6

Information requested by DAWE	Section
officers, and if the person is a subsidiary of another corporation, the history of the parent body and its executive officers).	

2. Introduction

2.1 Proponent

The designated proponent for the Calderwood residential development is Lendlease Communities (Calderwood) Pty Limited.

The contact for the Commonwealth assessment of the proposed action is:

Mark Anderson

Senior Development Manager, Communities

Level 14, Tower Three, International Towers Sydney

Exchange Place, 300 Barangaroo Avenue, Barangaroo NSW 2000

M 0419 148 853 | mark.anderson@lendlease.com

2.2 Site description

The action area forms part of the Calderwood Urban Development Project (CUDP) and is in the Calderwood Valley, in the Illawarra Region of NSW; approximately 20 km south west of Wollongong. The Calderwood Valley is bound by rural land to the north, east and west, the remaining stages of the CUDP to the south and to the south and south east, the existing suburbs of Tullimbar and Albion Park. Marshall Mount Creek runs through the centre of the action area. Existing main roads include Calderwood Road, Marshall Mount Road and Escarpment Drive. The action area is 299.97 ha and mostly comprises land previously used for agricultural purposes and is dominated by exotic pasture grasses. The action area also contains remnant patches of native vegetation along Marshall Mount Creek, and in three discrete patches across the action area. There are small patches of vegetation that have been opportunistically retained as part of the rural landscape and are generally in poor to moderate condition with some areas suffering from significant weed encroachment.

2.3 Background to the proposed action

Lendlease Communities (Calderwood) Pty Ltd (LLC) are proposing to develop a residential and commercial subdivision; including all associated ancillary infrastructure. The action area is located within the existing CUDP, previously referred to the Commonwealth on 2 March 2010 (EPBC 2010/5381). The Commonwealth determined that the proposed action was not a controlled action on 30 March 2010 and further assessment and approval under the EPBC Act was not required. Since this decision was made, Lendlease Communities (Calderwood) lodged a modification (Mod 4) to the existing transitional Part 3A Concept Plan approval for the then NSW DPIE approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act). Mod 4 was approved on 21 May 2021. As a result, limited areas of the CUDP now differ to the previously referred action. To take a precautionary approach and as a matter of abundant caution, LLC submitted a second referral to assess the impacts associated with Mod 4 (EPBC 2021/8981).

Mod 4 increased the lot yield across some stages of the Project, which are focused in and around the future town centre. The referral and this Preliminary Documentation focus on the areas which are

affected by Mod 4. Although the lot yield was proposed to increase, the development footprint has not increased with all impacts contained within the existing footprint, which had been submitted as part of the 2010 referral. The proposed action covers the following stages of the CUDP: stages 4, Town Centre East, Town Centre South, Town Centre North, Town Centre Core, 7A and 7B, 8-12.

The remaining stages of the CUDP are not affected by Mod 4 and as such are not included in this Preliminary Documentation.

2.4 Proposed action

This Preliminary Documentation covers the stages affected by Mod 4, being stages:

- 4
- Town Centre East
- Town Centre South
- Town Centre North
- Town Centre Core
- 7A and 7B, 8-12.

For the purposes of this report, the aforementioned stages will be referred to as the 'action area'. The proposed action encompasses the action area, which will be completed over approximately 10 years. Development will deliver a variety of lot sizes and dwelling types based upon current market demand for smaller housing / lot sizes; as well as a town centre with commercial and retail floor space and community parks. The majority of existing native vegetation will be retained within the action area, namely the existing patches of Illawarra and South Coast Lowland Forest and Woodland and the native vegetation along Marshall Mount Creek (Appendix C, Figure 4, page 4). To facilitate the residential development, extensions and upgrades of associated supporting infrastructure and services will be required. More specifically, the proposed action will involve:

- site preparation (earthworks and grading and associated noise, light and dust disturbance)
- residential lots in proximity to the existing township already completed at the CUDP
- town centre with large commercial and retail floor space
- utilities and services
- roads, bridge and pathways
- car parks
- local parks / open space
- ancillary infrastructure
- conservation land protection.

To facilitate these works, clearing of native vegetation will be required. Impacts to MNES as a result of result of clearing is described in this report.

2.5 Development footprint

The action area is approximately 299.97 ha, with 232.21 ha proposed for development (development footprint / disturbance footprint) and 68.23 ha proposed for retention for open space and conservation purposes.

2.6 Social and Economic

The proposed action would contribute to the following to social amenities within the locality:

- Mixed interactive dwellings
- Community facilities
- Libraries
- Open space
- Schools
- Childcare.

The contribution to social amenities has been based on Council requirements and the estimated population size (Elton Consulting 2018). Indicatively, the contribution would include:

- An additional 300sqm of community centre space bringing the total size of the community facility required to serve the needs of the Calderwood population to 1,200sqm
- An additional 220sqm of library space, bringing the total library floor space contributions to 845sqm
- Based on a population of 16,750 people and applying the 2.83ha per 1000 people standard, the CUDP population would create demand for a total of 47.4ha, an additional 14.2ha to what was included in the Approved Concept Plan. Using the 50/50 split between active and passive open space, this would comprise:
  - > 23.7ha for district sporting grounds (active open space)
  - > 23,7ha for local, district and city-wide parks (passive open space).
- Two primary schools (one 3ha site, another 2ha site) and one high school of 6ha
- Childcare centres to provide places for approximately 105 children.

The detail underpinning the analysis is contained in a full report accompanying this letter.

The expected economic contributions of the proposed action are (Delfin Lendlease 2010):

- the project will inject (directly) an estimated $2.9 billion into the local economy during the construction period in the form of payments to goods and service providers;
- 'leakages' or losses of these payment and jobs will be minimised by preferring the use of local construction inputs and labour where possible;
- direct construction expenditures and expenditures by incoming residents will create an additional PV$6.3 billion in net value for the Shellharbour Local Government Area (LGA) economy over the project period. Any cost to government should be viewed in the context of the size of the economic impacts and public benefits;
- the local construction sector will enjoy a large proportion of the additional value created during the initial phases, while the services and retailing sectors become the main beneficiaries as residents move in;
- the Project will assist in maintaining existing employment positions, particularly in the construction sector, and create an additional 7,925 full time equivalent (FTE) positions, with around 5,260 of these located in the Shellhabour LGA. This yields a high job containment ratio of over 60% for the development;

- the proponent's pro-active employment initiatives will further contribute to the employment of Shellharbour residents;
- the significant market entry level housing component would help reduce housing stress and encourage economic activity by attracting and retaining a skilled and younger labour force and increasing disposable incomes of residents; and
- the increase in housing mix and affordability would generate a range of benefits to residents including, but not limited to, better access to employment, training and educational resources, while the community would also benefit through impacts such as improved local amenity.

2.7 Environmental record of the proponent

Lendlease Communities (Calderwood) Pty Ltd is a subsidiary of the Lendlease Corporation. Lendlease Corporation has an exemplary record of environmental management and sustainability at state, national and international levels.

Lendlease has worked closely with community as well as local and state authorities to ensure site-responsive outcomes on its projects. Examples of this include returned effluent treatment and reuse systems, seed collection and propagation programmes with both Landcare and Greening Australia, undertaking HIA Green Smart Programmes across a number of projects, provision of site-based management plans across all communities, generation of site based urban design outcomes (in consultation with local authorities), water recycling programmes at a number of communities, waterway and corridor management plans ensuring no impact into downstream wetlands and builders water recycling programs.

Additional to this, Lendlease undertakes community education and interaction programmes across its communities to create a high level of social capital. Lendlease also uses local Supply Nation certified first nations business to undertake ecological restoration work.

Lendlease has won numerous state and national awards for master planned communities. These awards are recognition for the comprehensive planning and implementation of site-specific outcomes in working with all constraints including the provision of environmental and sustainability initiatives.

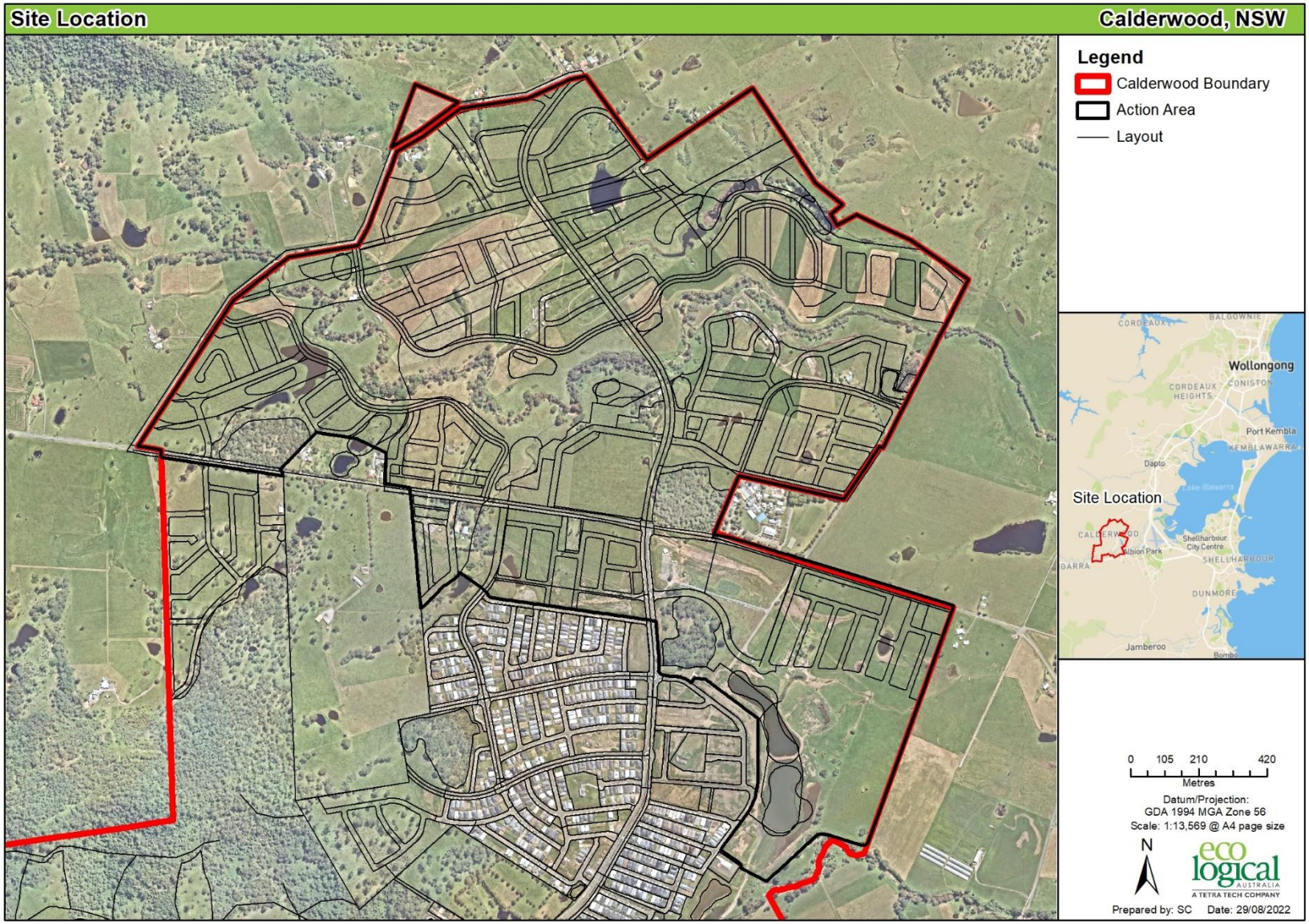

Figure 1: Location of the action area

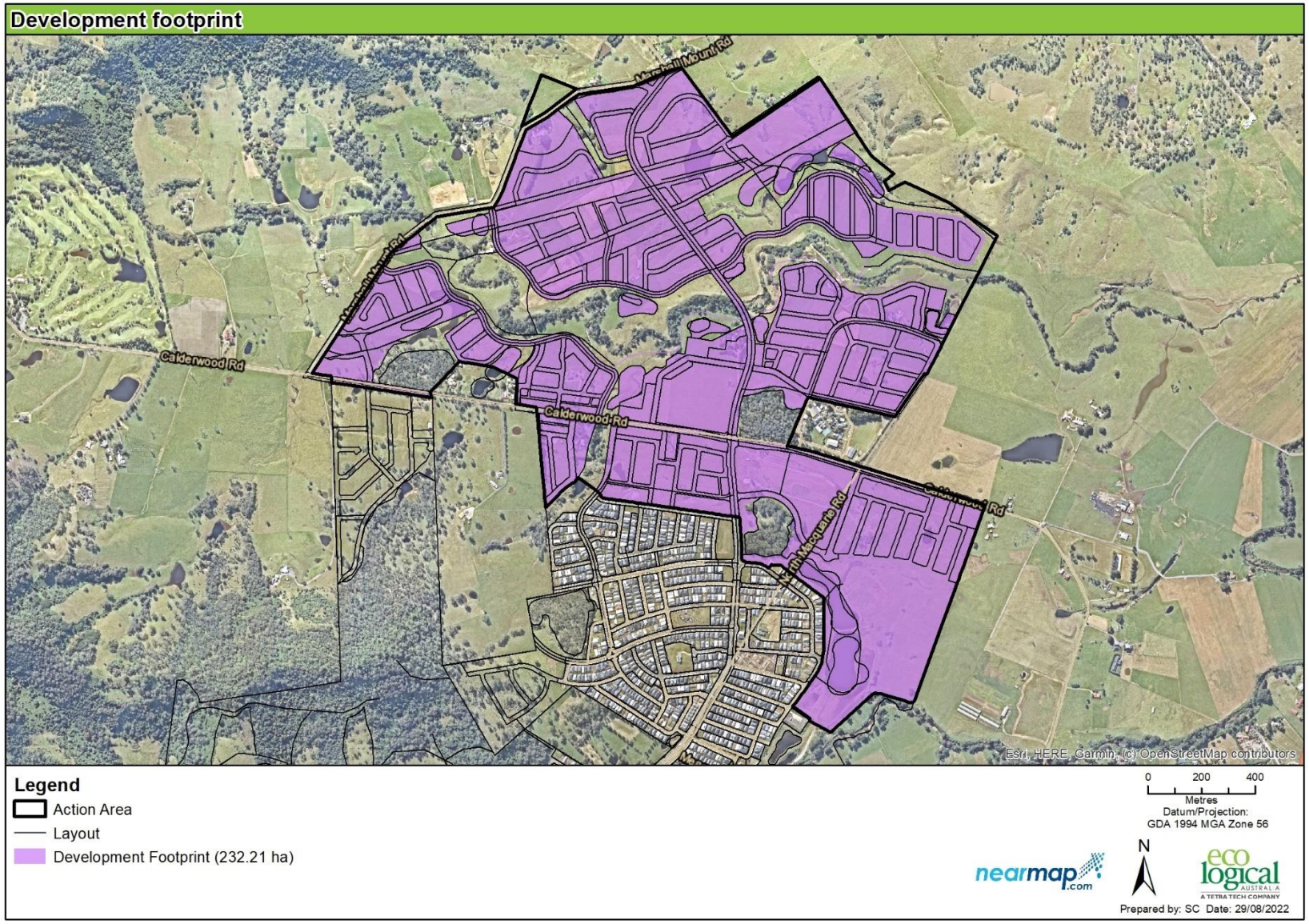

Figure 2: Development footprint in the action area

3. Legislative context and other assessments

3.1 Environmental impact assessments under Commonwealth or State legislation

The proposed action is seeking approval for subdivision, early site establishment works and subsequent urban development and associated infrastructure (power, water, sewerage and other utilities). This action has been written to consider the overall (total) impact on the site's environmental values for all stages of work and is based on the proposed layout plan for the action area. The proposed development will be staged over an indicative ten-year timeframe (subject to demand for housing lots).

3.1.1 Commonwealth legislation

Lendlease Communities (Calderwood) Pty Ltd (LLC) are proposing to develop a residential and commercial subdivision; including all associated ancillary infrastructure. The action area is located within the existing CUDP, previously referred to the Commonwealth on 2 March 2010 (EPBC 2010/5381). The Commonwealth determined that the proposed action was not a controlled action on 30 March 2010 and further assessment and approval under the EPBC Act was not required. Since this decision was made, Lendlease Communities (Calderwood) lodged a modification (Mod 4) to the existing transitional Part 3A Concept Plan approval for the then NSW DPIE approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act). Mod 4 was approved on 21 May 2021. As a result, limited areas of the CUDP now differ to the previously referred action. To take a precautionary approach and as a matter of abundant caution, LLC submitted a second referral to assess the impacts associated with Mod 4 (EPBC 2021/8981).

Mod 4 increased the lot yield across some stages of the Project, which are focused in and around the future town centre. The referral and this Preliminary Documentation focuses on the areas which are affected by Mod 4. Although the lot yield was proposed to increase, the development footprint has not increased with all impacts contained within the existing footprint, which had been submitted as part of the 2010 referral. The proposed action covers the following stages of the CUDP: stages 4, Town Centre East, Town Centre South, Town Centre North, Town Centre Core 7A and 7B, 8-12.

3.1.2 State legislation

Lendlease submitted a concept plan under the former part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (now repealed and replaced with State Significant Development and State Significant Infrastructure) for a development on approximately 700 ha of land for approximately 4,800 dwellings, 50 ha of mixed-use land, open space and land for environmental protection, and associated infrastructure.

On 8 December 2010 the Minister for Planning determined (with modifications) the Approved Concept Plan. Following approval of the Concept Plan, on 14 January 2011 Schedule 3 of State Environmental Planning Policy (Major Development) 2005 (now the State Significant Precincts SEPP) was amended to establish zoning and other planning controls for the CUDP.

The Approved Concept Plan comprised the plans, drawings and documents cited by the proponent in its Environmental Assessment, Preferred Project Report and Statement of Commitments, subject to the modifications and further assessment requirements set out in Schedule 2 of the Concept Plan notice of

determination. A Consolidated Concept Plan was prepared in March 2011 that includes the approved Concept Plan documentation.

Together, the planning controls at Schedule 3 of the State Significant Precincts SEPP and the Approved Concept Plan establish the statutory planning regime for the development of the CUDP.

The proposed Mod 4 sought to increase the total provision of housing (approximate number of dwellings) within the overall CUDP from 4,800 to 6,500 dwellings. The increase in dwellings was proposed without any expansion of the footprint of urban zoned land (residential and mixed-use zoned land) and without any change to the minimum lot sizes permitted under State Environmental Planning Policy (State Significant Precincts) 2005 (State Significant Precincts SEPP). It was also proposed without any change to the areas of land already approved for residential and other urban development under the existing Concept Plan Approval.

Mod 4 was approved by the delegate for the Minister of Planning on 21 May 2021.

3.2 Public consultation

During the process to obtain approval for Mod 4, the proposed modification was publicly exhibited with about 70 submissions received from local government, state government agencies and the public.

4. Matters of National Environmental Significance

4.1 DAWE requirements

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a Matter of National Environmental Significance (MNES) requires approval from the Australian Government Minister of the Environment (the Minister). An assessment of MNES relevant to the proposed action was conducted prior to the referral of the proposed action using:

- literature review, including a search of DCCEEW's Protected Matters Search Tool (PMST)
- review of relevant databases including the BioNet Atlas of NSW Wildlife
- extensive biodiversity and ecological surveys of the action area conducted between 2009 and 2020 as outlined below.

From the information provided in the referral, DCCEEW considered that the following community and species listed under the EPBC Act (MNES) are likely to be significantly affected by the proposed action:

- Illawarra and South Coast Lowland Forest and Woodland
- *Pterostylis gibbosa* (Illawarra Greenhood).

No other MNES were listed as being potentially affected in the Preliminary Documentation request, however for abundant clarity the following previously assessed MNES have been included in this report:

- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Chalinolobus dwyeri* (Large-eared Pied Bat).

4.2 Protected Matters Search Tool

A search of the EPBC Act Protected Matters Search Tool (PMST) and NSW BioNet database was undertaken on 23 August 2022 and returned 10 listed threatened ecological communities, 90 listed threatened species and 44 migratory birds as potentially occurring within 5 km of the proposed action area. These MNES are listed in Appendix E along with the likelihood of occurrence based on targeted field surveys and habitat present on the site (Appendix G). There is no marine habitat on site, so marine species have been excluded from these lists. Figure 3 show the general location of these records within a 5 km radius of the action area.

A number of MNES that have been predicted as likely to occur within a 5 km radius of the action area, and could occur in Illawarra and South Coast Lowland Forest and Woodland have already been excluded from consideration in the PD Report by ELA and DCCEEW, based on the results of targeted survey since 2010. Of the MNES predicted as likely to occur within 5 km of the action area, the following are either known or considered highly likely to occur:

- Illawarra and South Coast Lowland Forest and Woodland - known
- *Pteropus poliocephalus* (Grey-headed Flying-fox) – predicted
- *Chalinolobus dwyeri* (Large-eared Pied Bat) – known (foraging only).

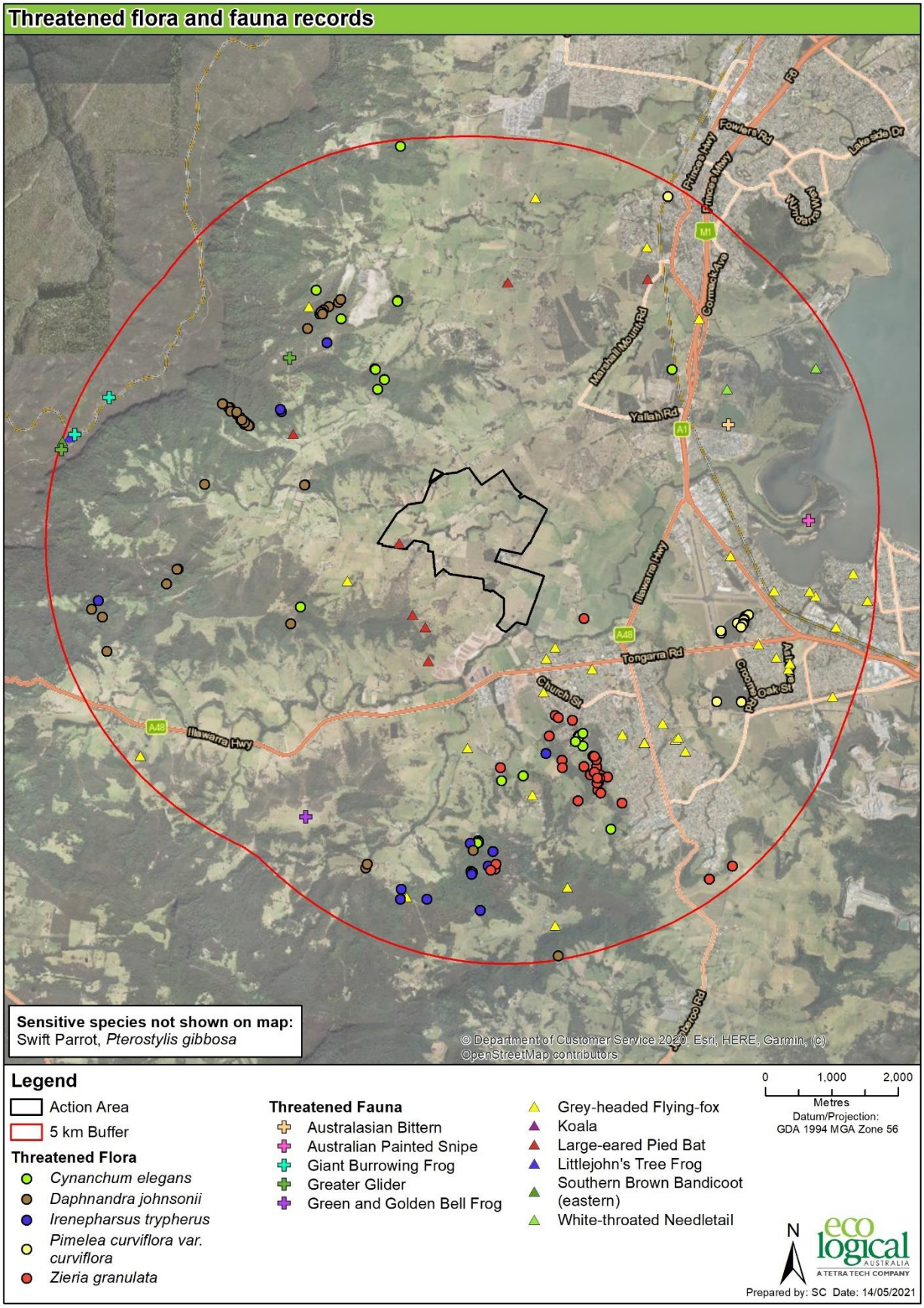

Figure 3: EPBC Act listed threatened flora and fauna within a 5 km radius of the action area

4.3 Field survey methodology

Numerous field surveys and impact assessments have been conducted for the site:

- Eco Logical Australia 2010. Calderwood Urban Development Project – Flora and Fauna Assessment. Prepared for Delfin Lendlease.
- Eco Logical Australia 2012. Targeted survey of *Pterostylis gibbosa* (Illawarra Greenhood) for the Calderwood Urban Development Project. Prepared for Lendlease.
- Eco Logical Australia 2018. Validation of *Environment Protection and Biodiversity Conservation Act 1999* listed Illawarra and South Coast Lowland Forest and Woodland, Calderwood Urban Development Project. Prepared for Lendlease.
- Eco Logical Australia 2018. Modification to Calderwood Part 3A Concept Plan Biodiversity Assessment. Prepared for Lendlease.

4.3.1 Threatened ecological communities

Vegetation validation was conducted across the action area in 2009, 2018, 2021 and 2022 (Table 4). A seven (7) person day field survey was completed across the action area in 2009 which employed the random meander method to validate vegetation community and condition mapping (each polygon mapped as part of the desktop assessment was visited). Vegetation condition was determined using the rules outlined in Table 2 and the vegetation present was assigned to the best fit mapping units consistent with the NPWS 2004 vegetation mapping. The rules outlined in Table 2 are based on the NPWS vegetation mapping codes for regional vegetation mapping projects.

Prior to the 2018 field survey, an assessment was completed to determine the relationship between the previously validated vegetation communities (ELA 2010) and any EPBC Act listed communities (Table 3). This was completed by reviewing the NPWS 2004 mapping unit descriptions, the BC Act Final Determinations and the EPBC Act conservation advice and listing advice for Illawarra and South Coast Lowland Forest and Woodland and River-flat Eucalypt Forest. The assessment determined that Lowland Woollybutt Melaleuca Forest and Riparian River Oak Forest can both be associated with EPBC Act listed communities. This was used to identify patches of vegetation in the action area that required additional survey.

Table 2: Rules used to determine vegetation condition during the 2010 survey (ELA 2010)

Condition code	Condition description	Indicates the following patterns*
A**	Low Disturbance	No visible signs of disturbance from air. Polygon may have some established tracks dissecting. Evidence of weeds may not be visible or only identified during field investigation, generally at low intensity. Gaps in canopy are more likely to be natural dynamic between rainforest/eucalypt structures.
B	Moderate Disturbance	A polygon may exhibit >75% integrity in forest canopy structure but contains features such as single or multiple canopy gaps where weed infestations have developed from light penetration. The polygon may also be marked by several poorly developed trails dissecting path or evidence of human disturbance such as clearing or understorey patchiness

Condition code	Condition description	Indicates the following patterns*
		Includes areas of regenerating vegetation
C	High Disturbance, Regenerating vegetation	Common around areas of previous mining and clearing. Dense weed infestations dominate the understorey or canopy. Structure of vegetation is limited to canopy and dense weed understorey. In some areas canopy may include exotic species amongst natives. Canopy gaps are clearly apparent, and evidence of soil disturbance may be apparent, as may be evidence of previous mining activities or clearing.
TX	Scattered trees (thinned canopy)	A regular feature of native vegetation cover in disturbed environments is the presence of scattered trees above an open or absent understorey in a mosaic of cleared and remnant vegetation. A code "Tx" was applied where Crown Canopy Projected Density (CCPD) of tree cover fell below ten percent. A minimum mapping area of 0.5 hectares was used.
EX	Excluded from assessment process	Excluded map units are: Cleared, Modified Lands, Water, Weeds and Exotics

Table 3: Relationship between NPWS 2004 vegetation communities and EPBC Act listed communities

Sub-community (NPWS 2004)	PCT association	BC Act listed community	EPBC Act listed community
Artificial Wetland	N/A	N/A	N/A
Lowland Woollybutt Melaleuca Forest	PCT 1326 Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Illawarra Lowlands Grassy Woodland	Illawarra and South Coast Lowland Forest and Woodland
Riparian River Oak Forest	PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	River-flat Eucalypt Forest	River-flat Eucalypt Forest
Weeds and Exotics.	N/A	N/A	N/A

The results of the 2009 field survey were used as a base map for all future survey. Survey was conducted by ELA in 2018 and 2021 to determine the extent of EPBC Act listed *Illawarra and South Coast Lowland Forest and Woodland* and *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* across the CUDP. The 2018 surveys were limited to areas of each stage that had previously been mapped as vegetation communities likely to correspond with Illawarra and South Coast Lowland Forest and Woodland; Lowland Woollybutt Melaleuca Forest (ELA 2010; Table 3). Each patch was assessed against the condition thresholds listed in the *Approved Conservation Advice for Illawarra and South Coast Lowland Forest and Woodland* (DotEE 2016). Each patch was traversed to document the following:

- presence of structural layers
- presence of large trees or trees with hollows
- species present in groundcover (native or exotic) including estimations of percentage of cover for native species
- contiguity of the patch with other patches in the surrounding landscape.

Where patches were in proximity to other patches of Illawarra and South Coast Lowland Forest and Woodland a rapid assessment of the neighbouring patch was conducted to determine whether it would meet the EPBC Act definition of the community. This allowed accurate mapping of all 30 m buffers to all Illawarra and South Coast Lowland Forest and Woodland. A 30 m buffer was applied to all EPBC Act patches to be consistent with the Approved Conservation Advice (DotEE 2016). Where existing vegetation polygons required refining, they were re-mapped using Arc Collector 10.2 while out in the field.

The 2021 field survey was limited to the vegetation along Marshall Mount Creek that was previously mapped as Riparian River-oak Forest (Figure 5, ELA 2010). The vegetation was assessed against the condition thresholds listed in *Conservation Advice for the River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* (DAWE 2020) by completing a random meander along all accessible portions of the creek. Two full floristic vegetation plots consistent with the NSW Biodiversity Assessment Method were also completed to determine the composition and structure of the patch. This assessment included documenting all flora species present, their relative cover and abundance in a 20 m x 20 m plot, and the presence / absence of hollows, fallen logs and leaf litter in a 20 x 50 m plot.

Consistent with the conservation advice thresholds, the following was considered during the field survey:

- has a canopy dominated by one or a combination of the following species: *Angophora floribunda, A. subvelutina, Eucalyptus amplifolia, E. baueriana, E. benthamii, E. bosistoana, E. botryoides, E. botryoides x E. saligna, E. elata, E. grandis, E. longifolia, E. moluccana, E. ovata, E. saligna, E. tereticornis, E. viminalis*.
- patch size ≥ 0.5 ha
- groundcover comprised of ≥ 30% perennial native species
- at least ≥ 4 native species per sample plot (0.4 x 0.4 ha).

The length of Marshall Mount Creek within the action area was treated as one large patch, consistent with the EPBC Act conservation advice (DAWE 2020).

The 2022 field survey was conducted by ELA Ecologists Alex Gorey and Mel Chapman for a total of 16 person hours and focused on completing one full vegetation integrity plot consistent with the Biodiversity Assessment Method (BAM) in each patch of Illawarra and South Coast Lowland Forest and Woodland (Patches 2, 10 and 11). Prior to establishing the location for the plot, a random meander was completed in each patch to identify any variation in condition or composition across the patch.

Table 4: Vegetation validation field survey dates

Date	Staff	Methodology	Hours or person days
21 October 2009	Liz Norris, Simon Tweed, Steven House	Random meander	3 person days
22 October 2009	Liz Norris, Simon Tweed	Random meander	2 person days
23 October 2009	Liz Norris, Simon Tweed	Random meaner	2 person days
31 August 2018	Alex Gorey, Dr Meredith Henderson	Validation of EPBC Act listed threatened ecological communities	16 hours
3 September 2018	Alex Gorey, Dr Meredith Henderson	Validation of EPBC Act listed threatened ecological communities	16 hours
18 September 2018	Alex Gorey, Dr Meredith Henderson	Validation of EPBC Act listed threatened ecological communities	16 hours
9 February 2021	Alex Gorey, Jake Proust	Validation of EPBC Act listed threatened ecological communities	18 hours
17 August 2022	Alex Gorey, Mel Chapman	Full vegetation integrity plots	16 hours

4.3.2 Threatened flora

Survey effort for *Pterostylis gibbosa* was conducted across the entire CUDP, however the following methodology only discusses the action area.

Survey effort for *Pterostylis gibbosa* was completed over two survey periods:

- September 2012
- September 2022.

4.3.2.1 Checking reference population

Prior to completing targeted survey across the action area in 2012 and 2022, a known population of *Pterostylis gibbosa*, approximately 3-4 km east-south-east of the action area, was visited on 10 September 2012 to confirm that the species was flowering and therefore easily detectable. This population of approximately 1,000 individuals, located in a remnant of Woollybutt-Melaleuca forest (equivalent to the EPBC Act listing of Illawarra and South Coast Lowland Forest and Woodland) on the Croom Regional Sporting Complex, is thought to be the largest of the Illawarra / Nowra populations (NPWS 2002; Alan Stephenson pers. comm.). The flowering of most terrestrial orchids is highly dependent on adequate rainfall in the preceding months and in dry seasons the plants may not flower at all. It was therefore important to verify that the autumn/winter rainfall of 2012 was sufficient to allow the Albion Park plants to flower.

The site visit to Croom on 10 September 2012 found that the species was in full flower with at least 30 flowering individuals observed within a few square metres (Appendix G).

The site visit to Croom on 7 September 2022 identified the reference population in flower. The timing of the targeted survey of the action area in the following two days was therefore considered to be ideal as any individuals present at the action area would most likely have also been in full flower.

4.3.2.2 September 2012 surveys

The three remnants mapped in Figure 4 were all surveyed on either 10 or 11 September by Dr Lachlan Copeland and Kimberley McCallum of Eco Logical Australia. Lachlan Copeland is an orchid expert with 15 years of experience in searching for, mapping, photographing and reporting on native orchid species. Kimberley McCallum, also an experienced field ecologist, was able to observe the plants flowering at Croom to become familiar with the species (both flowering plants and non-flowering rosettes) prior to the targeted surveys in the action area.

Both ecologists walked a series of parallel transects throughout Sites 1 (stages Town Centre North / Town Centre Centre), 2 (stages 7B and 7A) and 3 (stages Town Centre South and Town Centre East) approximately 10-15 m apart searching for suitable microhabitat (relatively bare ground with a predominantly native ground layer). The intention was to search more thoroughly in suitable microhabitat at a sufficiently slow enough speed to find any flowering or non-flowering individuals of *Pterostylis gibbosa*. Both ecologists carried a handheld Garmin GPS with the track function activated to record and later overlay their tracks on a series of fine-scale maps.

4.3.2.3 September 2022 surveys

The three remnants mapped in Figure 4 were all surveyed on 6 September by Robert Humphries and Izak Schoon of Eco Logical Australia. Both Robert and Izak are ecologists with experience in searching for, mapping, photographing and reporting on native orchid species. Both Robert and Izak have previously surveyed for and identified *Pterostylis gibbosa* in the field and have conducted numerous surveys for orchids.

Both ecologists walked a series of parallel transects in the outer 30 m of each patch of native vegetation at Sites 1 (stages Town Centre North / Town Centre Centre), 2 (stages 7B and 7A) and 3 (stages Town Centre South and Town Centre East). Parallel transects were approximately 10-15 m apart and focused on searching for individuals, including rosettes and flowering individuals. Given the concentration of the development footprint and potential indirect impacts limited to the outer 30 m of the patch, surveys throughout the entire patch were only proposed if individuals were identified in the outer 30 m.

Both ecologists carried a handheld Garmin GPS with the track function activated to record and later overlay their tracks on a series of fine-scale maps (Figure 4).

4.3.3 Threatened fauna

A terrestrial habitat assessment was conducted for the following MNES considered likely to occur across the action area:

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Pteropus poliocephalus* (Grey-headed Flying-fox).

The action area is in proximity to Johnson's Spur which forms a large, escarpment to the south west of the action area and was surveyed for potential rocky outcrops, cliffs, sandstone overhangs or caves that could be used as potential breeding habitat for the Large-eared Pied Bat. Survey for potential Large-

eared Pied Bat breeding habitat was completed by ELA ecologists Emily Messer and Rodney Armistead on 24 January 2019 and included traversing Johnson's Spur to identify any caves, cliffs, rocky outcrops or sandstone overhangs.

An assessment of nearby known camps and potential foraging resources in the action area was completed for Grey-headed Flying-fox during the vegetation validation surveys conducted in 2009, 2018, 2021 and 2022. Any potential feed tree species were noted.

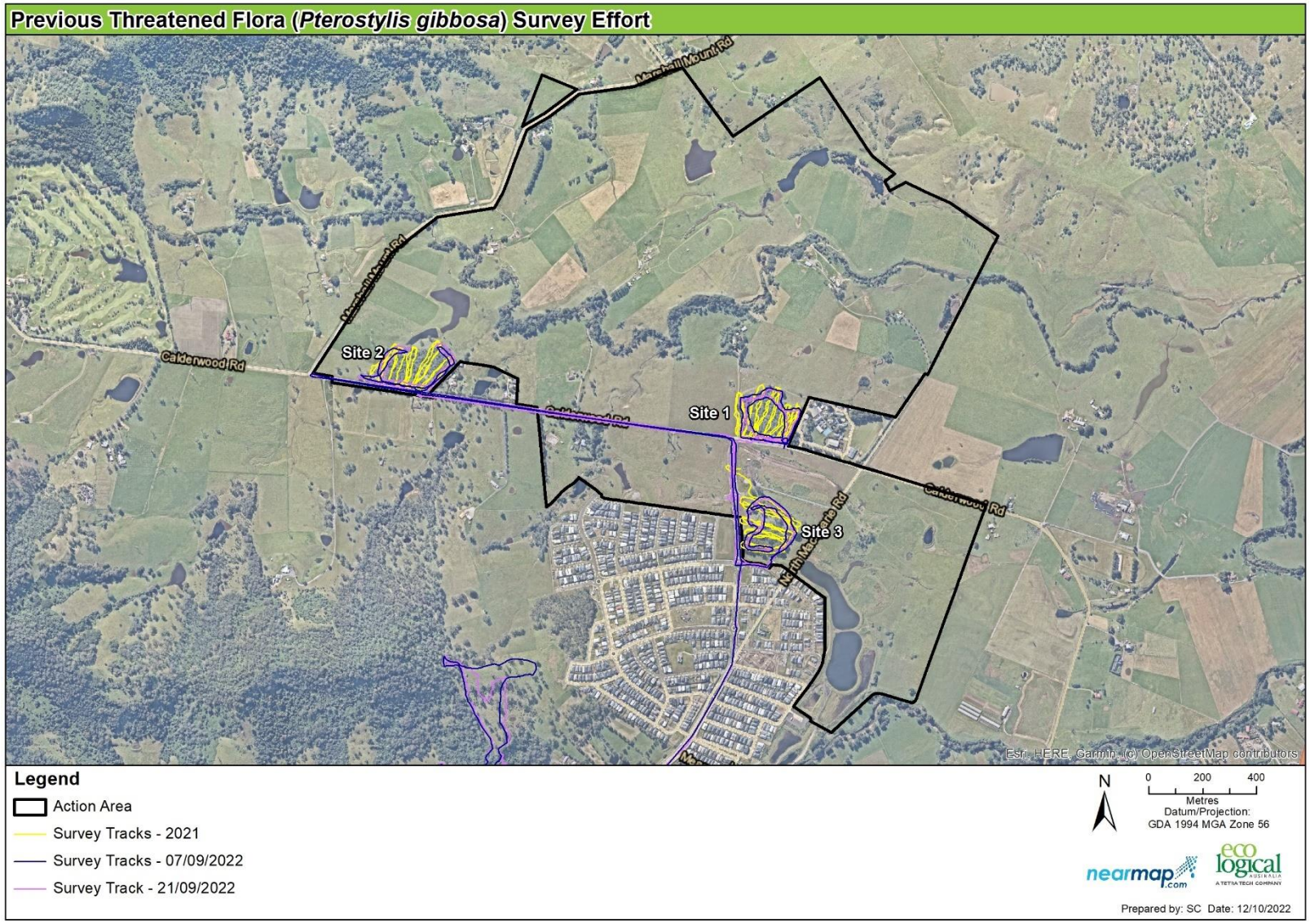

Figure 4: 2012 Survey effort for *Pterostylis gibbosa* across the action area

4.4 Results

4.4.1 Literature and data review

The literature and data review predicted the following MNES as either likely or having potential to occur across the action area:

Threatened ecological communities

- Illawarra and South Coast Lowland Forest and Woodland
- Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion
- River-flat Eucalypt Forest on Coastal Floodplains of NSW.

Threatened fauna

- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Chalinolobus dwyeri* (Large-eared Pied Bat) (Appendix C, Figure 7, page 7).

Threatened flora

- *Pterostylis gibbosa* (Illawarra Greenhood).

4.4.2 Vegetation communities

The 2009 field survey identified the following mapping units across the action area (Appendix C, Figure 8 page 8):

- Riparian River Oak Forest
- Artificial Wetland
- Lowland Woollybutt Melaleuca Forest
- Weeds and Exotics.

Riparian River Oak Forest was present along the banks of Marshall Mount Creek. There were two patches of Lowland Woollybutt Melaleuca Forest to the north of Calderwood Road with scattered stretches of artificial wetland mapped along the unnamed tributaries at the northern extent of the action area. Weeds and Exotics were mapped in two patches in the north western and south eastern corners of the action area. Riparian River Oak Forest was present in moderate condition. Lowland Woollybutt – Melaleuca Forest was present in two conditions; moderate to high levels of disturbance and scattered trees (Figure 5 and Figure 6). The artificial wetland and weeds and exotics were not assigned a condition category.

Table 5: Validated vegetation communities across the action area (ELA 2010)

ELA validated vegetation community	Total (ha)
Artificial Wetlands Unassessed	**6.70**
Coastal Grassy Red Gum Forest (Tx) – BC Act only	**0.23**
Fig Trees (Tx)	**0.09**
Lowland Woollybutt-Melaleuca Forest (B) – EPBC Act only	**7.00**
Lowland Woollybutt-Melaleuca Forest (TX) – BC Act only	**2.93**

ELA validated vegetation community	Total (ha)
Riparian River Oak Forest (C) – BC Act only	**12.09**
Weeds and Exotics Weeds and Exotics	**4.54**
Total	**33.59**

The 2018 survey to determine the presence of Illawarra and South Coast Lowland Forest and Woodland identified three patches which met the definition of the community; patches 2, 10 and 11. An assessment of each patch meeting the definition of Illawarra and South Coast Lowland Forest and Woodland in Table 6 is provided in Table 7. A 30 m buffer was applied to the edge of patch consistent with the conservation advice (Table 6, Table 7, Table 8). A 30 m buffer is consistent with the recommended buffer in the Conservation Advice for the community and will assist in minimising potential indirect impacts associated with the proposed action, such as rubbish dumping, sedimentation and erosion and weed encroachment.

The 2021 survey to determine the presence of River-flat Eucalypt Forest along Marshall Mount Creek determined that none of the previously mapped Riparian River Oak Forest met the EPBC Act definition of the community because:

- the community did not contain any *Eucalyptus* sp. and was dominated by *Casuarina cunninghamiana* subsp. *cunninghamiana*
- the groundcover contained < 10% perennial native species (determined through plot data – (Appendix H).

It was concluded that the patch of Riparian River Oak Forest does not meet the key diagnostic characteristics to be considered a patch of River-flat Eucalypt Forest consistent with the EPBC Act definition. Therefore, buffers were not applied to this community and further assessment under the EPBC Act is not required.

4.4.2.1 Illawarra and South Coast Lowland Forest and Woodland

The patches of Coastal Grassy Red Gum Forest and Lowland Woollybutt – Melaleuca Forest were assessed against the condition threshold in the conservation advice. Patches 2, 10 and 11 were all found to meet the EPBC Act definition of the community (Table 6 and Table 7).

JUSTIFICATION FOR EPBC ACT CONDITION

Table 6: EPBC Act condition thresholds for Illawarra and South Coast Lowland Forest and Woodland (Approved Conservation Advice DotEE 2016)

Category and rationale	Patch size thresholds	Biotic Threshold
A. High condition class. *A larger patch with good quality native understorey and / or many very large trees*	The patch is at least 2 ha	50% of its total understorey vegetation cover* is comprised of native species (exotic annuals are excluded from this assessment) **AND** At least 6 native plant species 0.5 ha in the ground layer **OR**

Category and rationale	Patch size thresholds	Biotic Threshold
		The patch has at least 10 trees that are either; very large (at least 60 cm DBH) or have hollows
B. High condition class *A patch with very good quality native understorey with a species rich ground layer*	The patch is at least 0.5 ha	At least 70% of the understorey vegetation cover* is comprised of native species (exotic annuals are excluded from this assessment) **AND** with at least 10 native plant species per 0.5 ha in the ground layer
C. Moderate condition class *A patch with good quality native understorey*	The patch is at least 0.5 ha	At least 50% of its total understorey vegetation cover* is comprised of native species (exotic annuals are excluded from this assessment) **AND** with at least 6 native plant species per 0.5 ha in the ground layer
D. Moderate condition class *A patch that makes other important ecological contributions*	The patch is at least 0.5 ha	At least 30% of total perennial understorey vegetative cover* is comprised of native species **AND** the patch is contiguous** with another patch of native vegetation *** (at least 1 ha in area) **OR** the patch has at least one large locally indigenous tree (at least 50 cm dbh), or at least one tree with hollows

**Understorey vegetation cover includes vascular plant species of both the ground layer and the shrub layer (where present). The ground layer includes herbs (graminoids and forbs) and low (≤0.5 m) shrubs, but does not include cryptogams, leaf litter or exposed soil.*

***Contiguous with another patch of native vegetation means the patch is continuous with or in close proximity (within 100 m) to another area of native vegetation.*

****'Native vegetation' refers to areas where ≥50% of the perennial vegetation cover is comprised of native plant species.*

Table 7: Justification for patches of EPBC Act Illawarra and South Coast Lowland Forest and Woodland in the action area (2018 survey results)

Patch	Stage	Condition class	Justification
2	Town Centre	A – High condition class	• patch size in action area 3.72 ha • groundcover comprised of ≥ 70% native species • contained at least 6 native groundcover species in each 0.5 ha of the patch
10	7B	A – High condition class	• patch size in action area 4.03 ha • contained ≥ 50% native groundcover species • contained 6 native species in each 0.5 ha of the patch
11	SP1 Extension	A – high condition class	• patch size in action area 2.88 ha • contained ≥ 50% native groundcover species • contained 6 native species in each 0.5 ha of the patch

Table 8: Justification for patches of EPBC Act Illawarra and South Coast Lowland Forest and Woodland in the action area (2022 survey results)

Patch	Stage	Condition class	Justification	Change in condition
2	Town Centre	A – High condition class	• patch size in action area 3.72 ha • groundcover comprised of ≥ 50% native species • contained at least 6 native groundcover species in each 0.5 ha of the patch	No - overall, condition remains mostly the same
10	7B	D – moderate condition class	• Patch size 4.03 ha • On average across the patch, groundcover > 30% native species • Patch contained trees with DBH > 50	Yes – condition has decreased, with cover of native species in the groundcover layer lower than in 2018.
11	SP1 Extension	A – high condition class	• patch size in action area 2.88 ha • contained ≥ 50% native groundcover species • contained 6 native species in each 0.5 ha of the patch	Some – higher proportion of exotic species in the groundcover in some areas of the patch.

DESCRIPTION OF CONDITIONS PRESENT IN THE ACTION AREA

The floristic composition and structure differed across the three patches due to their fragmentation and differences in current land use and land use history. A description of each patch is below.

Patch 2

Patch 2 is located adjacent to Town Centre and currently forms part of an agricultural landscape. The patch is currently subject to grazing pressures from horses and weed encroachment from the adjacent pasture grasses. The canopy was dominated by *Melaleuca linariifolia* (Flax-leaved Paperbark) and *Angophora floribunda* (Rough-barked Apple). The midstorey was largely absent with some scattered *Acacia binervata* and the groundcover was comprised of a mix of native and exotic species. Likely a

result of horse grazing, a majority of the patch contained plumes of the exotic *Sida rhombifolia* (Paddy's Lucerne) above a groundcover dominated by *Microlaena stipoides* var. *stipoides*. Other grasses, sedges and forbs were present, including *Entolasia stricta* (Wiry Panic), *Oplismenus aemulus* (Basket Grass), *Dianella prunina*, *Dichondra repens* (Kidney Weed) and *Centella asiatica* (Native Pennywort). Exotic species included *Paspalum dilatatum* (Paspalum), *Cenchrus clandestinus* (Kikuyu), *Lantana camara* (Lantana) and *Setaria parviflora* (Pigeon Grass).

The canopy was consistent across the patch with most stems mature and some above the large tree benchmark (50 DBH). There was evidence of canopy recruitment in the groundcover. The patch did not contain any hollow bearing trees, and fallen woody debris was limited. The presence of groundcover was mostly consistent across the patch with some small areas that did not contain any vegetation.

Patch 10

Patch 10 is in Stage 7B, along Calderwood Road and currently forms part of an agricultural landscape. The patch is currently subject to grazing pressures from cattle and weed encroachment from the adjacent pasture grasses. The canopy was diverse and was dominated by *Eucalyptus bosistoana* (Coast Grey Box), *Angophora floribunda* (Rough-barked Apple), *Melaleuca linariifolia* and *Eucalyptus eugenioides* (Thin-leaved Stringybark). The midstorey was largely absent, with scattered occurrences of *Daviesia genistifolia* (Broom Bitter Pea) and the exotic *Lantana camara* (Lantana). The groundcover was diverse and contained a mix of native and exotic species. The groundcover was dominated by *Microlaena stipoides* var. *stipoides, Entolasia marginata* (Bordered Panic), *Eragrostis brownii* (Browns Lovegrass), *Commelina cyanea*, *Solanum prinophyllum* and *Veronica plebeia* (Trailing Speedwell). The exotic *Cynodon dactylon* (Couch) was present in moderate abundance across the patch, with other exotic species including *Conyza bonariensis* (Flax-leaf Fleabane), *Trifolium repens* (White Clover) and *Hypochaeris radicata* (Catsear).

The patch contained both mature and juvenile canopy, however no regeneration of the canopy was identified. There was a moderate amount of woody debris, however no obvious hollows throughout the patch.

The overall condition of patch 10 has decreased since the 2018 surveys. The groundcover has a higher proportion of exotic species. This is likely a result of land use, both within and surrounding the patch. The continued cattle grazing and pressure from adjacent exotic pasture grasses has likely lowered the condition of the patch.

Patch 11

Patch 11 is in Stage Sp1 Extension and was previously part of an agricultural landscape. The patch is now fenced off with ATF fencing. The patch remains surrounded by exotic pasture grasses which continue to put pressure on the patch. The canopy was dominated by *Eucalyptus pilularis* (Blackbutt), with *Pittosporum undulatum* (Sweet Pittosporum) present in the midstorey. Some isolated occurrences of *Lantana camara* were also present in the midstorey. The groundcover varied in composition, with some areas being dominated by *Microlaena stipoides* var. *stipoides,* and other areas dominated by *Cenchrus clandestinus*. Where the groundcover was dominated by native species, *Microlaena stipoides* var. *stipoides* comprised approximately 90% of the groundcover, with other native species including *Imperata cylindrica* (Blady Grass), *Entolasia marginata, Glycine clandestina, Geranium homeanum* and

Echinopogon caespitosum (Bushy Hedgehog Grass). The cover and abundance of exotic species varied. Where present, exotic species included *Andropogon virginicus, Setaria parviflora, Delairea odorata* and *Ehrharta erecta* (Panic Veldt Grass).

Across the patch, the canopy was mature with very few trees under a DBH of 50. There was some recruitment of the canopy in the groundcover. The patch also contained woody debris, some of which was a result of previous clearing practices.

Table 9: Illawarra and South Coast Lowland Forest and Woodland to be affected and retained across the action area

EPBC Condition Category	Patch number	Total
A – high condition class	2	3.67
D – Moderate condition class	10	4.03
A – high condition class	11	2.88
	Total	**10.58**

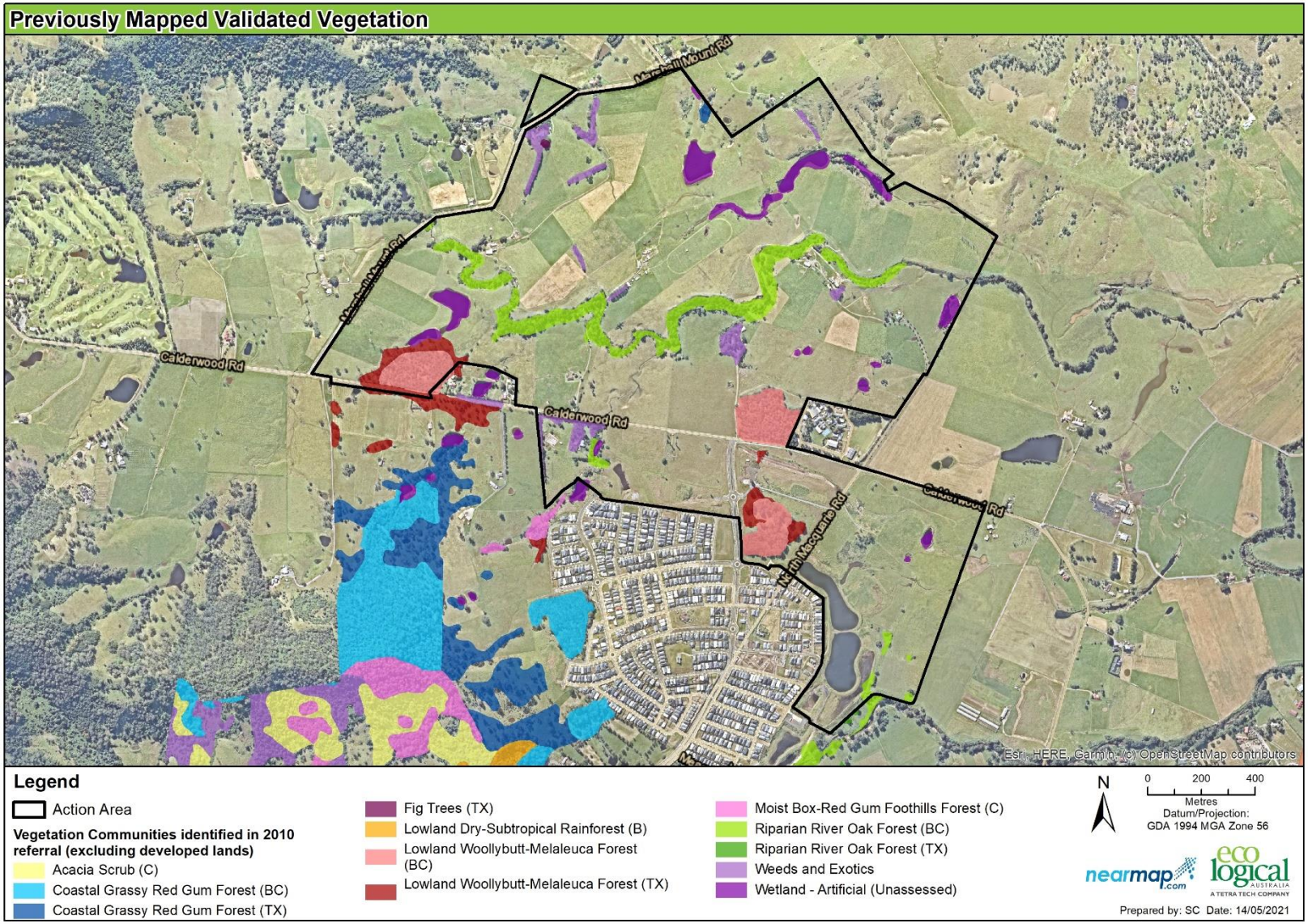

Figure 5: Previously mapped validated vegetation communities in the action area (ELA 2010)

Figure 6: Validated EPBC Act listed Illawarra and South Coast Lowland Forest and Woodland across the action area

4.4.3 Threatened species habitat assessment

Field survey determined that the action area and the adjacent Johnson's Spur do not contain any potential habitat for the Large-eared Pied Bat. The Large-eared Pied Bat relies on cliffs, caves or rocky overhangs which are used for breeding in proximity to foraging resources. The action area and Johnson's Spur do not contain any landscape features that would be used as breeding habitat for the Large-eared Pied Bat. There are no other landscape features within a foraging range (2 km) of the action area that could be used as breeding habitat. However, there are nearby records for this species which suggest it may utilise the action area occasionally as a foraging resource. It was concluded that this species would utilise the action area occasionally for foraging, however no breeding habitat is present and the foraging habitat would form part of a rage of resources within the region.

Potential foraging habitat for the Grey-headed Flying-fox was identified across the action area. All patches of the following vegetation communities were considered potential habitat:

- Lowland Woollybutt Melaleuca Forest
- Riparian River Oak Forest.

No camps were identified in the action area during survey. The closest known camp is 17 km north east (Figtree) and 17 km south east at Shellharbour. The action area is considered potential habitat for the Grey-headed Flying-fox and further assessment is required, which is set out in section 2.4 of this Referral.

4.4.4 Threatened flora

Targeted Pterostylis gibbosa survey

No *Pterostylis gibbosa* individuals were identified in the action area during the 2012 and 2022 survey. In 2012, Orchid Expert Lachlan Copeland determined that the action area did not provide suitable habitat for *Pterostylis gibbosa* (Appendix G). The 2022 survey effort confirmed the conclusions reached in the 2012 survey. Since the completion of the 2012 surveys, the condition of the native vegetation and impacts from grazing and agricultural practices has decreased the condition of the native vegetation present. Across each of the three sites, the groundcover did not represent suitable microhabtiat for this species.

Site 1

This remnant patch had a well-developed tree layer of *Eucalyptus longifolia* (Woollybutt) and *Melaleuca decora* (Paperbark) ranging from 8-15 m tall with an average projected foliage cover of about 50%. Beneath the tree layer were occasional shrubs of *Acacia binervata* (Two-veined Hickory), *Kunzea ambigua* (Tick Bush) and *Cassinia quinquefaria* (Dogwood) – this 2-5 m shrub layer ranged from absent in most areas to sparse in others with a cover of approximately 10%. The ground layer was relatively dense (ranging from 20-50% cover) and averaged 1-1.5 m in height.

By far the most common species was *Sida rhombifolia* (Paddy's Lucerne), an exotic forb common in heavily grazed environments. Other common weeds included *Verbena litoralis* (Purpletop) and *Rubus anglocandicans* (Blackberry). A low grass layer of *Microlaena stipoides* (Meadow Grass) and the introduced *Cenchrus clandestinus* (Kikuyu) ranged from sparse to dense throughout the site.

No plants of *Pterostylis gibbosa* or any other orchid were found in this patch. Accordingly, the species is considered highly unlikely to occur given the long history of grazing and very weedy, highly disturbed understorey. The area may well have once provided good habitat for the *Pterostylis gibbosa* in the past but is now very poor habitat given the dominance of weeds and heavy grazing. The 2022 survey confirmed the ongoing impacts of grazing and agricultural practices to the vegetation.

Plate 1: Evidence of weed invasion and disturbance in the understorey of Site 1

Site 2

This remnant patch had a well-developed tree layer of Woollybutt, Paperbark, *Eucalyptus amplifolia* (Cabbage Gum) and *Eucalyptus tereticornis* (Forest Red Gum) ranging from 7-20 m tall with an average projected foliage cover of about 50%. Tall shrubs were absent although a low shrub/forb layer of Paddy's Lucerne and *Nyssanthes erecta* (Barb-wire Weed) ranged from 0.4-1 m tall and covered approximately 20% of the ground. The lower ground layer, ranging from 20-50% cover, was dominated by introduced weeds such as Kikuyu, the introduced form of *Cynodon dactylon* (Couch) and *Senecio madagascariensis* (Fireweed).

No plants of *Pterostylis gibbosa* or any other orchid were found in Site 2. Accordingly, the species is considered highly unlikely to occur given the long history of grazing and very weedy, highly disturbed understorey. The area may well have once provided good habitat for the *Pterostylis gibbosa* in the past but is now very poor habitat given the dominance of weeds and heavy grazing. The site also appeared to be grazed more recently than Site 1 to the east.

Figure 7: Evidence of weed plumes in site 2

Site 3

Although mapped as a Woollybutt-Paperbark community this heavily grazed patch was in fact dominated by *Eucalyptus piperita* (Sydney Peppermint) with occasional trees of *Eucalyptus globoidea* (Stringybark) on the western edge of the remnant. The tree cover averaged about 50% while the height of the canopy ranged from 15-25 m. There was no shrub layer while the sparse ground layer was

dominated by introduced weeds such as Kikuyu, Paddy's Lucerne, *Axonopus* sp. (Carpet Grass) and Fireweed. The only common native species was Meadow Grass. This remnant has been heavily grazed to the extent that little native cover remains and the ground layer is so heavily modified and degraded that there is very little chance of any orchids being present. Not surprisingly, no plants of *Pterostylis gibbosa* were recorded.

Plate 2: Evidence of weed invasion and condition of groundcover in site 3

5. Impacts to threatened ecological communities

5.1 Illawarra and South Coast Lowland Forest and Woodland

5.1.1 Community description

Illawarra and south coast lowland forest and woodland typically occurs within 30 km of the coast in coastal valleys and low-lying foothills on the south coast of NSW. In the northern part of the ecological community's range, a sharp boundary is provided by the steep slopes of the eastern coastal escarpment. The ecological community can occur below approximately 350 m above sea level (ASL), but most occurrences are at a much lower altitude; between 10 and 150 m ASL (Tozer et al, 2010). At a local scale, the ecological community varies with aspect, with more mesic elements such as rainforest understorey plants occurring (but not dominating) on more sheltered or south-facing slopes.

Along the NSW coast between Moruya and Wollongong, the community occurs on sedimentary rocks including mudstone, silt and claystone, conglomerate, sandstone, chert and some evaporites. The ecological community occurs as a forest or woodland, with foliage cover of the main canopy greater than 10% (DotEE 2016). The canopy is typically dominated by *Eucalyptus* or *Angophora* trees. The composition of the understorey is variable and many patches have a sub-canopy of smaller trees as well as a shrub layer or a ground layer, which is grassy or sedgy. Proximity to rainforest may also increase the number of seedlings or saplings of mesic species.

Many patches have been disturbed and their current state reflects this, past clearance, with fire history and management involving grazing or under-scrubbing having a strong influence on the structural and floristic composition of the ecological community (DotEE 2016). Some patches, which would have been part of the ecological community in the past, are now so modified that they would not meet the key diagnostic characteristics or condition thresholds for the nationally protected ecological community.

The patches of the community in the action area contained a canopy of *Angophora floribunda* (Rough-barked Apple), *Melaleuca decora* (Honey Feather Myrtle), *Eucalyptus bosistoana* (Coast Grey Box) and *Eucalyptus longifolia* (Woollybutt). The midstorey was diverse and contained *Acacia maidenii* (Maiden's Wattle), *Acacia binervata* (Two-veined Hickory), *Pittosporum undulatum* (Sweet Pittosporum) and *Cassinia aculeata* (Dolly Bush). The groundcover comprised about 70% native species, with the most dominant *Microlaena stipoides* var. *stipoides* (Weeping Grass). Other native species present included *Dichondra repens* (Kidney Weed), *Eragrostis leptostachya* (Paddock Lovegrass), *Viola hederacea* (Ivy-leaved Violet) and *Dianella longifolia* (Blueberry Lily).

5.1.2 Condition of the community in the action area

The patches of Illawarra and South Coast Lowland Forest and Woodland occur as three discrete patches, separated by agricultural land and existing roads and urban development. The canopy was consistent across all three patches, although dominated by different species depending on the position in the landscape. The canopy was comprised of *Eucalyptus bosistoana* (Coast Grey Box), *Angophora floribunda* (Rough-barked Apple), *Melaleuca decora* and *Eucalyptus eugenioides* (Thin-leaved Stringybark), *Melaleuca linariifolia* and *Eucalyptus pilularis.*

The composition and structure of the community in the action area is a result of ongoing disturbance that has resulted from historic land use practices, which continue today. Cattle and horse grazing and clearing of the surrounding landscape have changed the structure of the community and resulted in weed encroachment. Grazing and weed encroachment continue to threaten the patches. Field survey data collected in 2010 and 2018 indicate that the abundance of native species across each patch has decreased over time, and weed plumes are more abundant.

5.1.3 Impacts to Illawarra and South Coast Lowland Forest and Woodland

The conservation advice for the community recommends that a 30 m buffer is provided between the development zone and the edge of the EPBC Act patches of the community to mitigate against indirect impacts to retained Illawarra and South Coast Lowland Forest and Woodland.

The development footprint has been designed to avoid and/or minimise, to the maximum extent practical, indirect impacts to native vegetation including indirect impacts to the proposed retention areas. The outer perimeter of the proposed residential footprint is a perimeter road or retained open space. Therefore, there will be no residential blocks directly adjacent to protected bushland areas. This has been designed to:

- remove the likelihood of illegal encroachment into native vegetation by future residents, thus minimising the chance of degradation through illegal clearing, weed invasion, garden escapes, fires and predation by domestic animals
- allows for a partially managed 30 m TEC buffer zone to be established between the proposed development footprint and the retained areas of the community.

The buffer has been applied to all edges of the patch that are not currently bordered by existing hardstand infrastructure. A buffer has not been applied to areas where existing infrastructure exists, as it is not possible for Lendlease Communities (Calderwood) to manage the buffer. In areas where the buffer will contain future hardstand surfaces, i.e. roads, these areas would not be managed as part of the buffer, although they will contribute to buffering indirect impacts to the community. The proposed development footprint has been designed to contain types of development that are passive and can contribute to the open space network.

In applying these rules, the area of Illawarra and South Coast Lowland Forest and Woodland directly affected by the proposed action is 0.28 ha (Table 10). The impacts are concentrated to the outer edges of the patches.

The proposed action will impact on the soil and potentially the soil seed bank where disturbance is proposed. No ground water extraction is likely to impact on this community and no surface water changes are likely to occur. Substantial portions of the action area are degraded as a result of historical land clearing, extensive pasture improvement, ongoing grazing and establishment of agricultural weeds. The proposed action is not considered likely to cause a substantial reduction in the quality or integrity of an ecological community by assisting any invasive species harmful to the ecological community becoming established. A Vegetation Management Plan will be developed and implemented to minimise the risks associated with the introduction of any invasive weeds or pathogens (refer to Mitigation Measures in Section 8).

Table 10: Illawarra and South Coast Lowland Forest and Woodland to be affected and retained across the action area

EPBC Condition Category	Patch number	Impact (ha)	Retained (ha)	Total
A – high condition class	2	0.07	3.61	3.67
D – Moderate condition class	10	0.19	3.84	4.03
A – high condition class	11	0.03	2.86	2.88
	Total	**0.28**	**10.30**	**10.58**

5.1.4 Application of the Significant Impact Criteria

The significant impact criteria (DoTEE 2013) were applied with respect to Illawarra and South Coast Lowland Forest and Woodland which concluded that a significant impact is unlikely to occur, and the proposed action would not result in any residual significant impacts to this community. Consistent with the EPBC Act Offsets Policy, offsets are not required if there are no residual significant impacts (Table 11).

Table 11: Application of the Significant Impact Criteria with respect to Illawarra and South Coast Lowland Forest and Woodland

Impact Assessment Criteria	Application
An action is likely to have a significant impact on a critically endangered community if there is a real chance or possibility that it will:	
reduce the extent of an ecological community	The proposed action would reduce the extent of the ecological community by 0.28 ha in the action area. The area of reduction is spread across three patches. The proposed action would retain 10.30 ha of the community within the action area. The proposed action would reduce the extent of the ecological community by 2.67 %.
fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The areas of the community to be removed are on the edges of larger patches, which are zoned for conservation. These larger patches are already fragmented from other patches of the community due to historical clearing and grazing for agricultural purposes and the development of urban infrastructure, including roads and schools. The extensive parcels of agricultural land that currently fragment the three patches would limit the amount of genetic transfer between the patches. The current distance between patches is between 200 m and 1 km. The maintenance of genetic diversity or transfer of genetic material would be limited to birds and bats carrying seed or pollen throughout the landscape. The construction of residential dwellings in place of agricultural land would not increase the existing fragmentation of the patches. Birds and bats would still be able to access all patches and assist in the maintenance of some level of genetic diversity and material transfer. Therefore, the proposed action would not fragment or increase the fragmentation of this community throughout the action area.

Impact Assessment Criteria	Application
adversely affect habitat critical to the survival of an ecological community	Habitat critical to the survival of an ecological community is defined as areas that are necessary for the long-term maintenance of the species or ecological community, such as: • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community The patches of the community in the action area may contribute to the genetic diversity of the community throughout its range. The action area is unlikely to contribute to the reintroduction or recovery of the community. The proposed action would remove 0.28 ha of Illawarra and South Coast Lowland Forest and Woodland on the edges of three existing patches. The areas to be affected are of the same vegetative composition and structure of the patches to be retained. There are no flora species that are unique to the areas to be affected. The patches all contain weed encroachment from the adjacent agricultural land. The ongoing disturbance in and adjacent to each patch has reduced the flora diversity in each patch. Given that the species to be affected are present within the retained areas, the areas for removal are not considered critical to the survival or recovery of the ecological community.
modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The proposed action may temporarily modify the soil composition and hydrology on the edge of the patches to be retained. Changes to the composition of the soil or nutrients would result from neighbouring bulk earthworks and water runoff during construction. However, changes to soil composition would be limited to the 0.28 ha of the community to be directly affected. The remaining impacts would occur within the 30 m buffer and do not directly affect the patch. The impacts would also be temporary and limited to the construction period. Due to the limited area of direct impact (0.28 ha) it is unlikely that the composition of the soil or nutrients would be affected across the entire patch. Extensive studies into the potential long-term changes in hydrology and water flow across the action area have been completed. It was concluded that, following the installation of a stormwater basin network, there would be no changes to the hydrology across the action area (Douglas Partners 2018, JWP 2019). Therefore, the proposed action is unlikely to reduce groundwater levels or alter the surface water drainage patterns.
cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	The proposed action would remove 0.28 ha of Illawarra and South Coast Lowland Forest and Woodland on the edge of three existing patches. The areas to be affected are of the same vegetative composition and structure of the areas of each patch to be retained. There are no flora species that are unique to the areas to be affected. Ecological burns and flora / fauna harvesting are not proposed for the patches of Illawarra and South Coast Lowland Forest and Woodland that would be retained across the action area. The patches to be retained are zoned E3 – Environmental Management, which limits permissible activities in each retained patch. Therefore, it is unlikely that the proposed action would result in a substantial change in species composition such that the occurrence of the community would be affected.

Impact Assessment Criteria	Application
cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	The proposed action would remove 0.28 ha of Illawarra and South Coast Lowland Forest and Woodland and retain 10.30 ha of the community. The area to be removed represents 2.67% of the community within the action area. The 0.28 ha to be removed would be 100% affected. The 10.30 ha of the community to be retained may be affected by indirect impacts associated with the proposed action, such as weed invasion or herbicide drift. In some areas, portions of the 30 m buffer have been retained, or the patch borders other areas of retained land which would minimise the indirect impacts on the patch. Although the proposed action would cause a reduction in the quality of the community, it is unlikely to be substantial, given that almost 98% of the community within the action area would be retained.
Interfere with the recovery of the ecological community	proposed action is unlikely to interfere with the recovery of the ecological community given that: • the reduction in the ecological community would be limited to 2.67% of the extent in the action area • the proposed action would not increase the fragmentation or isolation of the community across the action area • the proposed action would retain almost 98% of the community across the action area • the proposed action is unlikely to substantially alter the composition of the community such that it would constitute a significant impact • the proposed action is unlikely to cause substantial changes to the soil seed bank, nutrients or waterflow across the action area. The proposed action is unlikely to constitute a significant impact to Illawarra and South Coast Lowland Forest and Woodland.

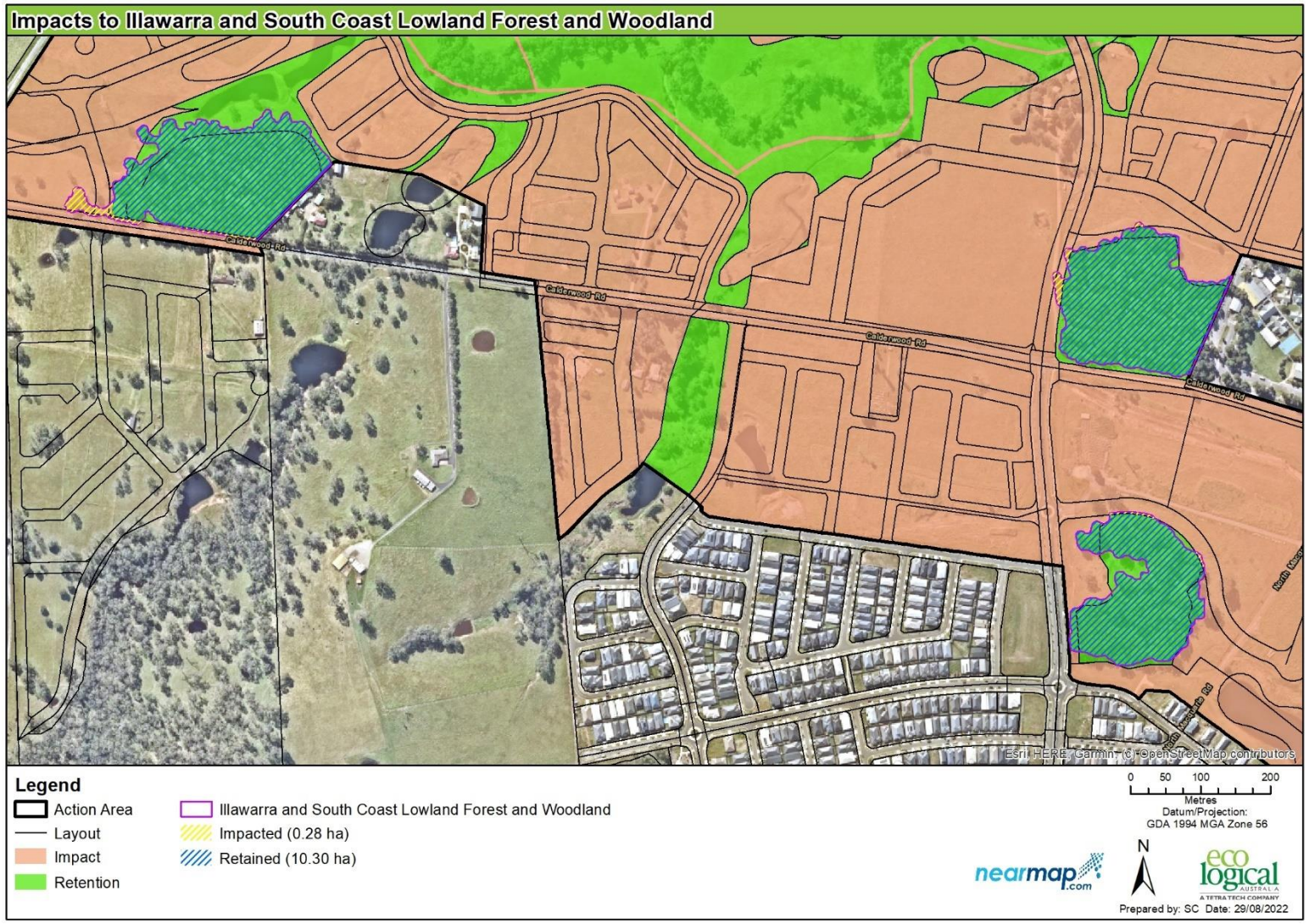

Figure 8: Illawarra and South Coast Lowland Forest and Woodland to be affected and conserved across the action area

6. Impacts to threatened flora

6.1 Pterostylis gibbosa

6.1.1 Species description

Pterostylis gibbosa is part of a large genus of ground-dwelling orchids. All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by *Eucalyptus tereticornis*, *E. longifolia* and *Melaleuca decora*. Near Nowra, the species grows in an open forest of *Corymbia maculata*, *E. tereticornis* and *E. paniculata*. In the Hunter region, the species grows in open woodland dominated by *E. crebra*, *E. tereticornis* and *Callitris endlicheri* (TSSC 2016).

The seeds of the Illawarra greenhood are wind dispersed and can remain dormant for up to two seasons. The seeds require the presence of a specific strain of the mycorrhizal fungus *Ceratobasidium cornigerum* for successful germination. This fungus is widespread and associated with leaf litter. A new tuberoid is produced each year adjacent to the original tuberoid which then withers and dies (Muston & Krusenstierna 1994). The Illawarra greenhood can survive occasional burning and grazing because of its capacity to reshoot from an underground tuber (TSSC 2016). The Illawarra greenhood appears to benefit from some disturbance. Rapid population growth has been observed after fire at Albion Park. In the absence of disturbance, it is possible that populations of the species decline or that most individuals remain dormant as tubers until a fire stimulates re-emergence. However, the numbers of orchids visible above ground tend to decline with the re-establishment of post-disturbance shrub and grass cover.

6.1.2 Distribution and abundance and security

The Illawarra greenhood is known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra) of New South Wales. It is apparently extinct on the Cumberland Plain in western Sydney, where it was first collected in 1803 (TSSC 2016). The former Office of Environment and Heritage estimates that there are 400 plants at Milbrodale; 400 plants at Yallah; 3000 plants at Croom in Albion Park; and 400 plants in the Shoalhaven region at Worrigee Nature Reserve (TSSC 2016; Figure 9).

6.1.3 Direct impacts

Pterostylis gibbosa has not been identified in the action area and is considered highly unlikely to occur. Therefore, no direct impacts are expected to occur to this species as a result of the proposed action. The significant impact criteria have not been applied with respect to this species.

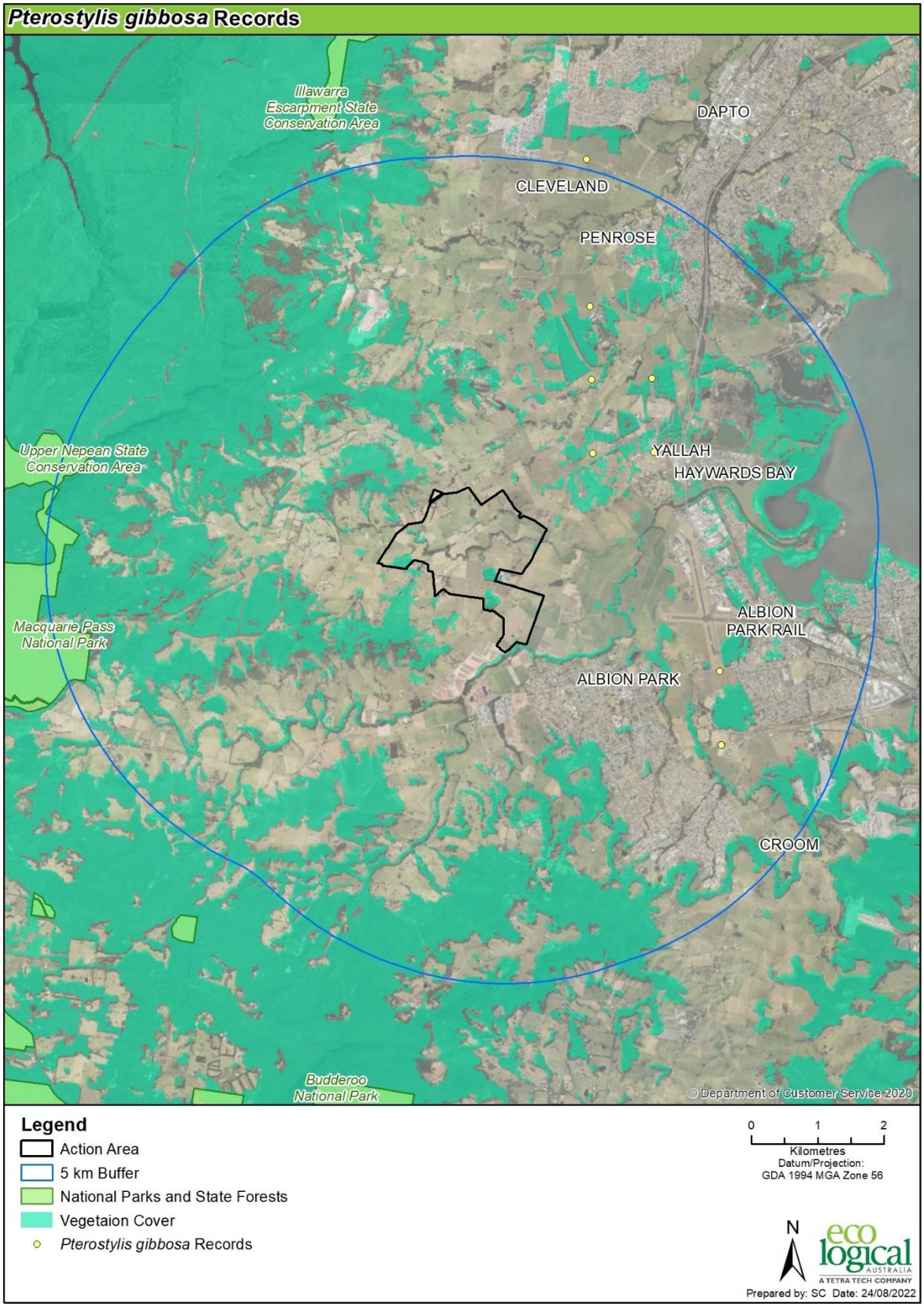

Figure 9: Pterostylis gibbosa records within 5 km of the action area

7. Impacts to threatened fauna

7.1 Grey-headed Flying-fox (*Pteropus poliocephalus*)

7.1.1 Species ecology and distribution nationally

The Grey-headed Flying-fox was not detected in the action area during survey. The Grey-headed Flying-fox is typically medium to dark grey with many light-tipped hairs with fur extending to the feet. Its defining feature is an orange or russet-coloured collar which encircles the neck. This species occupies the coastal lowlands and slopes of south-eastern Australia from Bundaberg to Geelong and inland NSW to the tablelands and western slopes. The Grey-headed Flying-fox is a highly mobile, partially migratory species with a distribution that is highly varied between seasons and years. The Grey-headed Flying-fox forms part of one single, interbreeding population. The species breeds once a year between October and December (DAWE 2021).

Grey-headed Flying-foxes typically roost in camps which are used as a daytime refuge. Camps are generally stable sites, however numbers and occupation can vary over time, depending on the availability of foraging resources within the locality (DAWE 2021).

This species primarily feeds on blossom and fruit in the canopy and will occasionally supplement this with leaves. This species tends to favour *Eucalyptus, Corymbia, Angophora, Melaleuca, Banksia* and *Ficus* species and will migrate in response to flowering events and the availability of food. The bat will forage between 20 km and 40 km in a feeding foray from a camp site, with most distances <20 km. Up to 20 km is considered the average foraging distance and has been used in this assessment.

Threats to the Grey-headed Flying-fox include loss of foraging and roosting habitat, competition with Black Flying-foxes, negative public attitude and conflict with humans, electrocution, entanglement in netting and on barbed-wire, climate change and disease (DAWE 2021). The National Recovery Plan for the Grey-headed Flying-fox (DAWE 2021) defines habitat critical to the survival of the species as natural habitat that is patches which:

- contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May)
- contain native species used for foraging and occur within 20 km of a nationally important camp as identified on the Department's interactive flying-fox web viewer, or
- contain native and or exotic species used for roosting at the site of a nationally important Grey-Headed Flying-Fox camp as identified on the Department's interactive flying-fox web viewer.

The plan also notes that foraging resources which provide resources in times of food shortage or winter flowering species may also be critical to the survival of the species. This can include *Eucalyptus tereticornis* and *Eucalyptus pilularis* both of which were identified in the action area (DAWE 2021). Neither of the camps within a 20 km radius of the action area (Figtree or Shellharbour) are Nationally Important Camps, as neither have:

- contained ≥ 10,000 individuals in more than one year for the past ten years OR
- have been occupied by more than 2,500 Grey-headed Flying-foxes permanently or seasonally every year for the last 10 years (DAWE 2021).

7.1.2 Distribution in the action area

The Grey-headed Flying-fox has not been previously identified as present in the action area. The BioNet records within 20 km of the action area has not previously recorded the species as present in the action area. There are 688 records for this species within a 20 km radius of the action area (Figure 10). Camps within a 20 km radius of the action area include:

- Figtree – last estimates 500 – 2,499 bats (surveyed December 2021)
- Shellharbour – last recorded 1 – 499 bats (surveyed late 2020; DCCEEW 2022).

7.1.3 Direct impacts

The action area contains 37.69 ha of potential habitat for this species, with 11.35 ha to be affected and 26.34 ha to be retained (Figure 11). There is an additional 68,955 ha of potential foraging habitat within a 20 km radius of the site, 20,684 ha of which is within either National Parks or State Forests. No camps were identified in the action area during survey.

7.1.4 Indirect impacts

Indirect impacts to the Grey-headed Flying-fox that may result from the proposed action include electrocution from overhead powerlines and heat stress. The proponent is proposing to run all powerlines underground which will remove the risk of electrocution from overhead powerlines (other than existing high voltage lines that traverse the study area). It is difficult to quantify how the proposed action would contribute to mortality due to heat stress and is outside the scope of this report.

7.1.5 Application of Significant Impact Criteria

The significant impact criteria were applied to the Grey-headed Flying-fox and concluded that the proposed action would not constitute a significant impact to this species , therefore there are no residual impacts. Consistent with the EPBC Act Offsets Policy, offsets are not required if there are no residual significant impacts (Table 12).

Table 12: Application of the significant impact criteria with respect to the Grey-headed Flying-fox

Criterion	Assessment
lead to a long-term decrease in the size of an important population of a species	The Grey-headed Flying-fox is comprised of one large interbreeding population (DAWE 2021). The presence of any individuals of this species signals that an important population is present. The proposed action would result in the removal of 11.35 ha of potential foraging habitat for the Grey-headed Flying-fox, with 26.34 ha to be retained across the action area. No known camps would be affected. The potential foraging habitat to be removed is considered marginal and would form part of a mosaic of foraging resources. When the canopy is not in flower, other foraging resources throughout the region would be utilised. Given the low density of canopy species in the development footprint it is unlikely to produce enough nectar to sustain individuals foraging within the locality. The Grey-headed Flying-fox is highly mobile and has a large home range travelling long distances on feeding foray (up to 20 km from camps (DCCEEW 2022)). The Grey-headed Flying-fox would use the action area on an occasional basis and would not depend on these foraging resources. As such, the proposed action is unlikely to lead to a long-term decrease in the size of an important population of the Grey-headed Flying-fox.
reduce the area of occupancy of an important population	The Grey-headed Flying-fox is comprised of one large interbreeding population. The presence of any individuals of this species signals that an important population is present. The proposed action would remove 11.35 ha of potential foraging habitat for the Grey-headed Flying-fox. No

Criterion	Assessment
	known camps would be affected. The removal of 11.35 ha of potential foraging habitat would reduce the area of occupancy of the Grey-headed Flying-fox, however the impact is unlikely to be significant. The foraging habitat to be removed could form a critical foraging resource for the Grey-headed Flying-fox due to the presence of *Eucalyptus tereticornis* and *Eucalyptus pilularis*. Although these species are present, their distribution across the action area is sparse. About 26.34 ha of potential foraging habitat would be retained within the action area and 68,955 ha of additional habitat is available within a 20 km radius of the site, of which 20,684 ha is secured as part of National Parks or State Forests. The Grey-headed Flying-fox is highly mobile and will utilise a range of foraging resources within the region. Therefore, although the removal of 11.35 ha of potential foraging habitat would reduce the area of occupancy of the species it is not considered to be significant.
fragment an existing important population into two or more populations	The Grey-headed Flying-fox is comprised of one large interbreeding population. The presence of any individuals of this species signals that an important population is present. The proposed action would result in the removal of 11.35 ha of potential foraging habitat for the Grey-headed Flying-fox. No known camps would be affected. The area of habitat that would be affected as part of the proposed action exist on the edge of larger patches throughout the action area. The proposed action would not fragment an existing native vegetation into two or more, as the patches are already fragmented as a result of extensive clearing for agricultural purposes. The proposed action would increase the fragmentation marginally, however this is highly unlikely to affect the Grey-headed Flying-fox given their highly mobile nature. Further, the proposed action would not remove foraging habitat such that no habitat is available between two or more camps. As such, the proposed action would not fragment an existing population into two or more.
adversely affect habitat critical to the survival of a species	For the Grey-headed Flying-fox, critical habitat is defined as • contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May) • contain native species used for foraging and occur within 20 km of a nationally important camp as identified on the Department's interactive flying-fox web viewer, or • contain native and or exotic species used for roosting at the site of a nationally important Grey-Headed Flying-Fox camp as identified on the Department's interactive flying-fox web viewer. The action area is located 17 km south-west of the Figtree camp and 10 km north west of the Shellharbour camp. The Figtree camp has not contained more than 30,000 individuals since monitoring began. There are also no camps within 20 km of the site currently supporting more than 30,000 individuals (DAWE 2021). However, the action area does contain a low abundance of foraging habitat that can flower in August to May. The proposed action would affect critical habitat, however the impacts are unlikely to be adverse, given the extent of habitat to be removed, areas to be retained and foraging habits of the species. The proposed action would not adversely affect habitat critical to the survival of this species.
disrupt the breeding cycle of an important population	No roosting habitat would be removed or disturbed for the Grey-headed Flying-fox. The removal of 11.35 ha of marginal foraging habitat would be unlikely to disrupt the foraging behaviour of any individuals such that the breeding cycle of the Grey-headed Flying-fox would be disrupted.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that	The proposed action will not modify or isolate the availability or quality of habitat to the extent that the Grey-headed Flying-fox is likely to decline. The proposed action would decrease the availability of foraging habitat within this species' range, however it is unlikely to be at such an extent that the Grey-headed Flying-fox would

Criterion	Assessment
the species is likely to decline	decline. The foraging habitat in the action area is considered marginal for the Grey-headed Flying-fox. The foraging habitat is not directly contiguous with known camps and would be unlikely to form a primary foraging source for young. Given the large foraging ranges of these species, the action area would likely form a mosaic of foraging resources and would be relied upon only occasionally by this species. Thus, the proposed action is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The major threats to the Grey-headed Flying-fox are related to vegetation clearance, camp disturbance, mortality in commercial fruit crops, heat stress, entanglement, climate change, bushfire, conflict with humans and electrocution. These threats are not associated with the increased presence of an invasive species. The proposed action is unlikely to result in invasive species becoming established in the Grey-headed Flying-fox habitat.
introduce disease that may cause the species to decline, or	The Grey-headed Flying-fox is susceptible to the Lyssavirus. Increases of the Lyssavirus typically occurs when a population is undergoing stress. The action area would provide marginal foraging habitat that would make up a mosaic of resources that would be utilised in the region. The action area would not provide the primary foraging resource, nor does the action area contain known camps for this species. The removal of 11.35 ha of marginal foraging habitat is unlikely to cause a level of distress such that the Grey-headed Flying-fox is likely to decline.
interfere substantially with the recovery of the species.	The recovery of the Grey-headed Flying-fox requires identifying important camps and foraging habitat used around camps. As discussed above, there are no camps critical to the survival of the Grey-headed Flying-fox within a 20 km radius of the action area. The proposed action is unlikely to interfere with the recovery of the species given: • no camps would be affected • the proposed action would remove 11.35 ha of marginal habitat on the edge of larger patches • the proposed action would not fragment or isolate any areas of foraging habitat or foraging habitat from a camp • the species is highly mobile and forages widely. Thus, the proposed action would be unlikely to interfere with the recovery of this species.

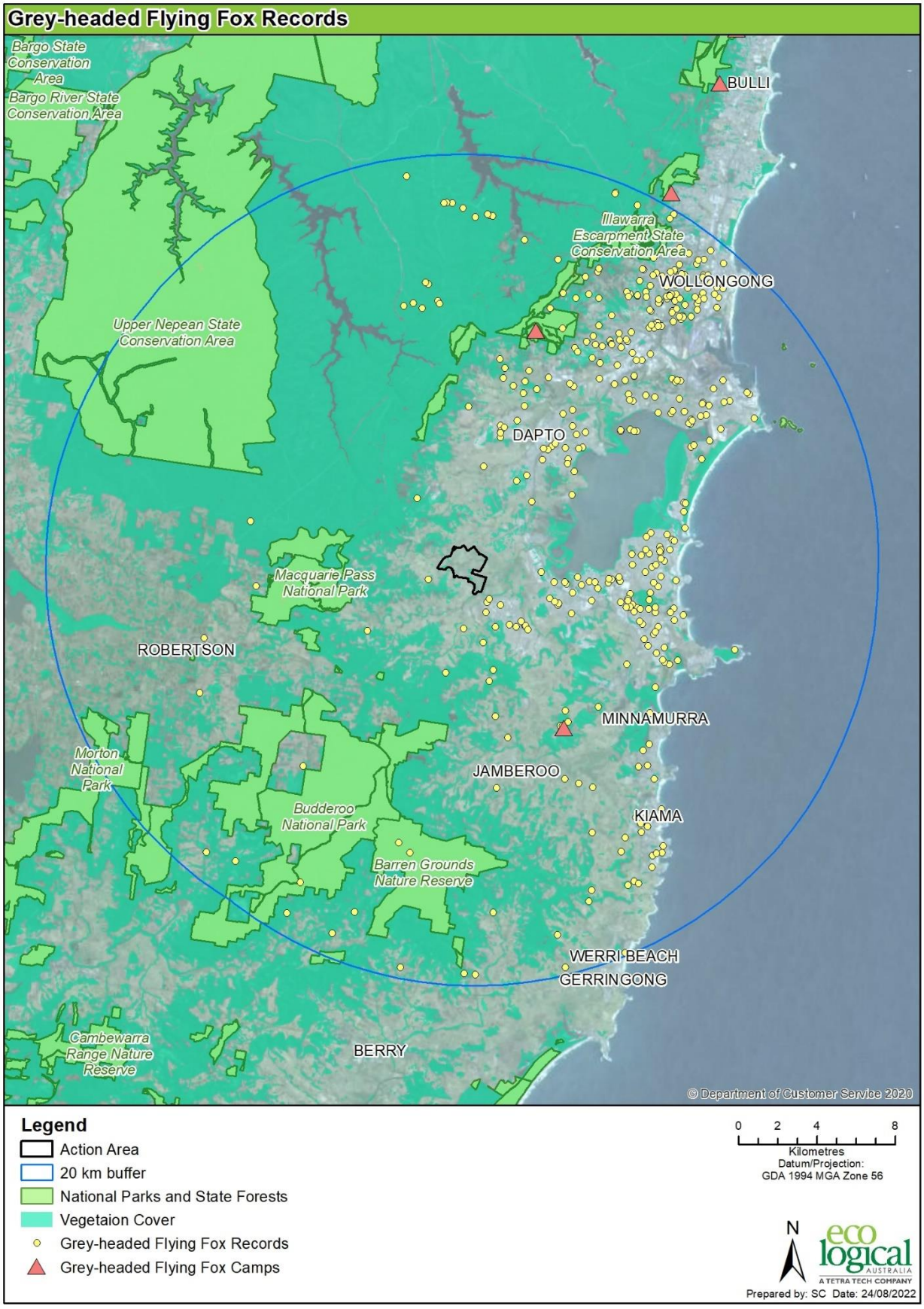

Figure 10: Grey-headed Flying-fox camps and records within 20 km of the action area

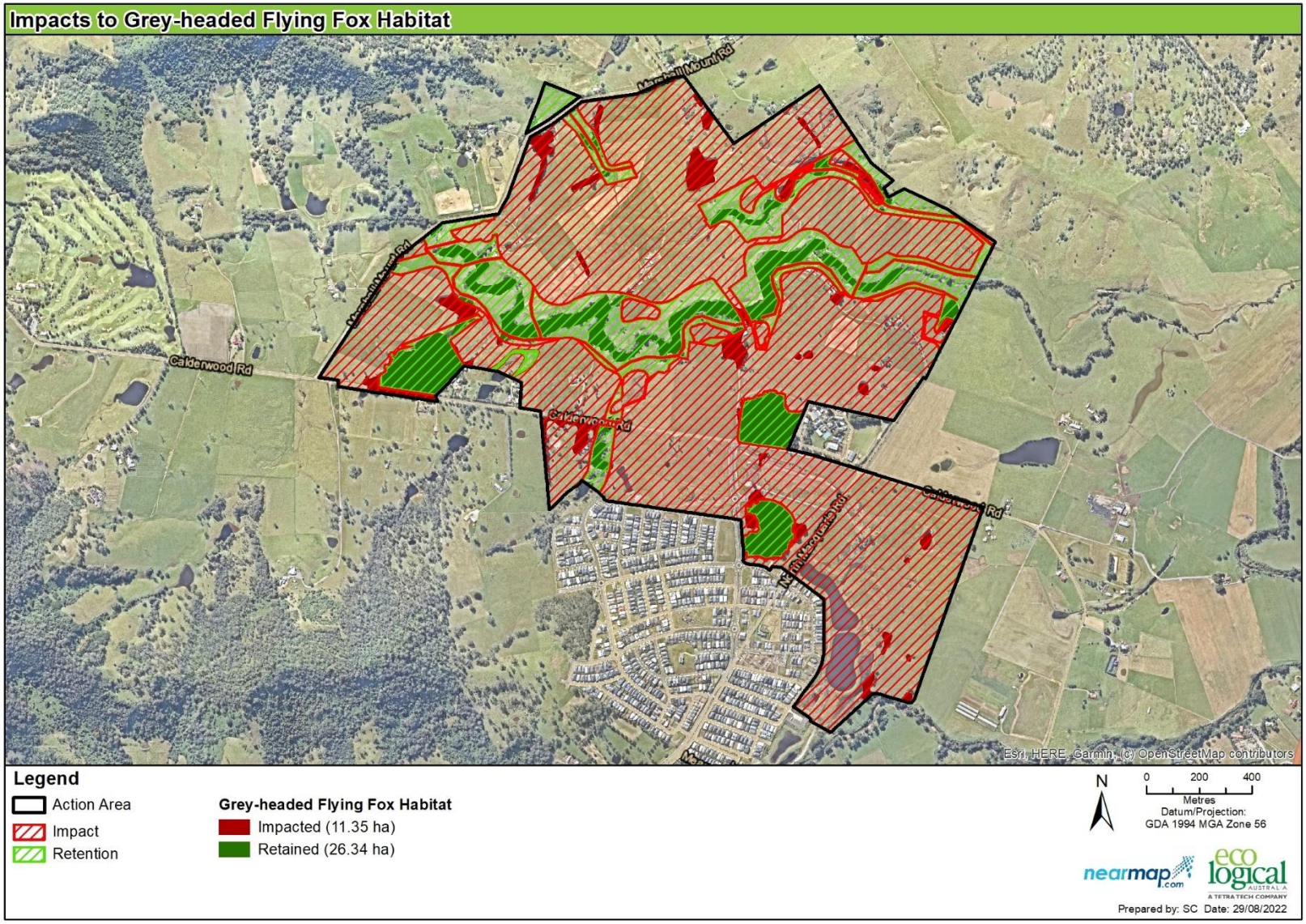

Figure 11: Grey-headed Flying-fox foraging habitat to be affected and retained

7.2 Large-eared Pied Bat (*Chalinolobus dwyeri*)

7.2.1 Species ecology

The Large-eared Pied Bat is a medium-sized insectivorous bat measuring approximately 100mm including the head and tail. Much of the information on the ecology of the large-eared pied bat comes from studies of the population at the type locality at Copeton, NSW during the early 1960s (Dwyer 1966). Over most of its range, the large-eared pied bat appears to roost predominantly in caves and overhangs in sandstone cliffs and forage in nearby high-fertility forest or woodland near watercourses (DERM 2011).

The large-eared pied bat is known from Shoalwater Bay, north of Rockhampton, Qld, south to the vicinity of Ulladulla in NSW. In Shoalwater Bay it is known from a single individual, and the size and number of populations in this area is unknown. Further records are known in Qld from sandstone escarpments in the Carnarvon and Expedition Ranges and Blackdown Tablelands. It is likely that these areas support a high proportion of the Qld populations of this bat, although estimates of the number of individuals present and their distribution in these areas has not been established. Additional records exist in the Scenic Rim near the NSW/Qld border. Given their location in the geological landscape, the populations in this area appear to be reliant on the presence of roosts in volcanic rock types (DERM 2011).

The most recent record from this area was an adult female captured adjacent to rhyolite cliffs at Springbrook in August 2004 (DERM 2011). Much of the known distribution of the large-eared pied bat occurs in NSW. In the north east of the state at Coolah Tops, Mt Kaputar and Warrumbungle National Park it is present in areas of volcanic strata. It is more widely distributed, but still uncommon and patchy within its distribution, in the sandstone areas of the Sydney Basin and the western slopes.

Sandstone cliffs and fertile wooded valley habitat within close proximity of each other should be considered habitat critical to the survival of the large-eared pied bat. The action area does not contain any critical habitat given the absence or nearby presence of potential breeding habitat in the form of sandstone cliffs or caves. However, the presence of nearby records suggests that the action area could be used for foraging purposes on an occasional basis.

Important populations are considered those that occur in areas dominated by sandstone escarpments, which within NSW is limited to the Sydney basin and North West slopes. The action area does not contain any sandstone escarpments and therefore, does not form critical habitat. Given the absence of critical habitat in the locality, any individuals utilising the action area would not form an important population.

7.2.2 Distribution in the action area

The Large-eared Pied Bat has been previously recorded immediately adjacent to the southern boundary of the action area. There are 17 records for this species within a 20 km radius of the action area. No potential breeding sites were identified in the action area during survey.

7.2.3 Direct impacts

The action area contains 22.33 ha of potential foraging habitat for this species, with 3.26 ha to be affected and 22.68 ha to be retained. There is an additional 68,955 ha of potential foraging habitat within a 20 km radius of the site, 20,684 ha of which is within either National Parks or State Forests, of

which there are previous records for the species which suggests that individuals would utilise these areas.

7.2.4 Indirect impacts

Indirect impacts likely to affect the Large-eared Pied Bat include disturbance to primary nursery sites by human recreational activities (caving) and feral animals (goats), loss of habitat, predation by introduced species and disturbance to habitat from livestock (DotEE 2016). There are no primary nursery sites known in the action area and grazing will be excluded from the retained areas

7.2.5 Application of the Significant Impact Criteria

The Significant Impact Criteria was applied with respect to the Large-eared Pied Bat and concluded that the proposed action is unlikely to constitute a significant impact on this species and the proposed action would not result in any residual significant impacts to this community. Consistent with the EPBC Act Offsets Policy, offsets are not required if there are no residual significant impacts (**Table 13**).

Table 13: Application of the significant impact criteria with respect to the Large-eared Pied Bat

Criterion	Assessment
lead to a long-term decrease in the size of an important population of a species	Important populations are considered those that occur in areas dominated by sandstone escarpments, which within NSW is limited to the Sydney basin and North West slopes. The action area does not contain any sandstone escarpments and therefore, does not form part of critical habitat. The proposed action would result in the removal of 3.26 ha of potential foraging habitat for the Large-eared Pied Bat, with 22.68 ha to be retained across the action area. No known breeding habitat would be affected. The potential foraging habitat to be removed is considered marginal and would form part of a mosaic of foraging resources. It is unlikely that the native vegetation in the action area is sufficient to sustain all locally foraging individuals. The Large-eared Pied Bat is mobile and has a home range of several kilometres from its breeding site (DERM 2011). The Large-eared Pied Bat would use the action area on an occasional basis and would not depend on these foraging resources. As such, the proposed action is unlikely to lead to a long-term decrease in the size of an important population of the Large-eared Pied Bat.
reduce the area of occupancy of an important population	Important populations are considered those that occur in areas dominated by sandstone escarpments, which within NSW is limited to the Sydney basin and North West slopes. The action area does not contain any sandstone escarpments and therefore, does not form part of critical habitat or part of an important population. The proposed action would result in the removal of 3.26 ha of potential foraging habitat for the Large-eared Pied Bat, with 22.68 ha to be retained across the action area. No known breeding habitat would be affected. The removal of 3.26 ha of potential foraging habitat would reduce the area of occupancy of the Large-eared Pied Bat, however the impact is unlikely to be significant. The foraging habitat to be removed does not form critical habitat for this species. About 22.68 ha of potential foraging habitat would be retained within the action area and 68,955 ha of additional habitat is available within a 20 km radius of the site, of which 20,684 ha is secured as part of National Parks or State Forests and could be within proximity of sandstone escarpments (note, this has not been field validated). The Large-eared Pied Bat is mobile and will utilise a range of foraging resources within the region. Therefore, although the removal of 11.35 ha of potential foraging habitat would reduce the area of occupancy of the

Criterion	Assessment
	species, an important population would not be affected and therefore it is not considered to be significant.
fragment an existing important population into two or more populations	Important populations are considered those that occur in areas dominated by sandstone escarpments, which within NSW is limited to the Sydney basin and North West slopes. The action area does not contain any sandstone escarpments and therefore, does not form part of critical habitat. The proposed action would result in the removal of 3.26 ha of potential foraging habitat for the Large-eared Pied Bat, with 22.68 ha to be retained across the action area. No known breeding habitat would be affected. The area of habitat that would be affected as part of the proposed action exist on the edge of larger patches throughout the action area. The proposed action would not fragment an existing native vegetation into two or more, as the patches are already fragmented as a result of extensive clearing for agricultural purposes. The proposed action would increase the fragmentation marginally, however this is highly unlikely to affect the Large-eared Pied Bat given their mobile nature. Further, the proposed action would not remove foraging habitat such that no habitat is available between or within proximity to breeding areas. As such, the proposed action would not fragment an existing important population into two or more.
adversely affect habitat critical to the survival of a species	Sandstone cliffs and fertile wooded valley habitat within close proximity of each other should be considered habitat critical to the survival of the Large-eared Pied Bat. The action area does not contain any critical habitat given the absence of potential breeding habitat in the form of sandstone cliffs or caves. However, the presence of nearby records suggests that the action area could be used for foraging purposes on an occasional basis. The proposed action would not adversely affect habitat critical to the survival of this species.
disrupt the breeding cycle of an important population	No roosting habitat would be removed or disturbed for the Large-eared Pied Bat. The removal of 3.26 ha of marginal foraging habitat would be unlikely to disrupt the foraging behaviour of any individuals such that the breeding cycle of the Large-eared Pied Bat would be disrupted.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed action will not modify or isolate the availability or quality of habitat to the extent that the Large-eared Pied Bat is likely to decline. The proposed action would decrease the availability of foraging habitat within this species range, however it is unlikely to be at such an extent that the Large-eared Pied Bat would decline. The foraging habitat in the action area is considered marginal for the Large-eared Pied Bat, as it is not continuous with known breeding habitat and would be unlikely to form a primary foraging source. Given the foraging ranges of this species, the action area would likely form a mosaic of foraging resources and would be relied upon only occasionally by this species. Thus, the proposed action is unlikely to decrease the availability or quality of habitat to the extent that the Large-eared Pied Bat is likely to decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The major threats to the Large-eared Pied Bat include: • Destruction of and interference with maternity and other roosts • Mining of roosts • Mine subsidence of cliff lines • Disturbance from human recreational activities • Habitat disturbance by livestock and feral animals • Predation by introduced predators • Vegetation clearance in proximity of roosts • Fire in proximity of roosts • Loss of genetic diversity These threats are not associated with the increased presence of an invasive species. The proposed action is unlikely to result in invasive species becoming established in the Large-eared Pied Bat habitat.

Criterion	Assessment
introduce disease that may cause the species to decline, or	There are no diseases listed in the Recovery Plan for the Large-eared Pied bat. The proposed action is unlikely to introduce any disease or pathogens affecting this species.
interfere substantially with the recovery of the species.	The recovery of the Large-eared Pied Bat requires mapping known colonies, roost structures and completing targeted survey to produce a revised distribution and habitat model. As discussed above, there are no known breeding areas in proximity of the action area. The proposed action is unlikely to interfere with the recovery of the species given: • no known breeding areas would be affected • the proposed action would remove 3.26 ha of marginal habitat on the edge of larger patches • the proposed action would not fragment or isolate any areas of foraging habitat or foraging habitat from a camp • the species is mobile and forages widely. Thus, the proposed action would be unlikely to interfere with the recovery of this species.

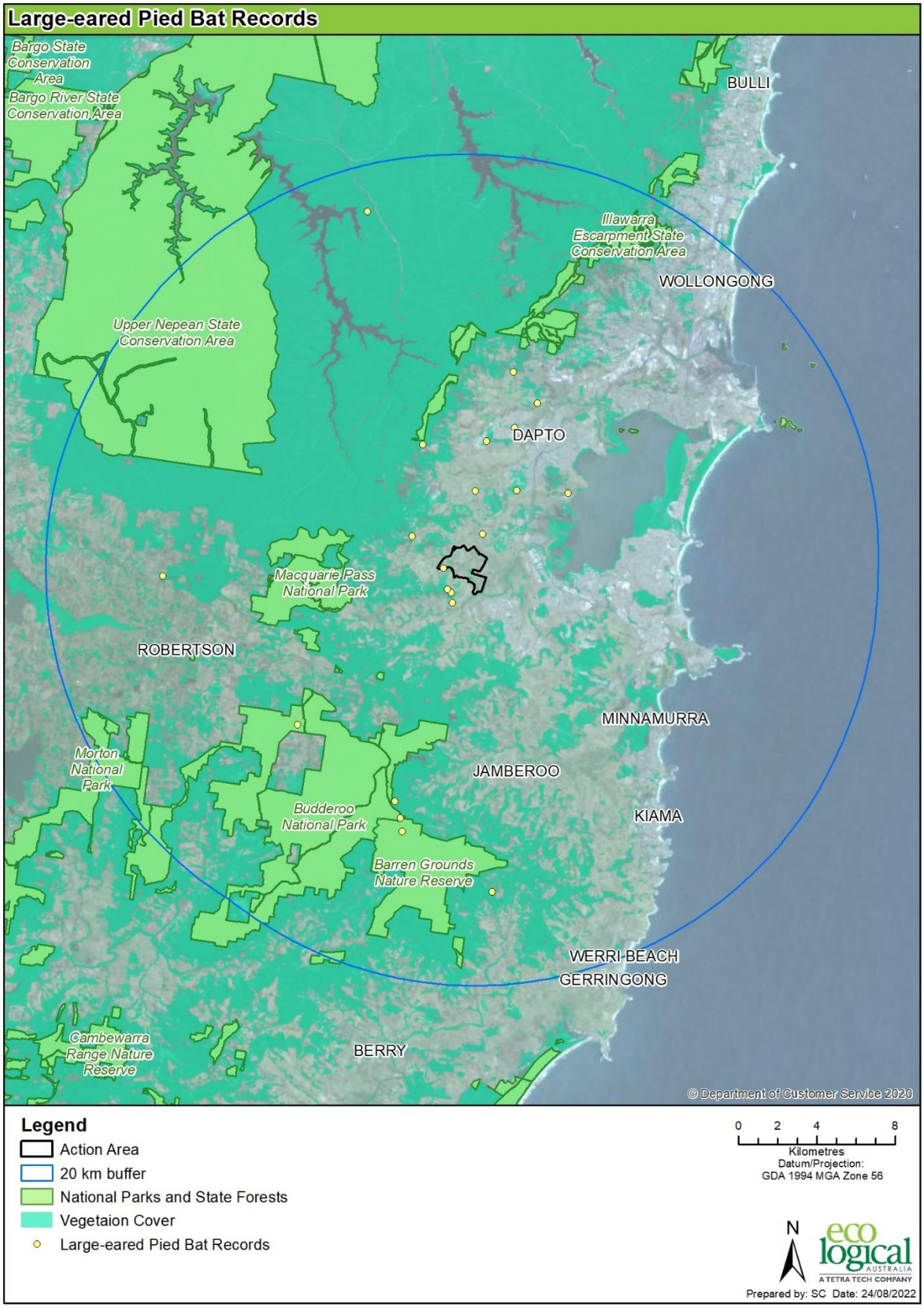

Figure 12: Large-eared Pied Bat records and preferred habitat within the locality

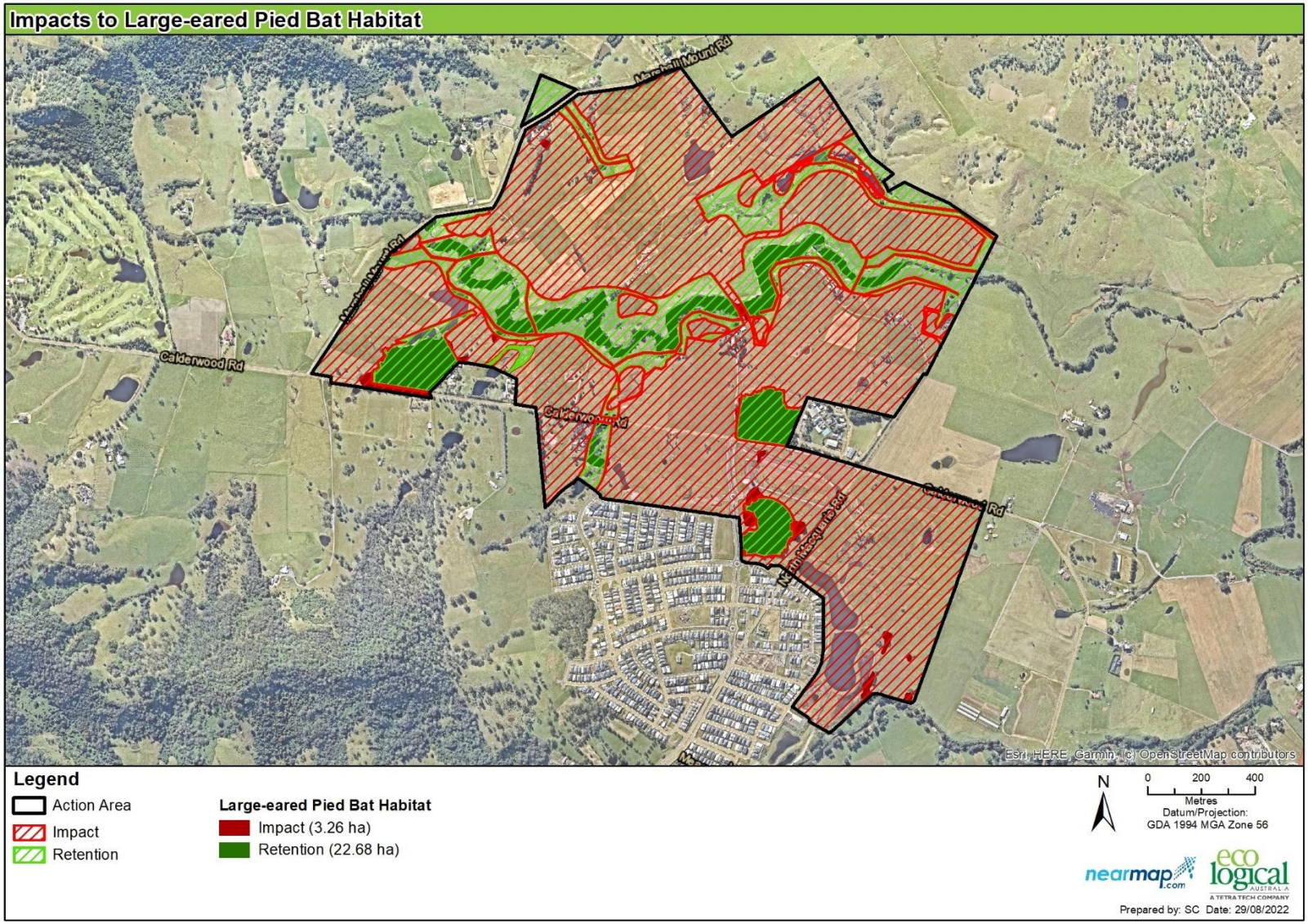

Figure 13: Large-eared Pied Bat foraging habitat to be affected, protected and retained

8. Proposed avoidance, minimisation and mitigation / management measures

A range of safeguards and mitigation measures will accompany the proposed action. The goal of these actions is to firstly minimise the direct impact introduced by the development and secondly to ensure that indirect impacts do not eventuate, so all proposed offset areas and adjacent conservation areas are adequately protected and managed alongside the development.

8.1 Avoidance and minimisation

8.1.1 Illawarra and South Coast Lowland Forest and Woodland

The design of the proposed action has followed the Significant Impact Guidelines for MNES (DotE 2013), which identifies important factors that must be considered when assessing the potential impacts on threatened species, populations, or ecological communities, or their habitats; namely to avoid, mitigate and finally to offset any residual impacts.

The proposed development footprint has undergone several iterations to avoid and minimise impacts to Illawarra and South Coast Lowland Forest and Woodland, which has resulted in an overall reduction in impacts from 0.72 ha to 0.28 ha. The efforts to avoid and minimise direct impacts has reduced the proposed impacts to Illawarra and South Coast Lowland Forest and Woodland by > 50%.

First iterations

The first iterations to the development footprint occurred during the assessment of the referral (EPBC 2021/8189). Modifications to the development footprint were made following feedback from the then DAWE, which raised concerns about indirect impacts to the community. The efforts to reduce direct impacts were detailed in a response to request for information dated 22 October 2021 (ELA 2021; Appendix K). Impacts to Illawarra and South Coast Lowland Forest and Woodland were reduced by 0.18 ha, with direct impacts estimated at 0.54 ha. To reduce direct impacts to the community, eight (8) residential allotments and an associated perimeter road were removed from patch 11.

The Response to Request for Information outlined extensive measures and considerations of the adjoining development to avoid and minimise indirect impacts to the retained Illawarra and South Coast Lowland Forest and Woodland. These measures included:

- Strategic placement of open space and parkland and roads with low impact passive use adjacent to retained vegetation
- Preparation and implementation of a Construction Environment Management Plan to manage potential indirect impacts during construction
- Preparation and implementation of a Vegetation Management Plan for retained Illawarra and South Coast Lowland Forest and Woodland to manage indirect impacts.

Second iterations

The second iterations to the development footprint occurred following the determination of the proposed action as a controlled action and further reduced impacts by 0.26 ha from 0.54 ha to 0.28 ha.

Consideration was given to any impacts adjacent to Illawarra and South Coast Lowland Forest and Woodland. The following reconfigurations were made to the development footprint to further reduce impacts:

- removal of approximately 30 residential allotments to the north of patch 2
- relocation of the perimeter road north of patch 2
- removal of approximately nine residential allotments from the western boundary of patch 10
- reconfiguration of the perimeter road bordering patch 10
- removal of residential allotments to the north of patch 10
- reconfiguration of the perimeter road to the north of patch 10
- relocation of the proposed basin to the north of patch 10
- expansion of the pocket parks surrounding patches 2 and 10 to allow for the retention of the community where it intersects with the park.

8.1.2 Planning controls

Retention of native vegetation

The Concept Plan provides for retention of the core ecological values of the site including Marshall Mount Creek and the patches of Illawarra and South Coast Lowland Forest and Woodland. This has minimised the potential impacts to some MNES.

Overall, approximately 93.3 % of all native vegetation will be retained in the action area as part of the E3 – Environmental Management or E2 -Environmental Conservation lands. Some 93.3 % of the good condition Illawarra and South Coast Lowland Forest and Woodland is proposed for retention, with the development footprint concentrated on previously cleared agricultural land.

Protection through zoning and the ESL layer

The proponent proposes to protect the retained Illawarra and South Coast Lowland Forest and Woodland and other retained native vegetation in the action area via the approved conservation zoning and an Environmentally Significant Lands (ESL) layer which will serve as an additional consent requirement for any future works proposed. The ESL has been placed over the patches of Illawarra and South Coast Lowland Forest and Woodland and the riparian corridors in the action area. These areas are zoned E2 – Environmental Conservation or E3 – Environmental Management. The specific controls relating to development on or adjacent to ESL are (JBA Urban Planning Consultants 2011):

Before granting consent, the consent authority must be satisfied that the development:

- *would substantially retain existing native vegetation, and*
- *would not adversely affect to a significant extent:*
  - *the ecological value of the existing vegetation, or*
  - *native fauna*
- *Before granting consent, the consent authority must consider whether;*
  - *the locality has high biological diversity*
  - *the locality contains:*

  - *a disjunct population of native species or a species that is neat the limit of its geographical range, or - riparian vegetation, or*
  - *vegetation associated with wetlands, and*
- *the land has connective importance as, or as part of*
  - *a corridor of native vegetation forming a connection that allows for the potential passage of species of flora or fauna between two or more areas of native vegetation, and*
- *the vegetation is adequately represented on land in the general locality, and*
- *the land is important as a site along a migratory route for wildlife, and*
- *the land functions as an important drought refuge for wildlife, and*
- *clearing of the land would be likely to contribute significantly to:*
  - *soil erosion, or*
  - *salinisation of soil or water, or*
  - *acidification of soil, or*
  - *landslip, or*
  - *deterioration in the quality of surface or ground water, or - increased flooding, or*
- *there is any need to conserve all or some of the native vegetation because:*
  - *of its unusually good condition or its significance as a sample of its type, or*
  - *the development will increase the perimeter of the native vegetation, and so the ratio of the boundary to the area of the native vegetation, making it more vulnerable to negative impacts, or*
  - *there is an archaeological site that has Aboriginal heritage significance on the land.*

Figure 14: Reduction in impacts to Illawarra and South Coast Lowland Forest and Woodland at Patch 2

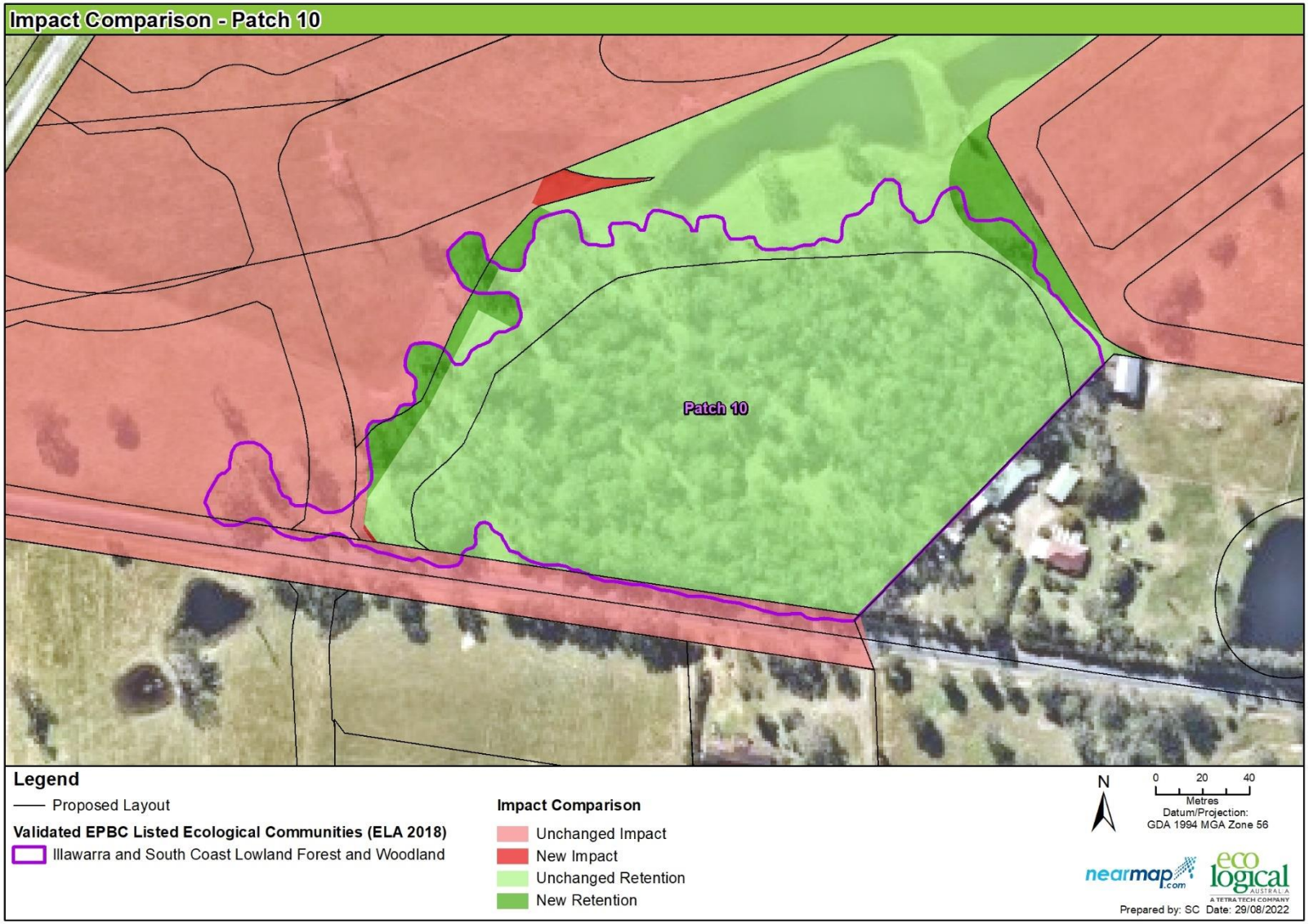

Figure 15: Reduction in impacts to Illawarra and South Coast Lowland Forest and Woodland at Patch 10

Figure 16: Reduction in impacts to Illawarra and South Coast Lowland Forest and Woodland at Patch 11

8.2 Mitigation measures

8.2.1 Management of potential indirect impacts

Activities within the development site have the potential to affect avoided or retained native vegetation over both the short and the long term. These potential impacts, often referred to as 'indirect' and/or 'edge effects', may include:

- the introduction of weeds and exotic species
- the spread of litter and rubbish
- introduction of domestic animals (cats and dogs)
- increased disturbance from pedestrian access
- runoff from construction containing nutrients, sediments and other pollutants
- inappropriate water, sewer and stormwater management leading to erosion
- recreational use of open space adjacent to offset areas.

The lot layout has been designed to avoid and/or minimise, to the maximum extent possible, indirect impacts to native vegetation including indirect impacts to the proposed retention area. The outer perimeter of the proposed residential footprint is either a perimeter road or open space. As such, there will be no residential blocks directly adjacent to protected bushland areas. This has been designed to:

- remove the likelihood of illegal encroachment into native vegetation by future residents, thus minimising the chance of degradation through illegal clearing, weed invasion, garden escapes, fires and predation by domestic animals
- allows for a managed 30 m TEC buffer zone to be established between the residential lots and protected bushland areas as required by the EPBC Act Conservation Listing Advice (TSSC 2020), see below.

8.2.2 TEC buffer zones

The conservation advice for Illawarra and South Coast Lowland Forest and Woodland recommends that a 30 m vegetated buffer is provided between the development zone and the edge of the community to mitigate against indirect impacts to retained areas of Illawarra and South Coast Lowland Forest and Woodland. As shown in Figure 17, Figure 18 and Figure 19, 30 m buffers have been applied to the edge of Illawarra and South Coast Lowland Forest and Woodland. In some locations the 30 m buffer captures areas that already contain hardstand surfaces. These locations have been excluded from any management measures that would be applied to the buffer. Where the buffers are mapped as 'retained' or 'proposed open space', they will be managed as part of the Vegetation Management Plan. It is proposed that the buffer areas are revegetated to a derived native grassland form of Illawarra and South Coast Lowland Forest and Woodland.

8.2.3 Flooding, stormwater and water quality

Inappropriate water, sewer and stormwater management presents potential risks to the integrity of the conservation areas. Water sensitive urban design (WSUD) features will be incorporated in the development. The preferred strategy option for water cycle management includes:

- vegetated swales incorporated into general streetscape

- vegetated filter strips located within open areas/parks adjacent and upslope of riparian corridors
- gross pollutant traps strategically located at outlet of stormwater drainage systems
- bio-retention (filtration) system located at the outlet of stormwater drainage system and off-line from existing waterways (and outside riparian zones where practicable)
- rehabilitated natural drainage channels incorporating stormwater treatment measures.

Stormwater runoff from urban areas will first be treated in bio-retention basins before being discharged to the streams. These basins will treat for water-borne pollutants such as nutrients and suspended solids and will also reduce discharge rates during small but frequent rainfall events, those which have greater impact on stream erosion.

The detention basins will include appropriate plantings arounds the banks. This will provide a strong buffer area between the urban development interface and the proposed retained areas, where they are in proximity. The water captured in the detention basins will only be retained for as long as required for it to be released at pre-development flow rates, once discharged (shortly after a rainfall event), the areas quickly dry out as an ephemeral water course. The quantity and quality of the water flowing out of the detention basins into natural watercourses (noting this will not intersect retained patches of Illawarra and South Coast Lowland Forest and Woodland) will be of a higher standard than predevelopment rural run-off and no different to the current high and low flow events.

As a result of the above measures, no stormwater run-off is expected to enter the retained areas other than periodic discharges of high quality water into existing waterways as described above, outside of the current distribution of Illawarra and South Coast Lowland Forest and Woodland. Further, the CEMP will include measures to ensure that any impacts during the construction phase of the bio-retention basins is confined to the development footprint and will not extend into proposed conservation areas.

8.3 Construction Environment Management Plan (Mitigation Measures)

Lendlease Communities (Calderwood) Pty Limited will prepare and implement a Construction Environment Management Plan (CEMP), for vegetation clearing within the action area. The CEMP would guide the development outlined in this report and ensure that all direct and indirect impacts are contained within the development footprint and appropriate mitigation measures are implemented to minimise indirect impacts to retained ecological values, specifically Illawarra and South Coast Lowland Forest and Woodland. This will address the management of the land proposed for retention and their buffers. such that surrounding roads will be fully curbed and guttered with no stormwater being discharged into the retained areas (treated water from the detention basins within the development footprint will flow into existing riparian areas).

The CEMP will include, but not be limited to:

- temporary and permanent protective fencing will be erected around all areas identified for retention prior to clearing activities commencing in relevant stages to minimise any inadvertent damage
- any removed hollow-bearing trees within the proposed development footprint that potentially contain roosting and breeding habitat for threatened fauna will be identified and hollows relocated to the retained land

- roads surrounding each part of the retained land will be fully curbed and guttered with piped stormwater management infrastructure to ensure that stormwater will not flow directly into the retained Illawarra and South Coast Lowland Forest and Woodland
- a de-watering plan will be prepared for any farm dams that are removed from the proposed development footprint
- a fauna pre-clearance protocol will be prepared for the removal of all trees within the proposed development footprint
- lighting around retained areas designed to minimise impacts to fauna
- monitoring of performance measures and non-compliance.

8.3.1 Preconstruction measures

The main preconstruction measures include fencing and erosion and sediment controls. Additional controls for managing the removal of native vegetation and fauna habitat and weed invasion have been included in the preconstruction measures, noting that these particular controls may be repeated during the life of the construction period.

Fencing conservation areas

Fauna exclusion fencing will be installed along the perimeter of all retained areas. Signage will be provided to increase community awareness of the importance of the retained areas. Fencing will be monitored and maintained as part of the Vegetation Management Plan reporting requirements to ensure their integrity remains intact.

Sediment and erosion control measures

The erosion and sediment controls will include the following measures:

- construction of temporary diversion drains or provision of staked straw bales on the high side of the disturbed areas to direct upstream runoff around the areas
- the use of silt fencing on the downstream side of the area of works to retain soils
- provision of a stabilised site access at appropriate points where construction vehicles will enter and leave the site to reduce the likelihood of vehicles tracking soil materials onto public roads
- topsoil stockpile located adjacent to the areas of disturbance and to have an earth bank on the upslope side to divert runoff around the stockpile with a sediment fence located 1 to 2 metres downslope of the stockpile
- rock wrapped in geofabric or straw bales will be installed in or around any stormwater drainage inlet.

The CEMP will include requirements for ensuring the required controls are in place prior to construction, marking/fencing vegetation for retention and pre-clearance ecological surveys.

Vegetation and habitat clearance

Vegetation clearance will be undertaken in a manner which is sensitive to the ecological values of the area. Strict clearing limits will be established and delineated to ensure that no over clearing occurs.

Hollow bearing trees (HBTs) will be cleared in a progressive manner in accordance with the hollow bearing tree clearance protocol in the CEMP to minimise potential impacts to hollow dependant fauna

during the construction phase. A suitably qualified and experienced ecologist will be on site during any vegetation clearance in ecologically sensitive areas (including areas containing MNES) as well as during the clearance of HBTs.

The pre-clearing protocol in the CEMP includes:

- threatened fauna searches one week prior to tree removal
- protocols for hollow-bearing tree removal
- addition of fallen logs to conservation areas
- supervision by an ecologist.

Woody material and hollow logs will be relocated to retained areas to supplement habitat features for fauna. Surplus material will be mulched on site, piled into unobtrusive piles or disposed of at a facility licensed to receive green waste. All weed propagules especially noxious will be bagged and disposed of as directed by legislation at a facility licensed to receive green waste. All weed waste without propagules will be composted onsite in small unobtrusive piles.

8.3.2 Construction and operation controls

Litter/sediment control

Local drainage from the urban areas will be filtered (using in-line filter pit inserts or equivalent) prior to discharge to water detention basins and to downstream ecosystems. This will allow for protection of the storages from gross pollutants and for the easy interception and collection of this pollutant material. The filtering system will remove nutrients and other pollutants to the agreed standards.

Lighting controls

The potential for added light impacts will be addressed through a range of control measures on the lighting to be used within the residential area, including:

- ensuring the development complies with the Australian Standard 4282 – Control of the obtrusive effects of outdoor lighting, which provides recommended limits for lighting
- incorporating a lighting strategy which prescribes limits on lights for various areas, such as:
  - post top overhead street lighting to be used facing down with minimal spill into adjacent areas, in particular, offset areas
  - lighting to be set on timers where appropriate, and/or set on sensor switches
  - position and directional lighting to be located near retained areas where deemed necessary but oriented away from the retained area and back into the development where suitable.

Waste management controls

All reasonable steps will be taken by the developer to remove waste deposited by others within the action area during the development stages. Construction waste management measures are included as a component of the CEMP (See Appendix K).

To deter any waste dumping within the retained areas in the longer term, exclusion fencing will be installed along the permitter of existing vegetation remnants and the surrounds of the conservation areas (as described above). Additionally, signage will be erected along the boundary to deter dumping.

8.4 Vegetation Management Plan

The Vegetation Management Plan (VMP) is proposed to apply to the retained areas of Illawarra and South Coast Lowland Forest and Woodland, and portions of the 30 m buffer that are not proposed for hardstand development. Indicatively, the VMP will be prepared consistent with the Environmental Management Plan Guidelines (DotE 2014) and include:

- Project description and objectives
- Environmental management roles and responsibilities
- Pest management
- Weed control
- Indicative planting schedules (where required)
- Performance targets
- Monitoring
- Risk evaluation.

The purpose of the VMP will be to manage potential indirect impacts that could occur to the retained Illawarra and South Coast Lowland Forest and Woodland. The VMP will also revegetate areas of the retained buffer, to minimise the current indirect impacts (weed invasion and cattle grazing) that are continuing to affect the integrity of each patch. Consistent with the Significant Impact Guidelines 1.2, the implementation of a VMP to manage indirect impacts and reduce a significant impact can be used, so long as:

- the effectiveness of the proposed measure is well established
- there is a high degree of certainty about the avoidance of impacts
- there is a high degree of certainty about the reduction of impacts.

VMPs and CEMPs are a tried and tested method of managing indirect impacts that have been proven to reduce or avoid impacts. Further, Lendlease Communities has had experience at the implementation of VMPs and CEMPs across NSW during and post the construction phase, and have the resources to correctly implement the plans.

8.5 Parties responsible for implementation

Lendlease Communities (Calderwood) Pty Ltd will ensure that all mitigation measures are undertaken until the completion of the development. On completion of the development, the responsibility for management of open space and offset areas may be transferred to Shellharbour City Council and Wollongong City Council who would continue to manage the open space areas.

Where necessary, suitable environmental, conservation, and engineering contractors experienced in bushland conservation and management will be employed. The contractors will be chosen through a tender process which will likely consider each tenderer's:

- experience with bushland conservation and management (previous environmental records)
- sustainability and efficiency
- cost
- availability of equipment.

A Project Ecologist will be engaged for the duration of the on-site works.

The Project Ecologist will ensure that all conditions relating to the biodiversity management of the site are fully implemented and complied with including:

- Vegetation not authorised to be removed shall be protected during construction to ensure the natural vegetation and topography is not unnecessarily disturbed.
- Exclusion fencing will be installed prior to site works commencing, exclusion fencing will delineate the limit of areas impacted by the works and provide protection for trees being retained within the works areas.
- Erosion and sedimentation controls will be in place prior to the commencement of site works and maintained throughout construction activities until the site is suitably revegetated.
- Stockpiling is to be located within the development areas and not within buffer zones.
- The design performance requirements and maintenance strategies of the drainage structure will ensure that there is no increase in water quantity exiting the structure relative to predevelopment conditions and there is no diminishing of water quality exiting the drainage structure relative to pre-development conditions.
- Areas requiring ecological restoration / rehabilitation will be actively regenerated via bush regeneration principles and, where needed, planted with a diversity of plant species from the existing vegetation community. Works will be in keeping with Best Practice Guidelines of the State and the Commonwealth.

The project ecologists will recommend and approve plant species selections and ensure the timing of material collection will result in the required plants being available at the time of on-ground restoration works.

8.6 Biodiversity impact summary

The proposed development has implemented measures to avoid and minimise impacts to MNES. As a result of the numerous iterations to the development footprint and the reduction in direct impacts to Illawarra and South Coast Lowland Forest and Woodland from 0.72 ha to 0.28 ha, the proposed development would not result in a residual significant impact to Illawarra and South Coast Lowland Forest and Woodland. The application of the significant impact criteria determined that a significant impact to Grey-headed Flying-fox and Large-eared Pied Bat was unlikely to occur, and therefore, residual significant impacts are not expected. Surveys for *Pterostylis gibbosa* were completed by orchid expert Lachlan Copeland in 2012 and determined that the action area was highly unlikely to provide habitat for the species. The targeted surveys conducted did not identify the species in the action area during survey, and no impacts are expected to occur. Additional surveys in 2022 confirmed the absence of this species and the unsuitability of the site as potential habitat. The implementation of a Vegetation Management Plan and Construction Environment Management Plan will further manage any indirect impacts that may occur to the retained Illawarra and South Coast Lowland Forest and Woodland.

Figure 17: Proposed 30 m buffer around patch 2, and existing and proposed land use

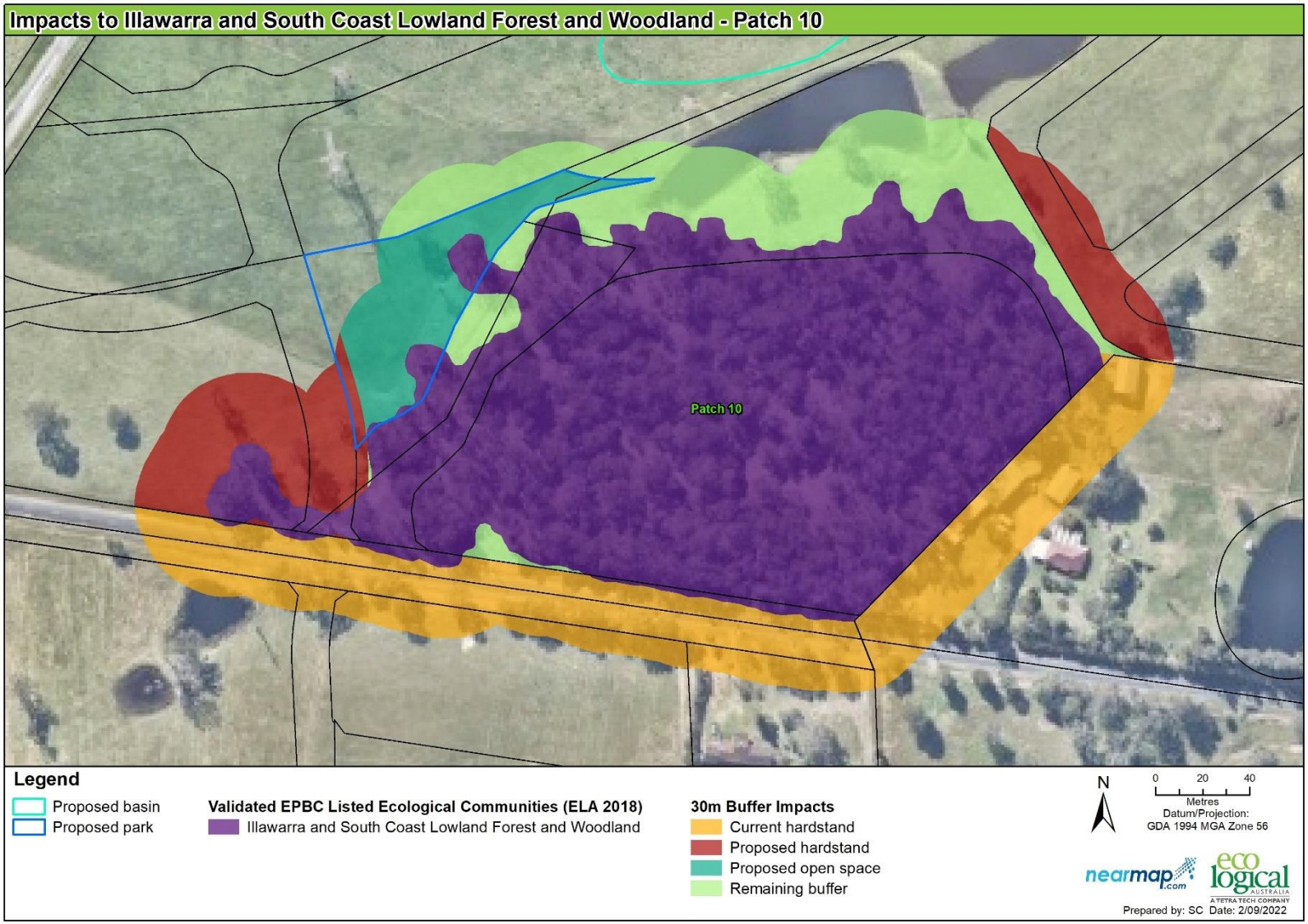

Figure 18: Proposed 30 m buffer around patch 10, and existing and proposed land use

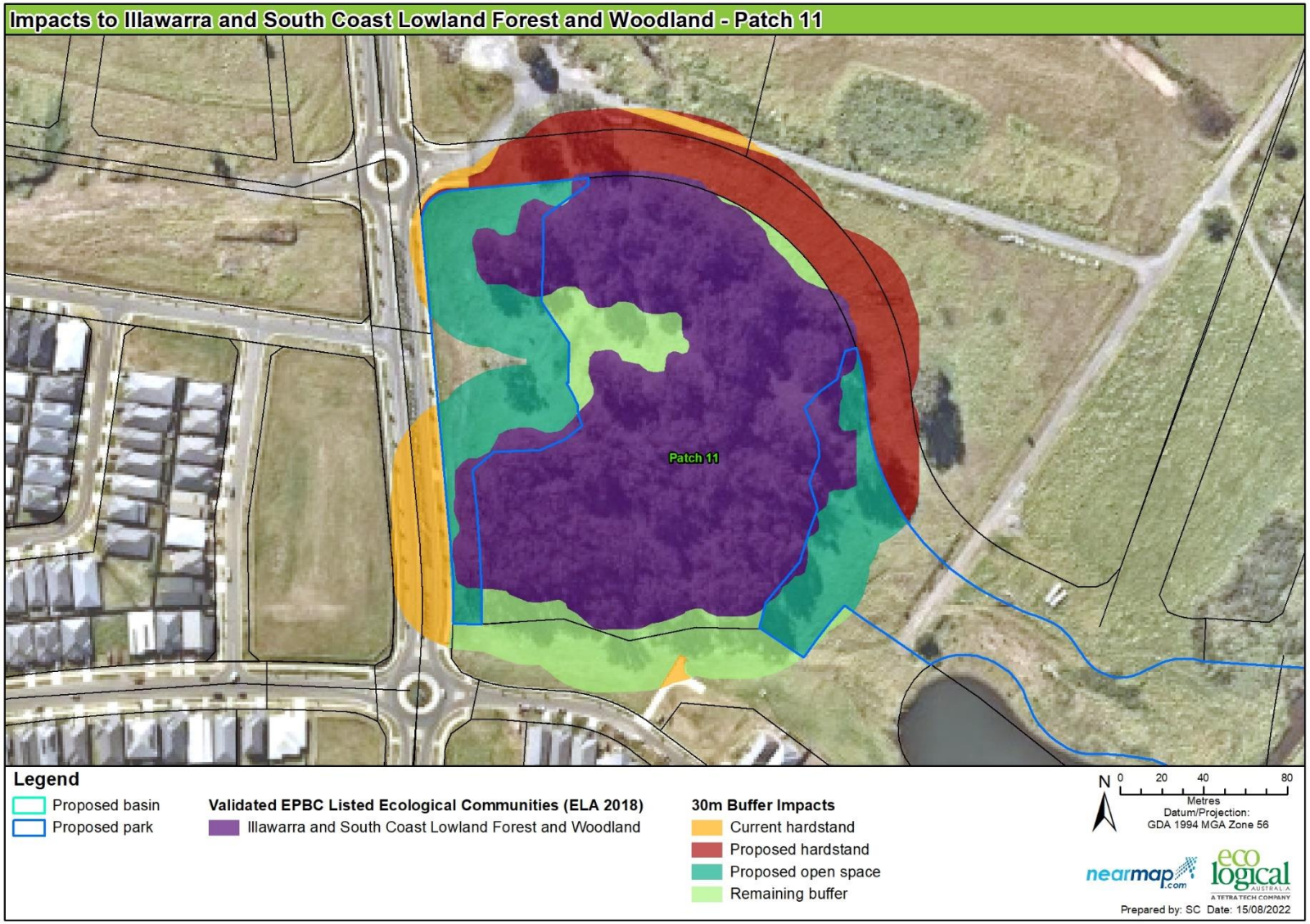

Figure 19: Proposed 30 m buffer around patch 11, and existing and proposed land use

9. References

All of the references used in preparing this referral are considered to be of a high reliability and from a reliable source as most have been prepared by either the Australian or NSW Government. The resources used comprise listing information, impact assessment guidelines and/or recovery plans for MNES.

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Appendix A Calderwood Mod 4 EPBC Act Referral Supporting documentation

Provided as a separate PDF document

Appendix B EPBC 2021/8189 Controlled Action Decision

Provided as a separate PDF document

Appendix C EPBC 2021 / 8189 PD Requirements

Provided as a separate PDF document

Appendix D Names, roles and qualifications of persons preparing this PD report

Name	Qualifications	PD Role
Eco Logical Australia staff		
Alex Gorey	Bachelor of Science 2012 Master of Sustainability 2015 6+ years experience in biodiversity assessment	Vegetation mapping & plots Targeted threatened flora surveys Report writing
Dr. Meredith Henderson	Bachelor of Science PhD Vegetation Dynamics Accredited BAM Assessor 30+ years experience in biodiversity surveys & EIA	Principal Ecologist Vegetation mapping & plots Targeted threatened flora surveys
Dr. Rod Armistead	PhD in Conservation Biology Bachelor of Advanced Since (Hons) 20+ years experience in fauna surveys and EIA	Fauna Ecologist Targeted threatened fauna surveys
Mel Chapman	Graduate Certificate in Environmental Studies 2021 2 years experience in biodiversity assessment	Full floristic plots
Former ELA Staff	**prior to 2018**	
Liz Norris	Bachelor Environmental Science (Honours) Accredited Biobanking and BC Act Assessor 20 years experience in biodiversity surveys & EIA	Senior Botanist Vegetation mapping and community descriptions Targeted threatened flora survey Biometric plots
Karen Spicer	Bachelor of Env Science (Hons) 1999 Accredited BAM Assessor 15+ years experience in biodiversity assessment and EIA	Senior Botanist Vegetation mapping & plots Targeted threatened flora surveys

Appendix E Protected Matters Search Tool

Provided as a separate PDF document

Appendix F Likelihood of occurrence assessment

Provided as a separate PDF document

Appendix G 2012 Targeted survey results for *Pterostylis gibbosa*

Provided as a separate PDF document

Appendix H 2021 Riparian Corridor Plot Data

Provided as a separate PDF document

Appendix I Aboriginal Heritage Assessment (Kelleher Nightingale Consulting Pty Ltd 2018)

Provided as a separate document

Appendix J Calderwood Urban Development Project Statement of Commitments

Provided as a separate document.

Appendix K Response to Request for Information (22 October 2021)

Provided as a separate PDF document

Appendix L Response to Request for Information dated 15 March 2022

Appendix M Site photos

Figure 20: Patch 2

Figure 21: Patch 11

Figure 22: Patch 10

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Appendix C Notification of Approval (Department of Climate Change, Energy, the Environment and Water 9 April 2023)

Australian Government
Department of Climate Change, Energy, the Environment and Water

Notification of approval

Calderwood Mod 4 Residential Development, Calderwood Valley, NSW (EPBC ref 2021/8981)

This decision is made under section 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Note that section 134(1A) of the EPBC Act applies to this approval. That provision provides, in general terms, that if the approval holder authorises another person to undertake any part of the Action, the approval holder must take all reasonable steps to ensure that the other person is informed of any conditions attached to this approval, and that the other person complies with any such conditions.

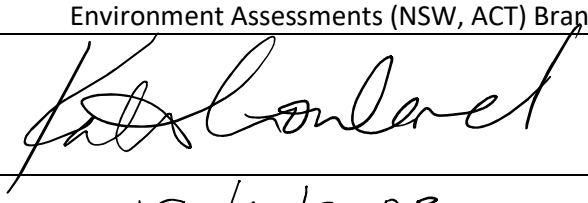
Proposed action

person to whom the approval is granted (approval holder)	Lendlease Communities (Calderwood) Pty Limited
ABN of approval holder	53 079 989 674
Action	To develop a residential and commercial subdivision, including associated ancillary infrastructure in Calderwood Valley, NSW. See EPBC Act referral 2021/8981.

Approval decision

decision	My decision on whether or not to approve the taking of the Action for the purposes of the controlling provision for the Action is as follows.	
	Controlling Provision	**Decision**
	Listed threatened species and communities (section 18 and section 18A)	Approved
period for which the approval has effect	This approval has effect until 30 April 2038.	
conditions of approval	The approval is subject to conditions under the EPBC Act as set out in Annexure A.	

Person authorised to make decision

name and position	Kate Gowland Branch Head Environment Assessments (NSW, ACT) Branch
signature	
date of decision	19/4/2023

Annexure A

Note: Words appearing in **bold** have the meaning assigned to them at PART C – DEFINITIONS.

Part A – Conditions specific to the Action

1) In taking the Action, the approval holder must not **clear** outside the **Action area**.

2) The approval holder must not **clear**:

   a) any **Illawarra Forest** outside of the **Illawarra Forest impact areas**, and

   b) more than of 0.28 hectares (ha) of **Illawarra Forest**.

3) The approval holder must implement a Vegetation Management Plan (VMP) for the **Illawarra Forest retained areas** and the inner 15m of all retained vegetation within the **buffer zones**. The environmental outcomes of implementing the VMP must be that the **Illawarra Forest retention areas** continue to meet the EPBC Act condition thresholds for listing as **Illawarra Forest** for the duration of this approval. The VMP must be consistent with the **Environmental Management Plan Guidelines** and must:

   a) include an analysis of the potential impacts of the Action on the **Illawarra Forest retained areas** including the facilitated impacts arising from the Action (specifically, the increase in activity which will occur, near **Illawarra Forest retained areas** as a result of the Action),

   b) detail management measures for the conservation management of the **Illawarra Forest retained areas** and the inner 15m of the retained vegetation in the **buffer zones**, including:

      i) pest management,

      ii) weed control, and

      iii) revegetation measures and planting schedules,

   c) specify measurable, achievable and timebound performance criteria to achieve the environmental outcomes,

   d) detail the roles and responsibilities of those implementing the VMP,

   e) include a schedule of monitoring to assess the success of the VMP implementation against the environmental outcomes and performance criteria, and

f) include a risk assessment of the VMP not achieving the environmental outcomes and/or performance criteria.

The approval holder must implement the VMP until the expiry of this approval.

4) The approval holder must implement a Construction Environment Management Plan (CEMP). The environmental outcomes of implementing the CEMP must be to avoid all avoidable potential impacts and to mitigate all unavoidable impacts to **protected matters** as a result of taking the Action. The CEMP must:

~~a)~~ include measures and specify the timing of installation of temporary and permanent fencing, to restrict access, along the boundaries of the inner 15 m of the retained vegetation in the **buffer zones**,

b) detail the method, effort, and timing to identify and record the location of any hollow-bearing trees within the **Action area**,

c) detail the method(s) which will be implemented to relocate any hollow-bearing trees **cleared** within the **Action area** to the **Illawarra Forest retained areas** without causing any harm to **Illawarra Forest**,

d) include measures to install and maintain piped stormwater management infrastructure along all roads surrounding the **Illawarra Forest retained areas** and **buffer zones** to ensure stormwater falling or flowing on roads cannot flow into the **Illawarra Forest retained areas**,

e) specify a de-watering plan for any farm dams removed from within the **Action area**,

f) include a fauna pre-clearance protocol to ensure fauna are afforded the opportunity to safely vacate any tree or area within the **Action area** prior to that tree or area being **cleared**,

g) detail the lighting measures to prevent artificial lighting impacts to fauna within the **Illawarra Forest retained areas** during the operational phase,

h) specify measurable, achievable and timebound performance criteria to achieve the environmental outcomes, and

i) include the methods, effort, and a schedule of monitoring to determine whether the performance criteria and environmental outcomes have been or are likely to be achieved and to detect any non-compliance with the commitments made in the CEMP.

j) detail measures to manage potential indirect impacts to the **Illawarra Forest retained areas** and the inner 15m of the retained vegetation in the **buffer zones**.

The approval holder must implement the CEMP until the expiry of this approval.

Part B – Administrative conditions

NOTIFICATION OF DATE OF COMMENCEMENT OF THE ACTION

5) The approval holder must notify the **department** electronically of the date of **commencement of the Action**, within 5 **business days** of **commencement of the Action**.

6) If the **commencement of the Action** does not occur within 5 years from the date of this approval, then the approval holder must not **commence the Action** without the prior written agreement of the **Minister**.

COMPLIANCE RECORDS

7) The approval holder must maintain accurate and complete **compliance records**.

8) If the **department** makes a request in writing, the approval holder must provide electronic copies of **compliance records** to the **department** within the timeframe specified in the request.

Note: Compliance records may be subject to audit by the **department**, or by an independent auditor in accordance with section 458 of the **EPBC Act**, and/or be used to verify compliance with the conditions. Summaries of the results of an audit may be published on the **department's** website or through the general media.

9) The approval holder must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the **department's** *Guidelines for biological survey and mapped data* (2018), or any subsequent official version or as otherwise specified by the **Minister** in writing.

10) The approval holder must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the **department's** *Guide to providing maps and boundary data for EPBC Act projects* (2021), or any subsequent official version or as otherwise specified by the **Minister** in writing.

11) The approval holder must submit all **monitoring data** (including **sensitive ecological data**), surveys, maps, other spatial and metadata and all species occurrence record data (sightings and evidence of presence) electronically to the **department** within 12 months of the approval.

ANNUAL COMPLIANCE REPORTING

12) The approval holder must prepare a **compliance report** for each 12-month period following the date of this approval, or as otherwise agreed to in writing by the **Minister**.

13) Each **compliance report** must be consistent with the **department's** *Annual Compliance Report Guidelines* (2014), or any subsequent official version.

14) Each **compliance report** must include:

    a) Accurate and complete details of compliance and any non-compliance with the conditions and the **plans**, and any **incidents**.

    b) One or more **shapefile** showing all **clearing** of any **protected matters**, and/or their habitat, undertaken within the 12-month period at the end of which that **compliance report** is prepared.

    c) A schedule of all **plans** in existence in relation to these conditions and accurate and complete details of how each plan is being implemented.

15) The approval holder must:

    a) Publish each **compliance report** on the **website** within 60 **business days** following the end of the 12-month period for which that **compliance report** is required.

    b) Notify the **department** electronically, within 5 **business days** of the date of publication that a **compliance report** has been published on the **website**.

    c) Provide the weblink for the **compliance report** in the notification to the **department**.

d) Keep all published **compliance reports** required by these conditions on the **website** until the expiry date of this approval.

e) Exclude or redact **sensitive ecological data** from **compliance reports** published on the **website** or otherwise provided to a member of the public.

f) If **sensitive ecological data** is excluded or redacted from the published version, submit the full **compliance report** to the **department within** 5 **business days** of its publication on the **website** and notify the **department** in writing what exclusions and redactions have been made in the version published on the **website**.

Note: Compliance reports may be published on the **department's** website.

REPORTING NON-COMPLIANCE

16) The approval holder must notify the **department** electronically, within 2 **business days** of becoming aware of any **incident** and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a **plan**.

17) The approval holder must specify in the notification:

a) Any condition or commitment made in a **plan** which has been or may have been breached.

b) A short description of the **incident** and/or potential non-compliance and/or actual non-compliance.

c) The location (including co-ordinates), date, and time of the **incident** and/or potential non-compliance and/or actual non-compliance.

Note: If the exact information cannot be provided, the approval holder must provide the best information available.

18) The approval holder must provide to the **department** in writing, within 12 **business days** of becoming aware of any **incident** and/or potential non-compliance and/or actual non-compliance, the details of that **incident** and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a **plan**. The approval holder must specify:

a) Any corrective action or investigation which the approval holder has already taken.

b) The potential impacts of the **incident** and/or non-compliance.

c) The method and timing of any corrective action that will be undertaken by the approval holder.

INDEPENDENT AUDIT

19) The approval holder must ensure that an **independent audit** of compliance with the conditions is conducted for every five-year period following the **commencement of the Action** until this approval expires, unless otherwise specified in writing by the **Minister**.

20) For each **independent audit**, the approval holder must:

a) Provide the name and qualifications of the nominated **independent** auditor, the draft audit criteria, and proposed timeframe for submitting the **audit report** to the **department** prior to commencing the **independent audit**.

b) Only commence the **independent audit** once the nominated **independent** auditor, audit criteria and timeframe for submitting the **audit report** have been approved in writing by the **department**.

c) Submit the **audit report** to the **department** for approval within the timeframe specified and approved in writing by the **department**.

d) Publish each **audit report** on the **website** within 15 **business days** of the date of the **department's** approval of the **audit report**.

e) Keep every **audit report** published on the **website** until this approval expires.

21) Each **audit report** must report for the five-year period preceding that **audit report**.

22) Each **audit report** must be completed to the satisfaction of the **Minister** and be consistent with the **department's** *Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines* (2019), or any subsequent official version.

COMPLETION OF THE ACTION

23) The approval holder must notify the **department** electronically 60 **business days** prior to the expiry date of this approval, that the approval is due to expire.

24) Within 20 **business days** after the **completion of the Action**, and, in any event, before this approval expires, the approval holder must notify the **department** electronically of the date of **completion of the Action** and provide **completion data**.

Part C - Definitions

In these conditions any bolded use of a word or term refers to the below definition of that word or term:

Action area means the location of the Action, represented in Attachment 1 by the zones enclosed within the yellow solid lines designated 'Action Area'.

Audit report means a written report of compliance and fulfilment of the conditions attached to this approval, objectively evaluated against the audit criteria approved by the **department**.

Business day means a day that is not a Saturday, a Sunday or a public holiday in the state or territory of the Action.

Buffer zones means the areas represented in Attachments 3-5 by the zones enclosed within the solid pink lines labelled '30 m Buffer'.

Clear, **cleared** or **clearing** means the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting, or burning of vegetation, but does not include weeds (see the *Australian weeds strategy 2017 to 2027*, Commonwealth of Australia 2017 for further guidance).

Commence the Action or **Commencement of the Action** means the date on which the first instance of any activity associated with the Action (including **clearing** and **construction**) is undertaken. **Commencement of the Action** does not include minor physical disturbance necessary to:

a) Undertake pre-clearance surveys or monitoring programs.

b) Install signage and /or temporary fencing to prevent unapproved use of the project area.

c) Protect environmental and property assets from fire, weeds, and feral animals, including use of existing surface access tracks.

d) Install temporary site facilities for persons undertaking pre-commencement activities so long as these are located where they have no impact on any **protected matter**.

Completion data means an environmental report and spatial data clearly detailing how the conditions of this approval have been met. The **department's** chosen format for spatial data is a **shapefile**.

Completion of the Action means the date on which all activities associated with this approval have permanently ceased and/or been completed.

Compliance records means all documentation or other material in whatever form required to demonstrate compliance with the conditions of approval in the approval holder's possession, or that are within the approval holder's power to obtain lawfully.

Compliance report means a written report of compliance with, and fulfilment of, the conditions attached to the approval.

Construction the erection of a building or structure that is, or is to be, fixed to the ground and wholly or partially fabricated on-site; the alteration, maintenance, repair or demolition of any building or structure; any work which involves breaking of the ground (including pile driving) or bulk earthworks; the laying of pipes and other prefabricated materials in the ground, and any associated excavation work; but excluding the installation of temporary fences and signage.

Department means the Australian Government agency responsible for administering the **EPBC Act**.

Environmental Management Plan Guidelines means the *Environmental Management Plan Guidelines*, Commonwealth of Australia 2014.

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

Illawarra Forest means the **EPBC Act** listed threatened ecological community Illawarra and south coast lowland forest and woodland ecological community. Within the **Action area**, the location of identified **Illawarra Forest** is represented in Attachment 2 by the zones enclosed within the purple solid lines designated 'Illawarra and South Coast Lowland Forest and Woodland'.

Illawarra Forest impact areas means the areas of **Illawarra Forest** represented in Attachment 2 by the zones shaded with yellow hatching and labelled 'Impacted (0.28 ha)'.

Illawarra Forest retention areas/ Illawarra Forest retained areas means areas of **Illawarra Forest** represented in Attachment 2 by the zones shaded with blue hatching and labelled 'Retained (10.30 ha)'.

Incident(s) means any event which has the potential to, or does, impact on any **protected matter**.

Independent means a person or firm who does not have any individual, financial*, employment* or family affiliation or any conflicting interests with the project, the approval holder or the approval holder's staff, representatives, or associated persons.

*Other than for the purpose of undertaking the role for which an independent person is required

Independent audit means an audit conducted by an **independent** and suitably qualified person as detailed in the *Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines* (2019), or any subsequent official version.

Minister means the Australian Government Minister administering the **EPBC Act**, including any delegate thereof.

Monitoring data means the data required to be recorded under the conditions of this approval.

Plan(s) means any action management plan or strategy that the approval holder is required by these conditions to implement.

Protected matter(s) means a matter protected under a controlling provision in Part 3 of the **EPBC Act** for which this approval has effect.

Sensitive ecological data means data as defined in the Australian Government Department of the Environment *Sensitive Ecological Data – Access and Management Policy V1.0* (2016), or any subsequent official version.

Shapefile(s) means location and attribute information about the Action provided in an Esri shapefile format. Shapefiles must contain '.shp', '.shx', '.dbf' files and a '.prj' file that specifies the projection/geographic coordinate system used. Shapefiles must also include an '.xml' metadata file that describes the shapefile for discovery and identification purposes.

Website means a set of related web pages located under a single domain name attributed to the approval holder and available to the public.

Attachments

Attachment 1 – Action Area

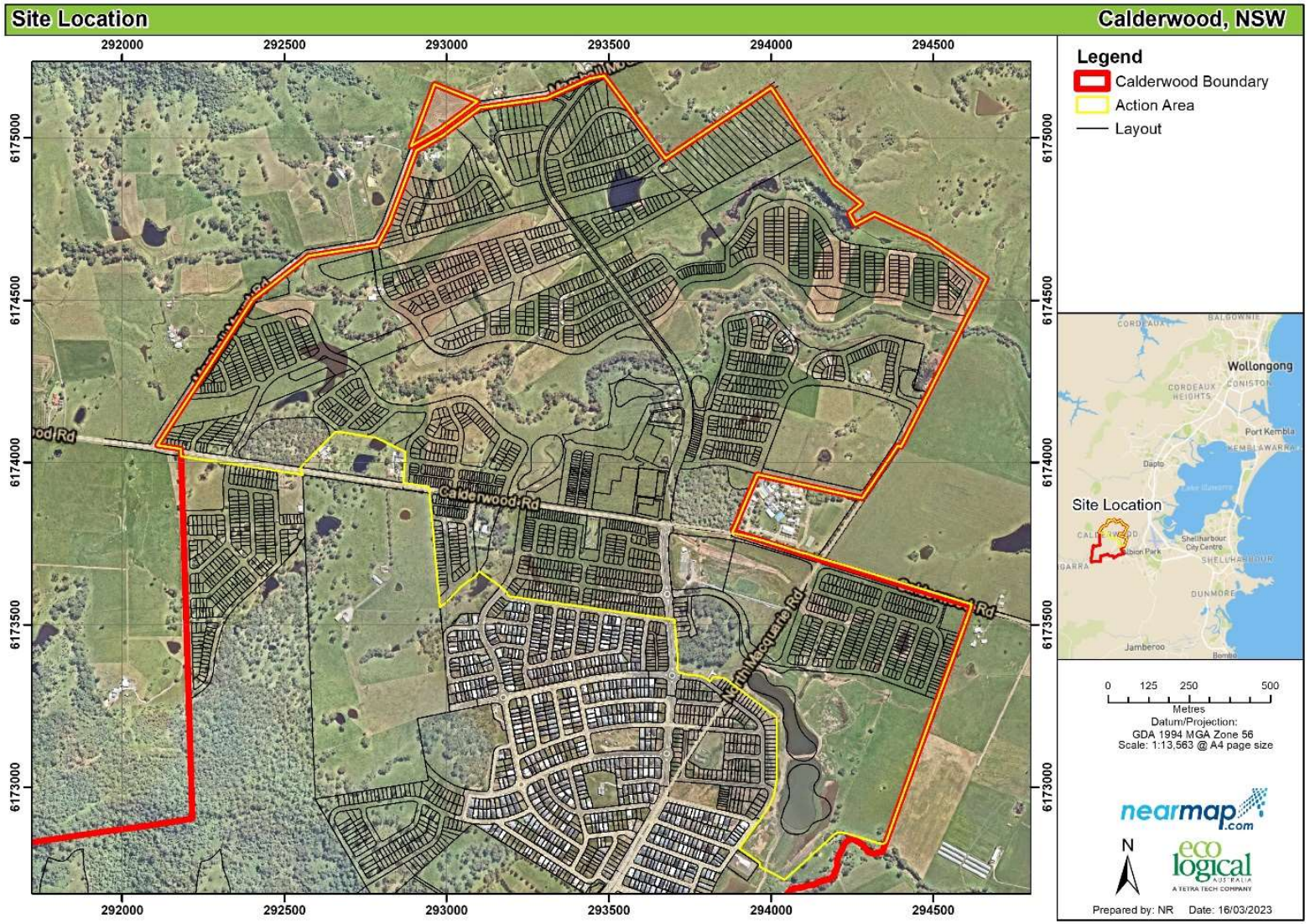
Attachment 2 - **Illawarra Forest** to be affected and retained across the development footprint

Attachment 3 - Proposed 30 m **buffer zone** around patch 2, and existing and proposed land use

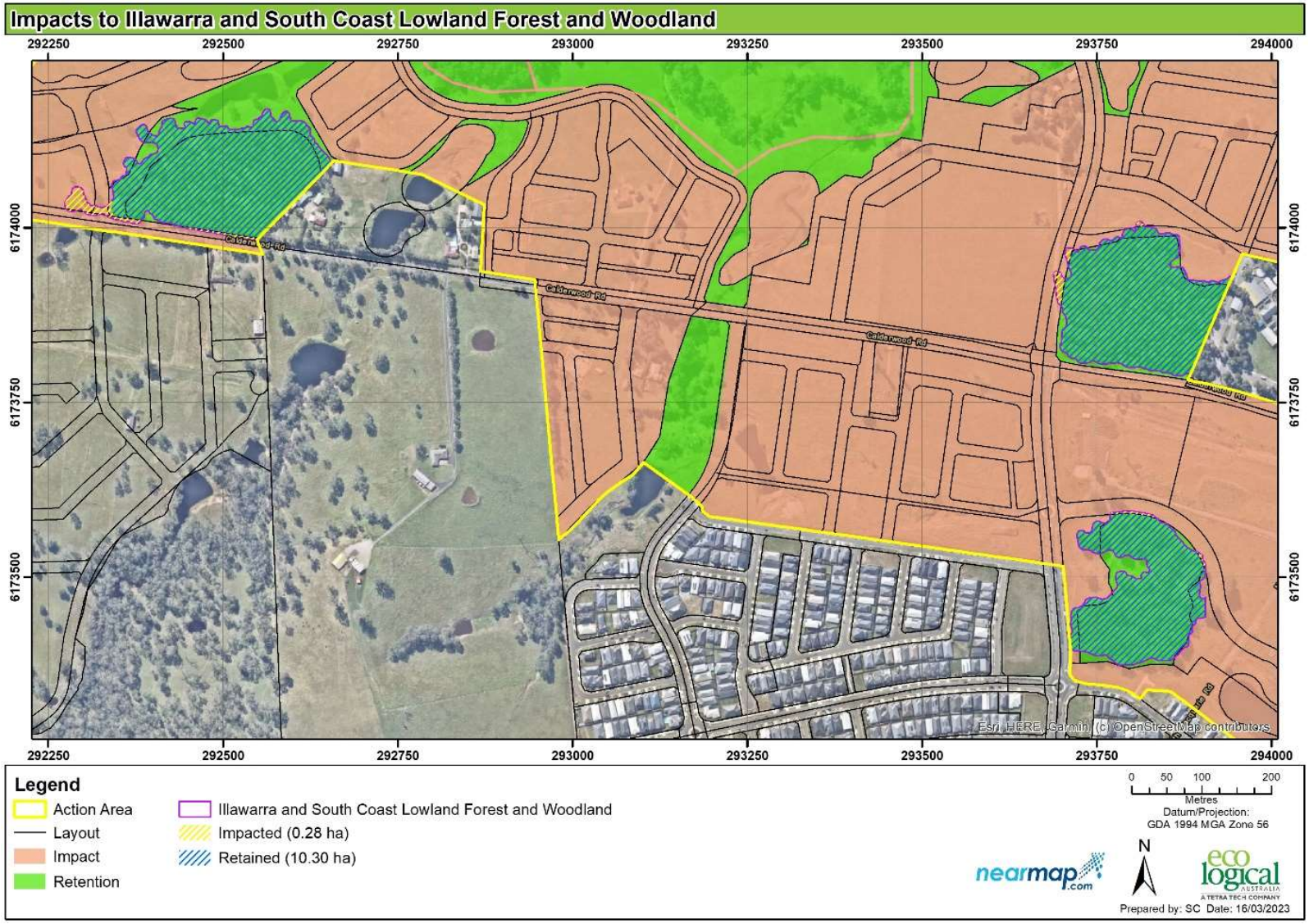
Attachment 4 - Proposed 30 m **buffer zone** around patch 10, and existing and proposed land use

Attachment 5 - Proposed 30 m **buffer zone** around patch 11, and existing and proposed land use

Attachment 1 – Action area

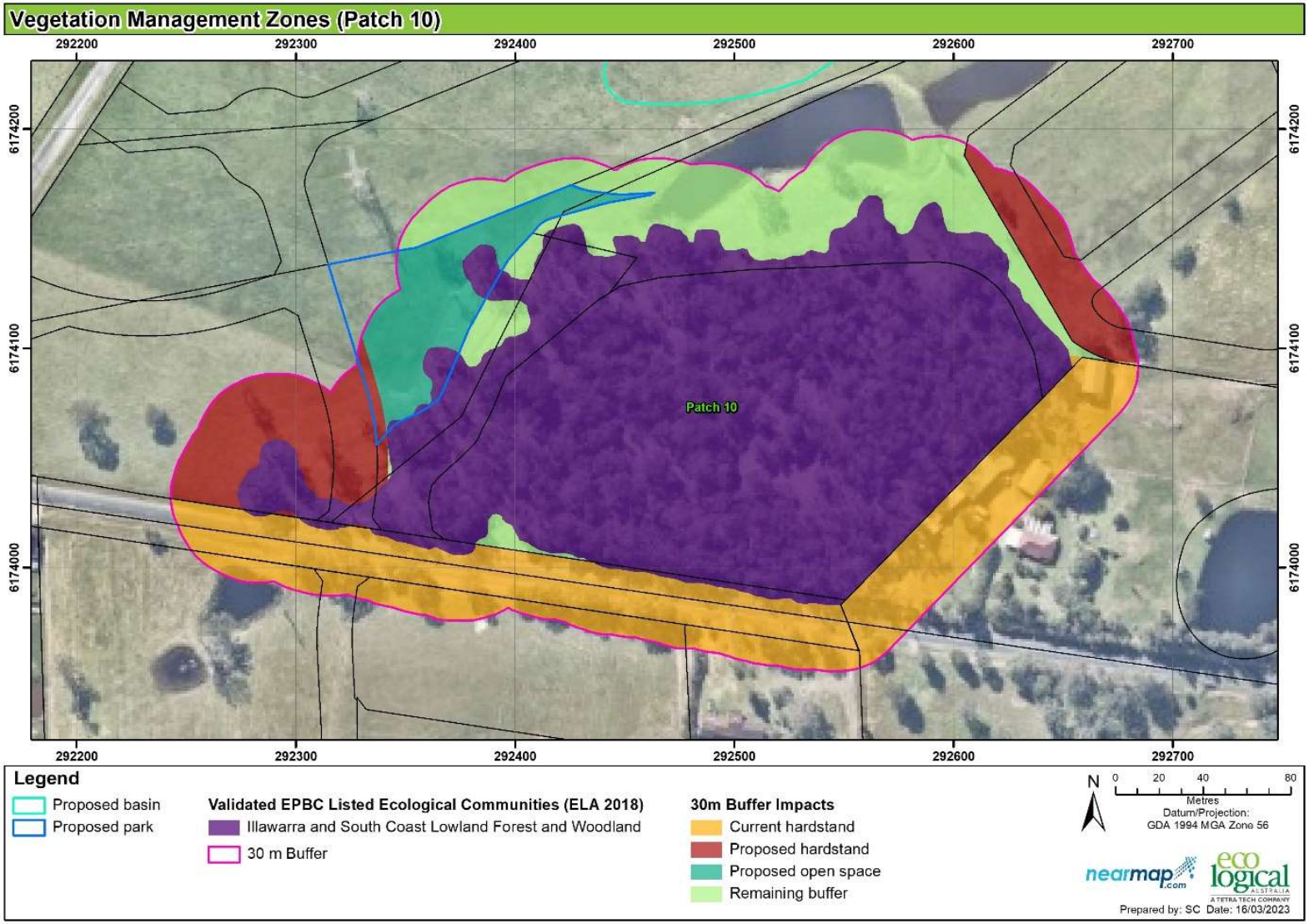


Attachment 2 – Illawarra and South Coast Lowland Forest and Woodland to be affected and retained across the development footprint.

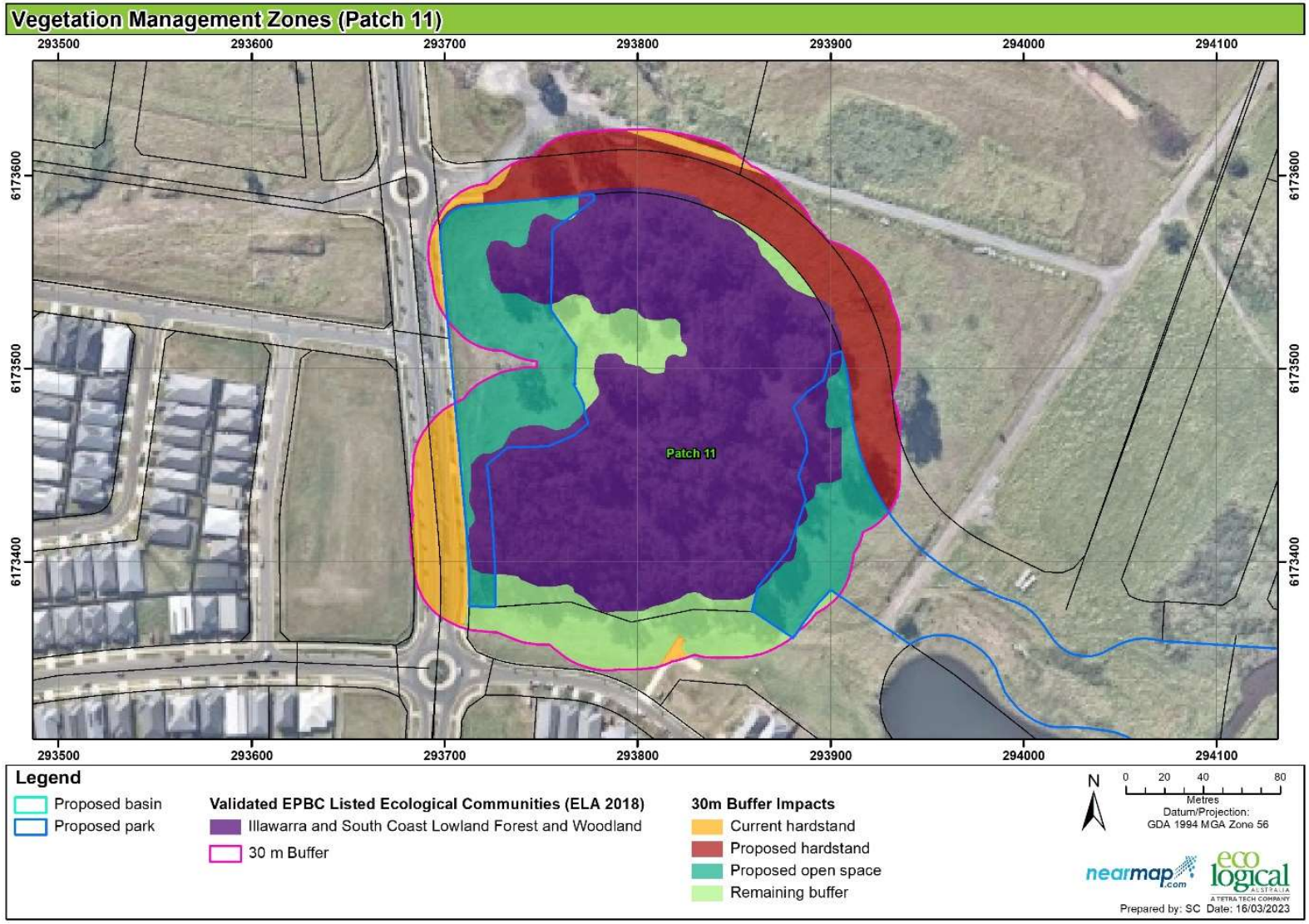


Attachment 3 - Proposed 30 m buffer zone around patch 2, and existing and proposed land use

Attachment 4 – Proposed 30 m buffer zone around patch 10, and existing and proposed land use



Attachment 5 – 30m buffer zone around Patch 11, and existing and proposed land use



Appendix D Lot and Staging Layout Plan (Stockland Development October 2024)

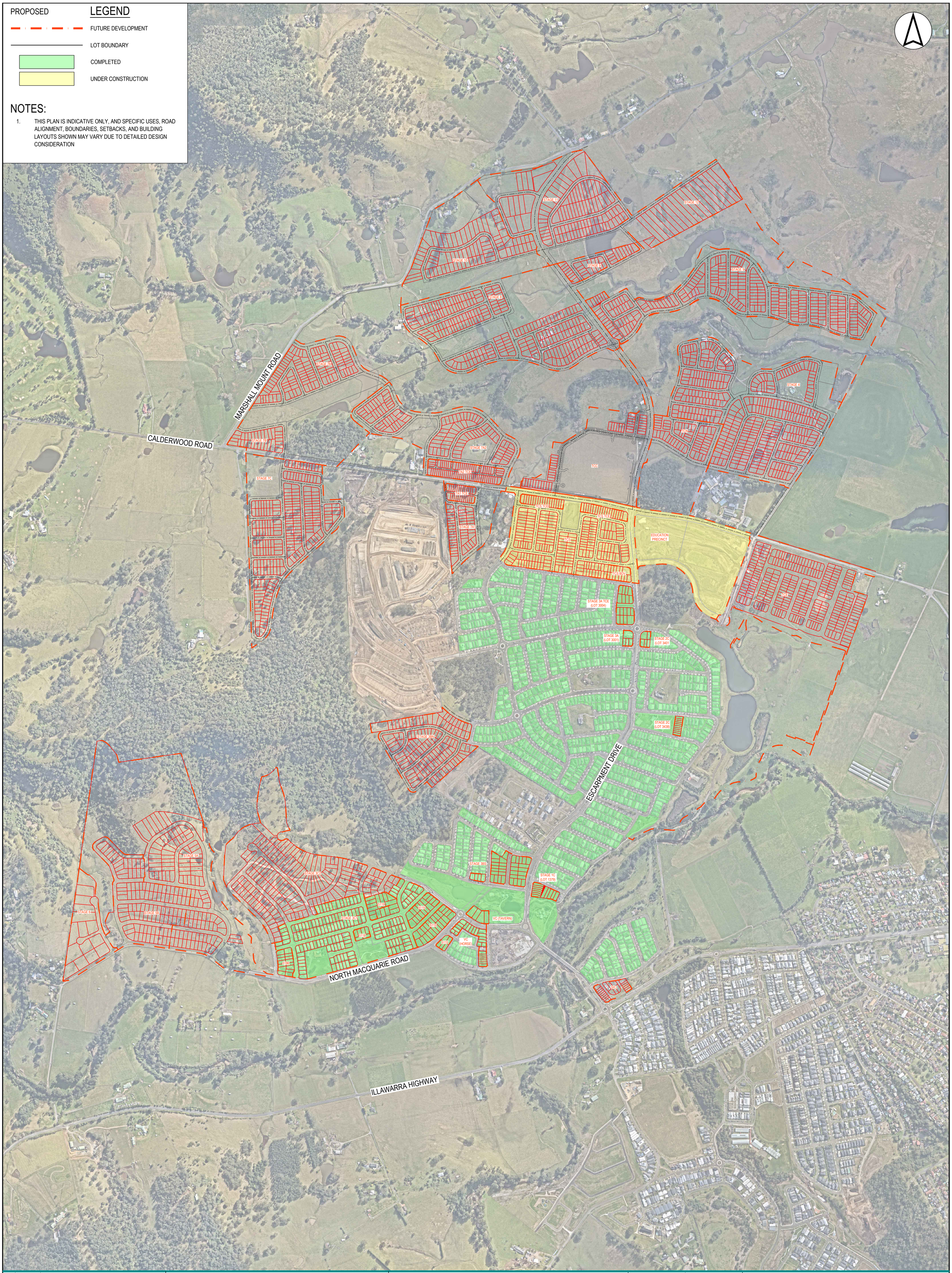
PROPOSED

LEGEND

- FUTURE DEVELOPMENT
- LOT BOUNDARY
- COMPLETED
- UNDER CONSTRUCTION

NOTES:

1. THIS PLAN IS INDICATIVE ONLY, AND SPECIFIC USES, ROAD ALIGNMENT, BOUNDARIES, SETBACKS, AND BUILDING LAYOUTS SHOWN MAY VARY DUE TO DETAILED DESIGN CONSIDERATION



REV	DATE	DESCRIPTION
P1	OCT 2024	ISSUED FOR INFORMATION

lendlease

A1 PLOT 0 50 100 150 250 200 300 A3 PLOT
6000 100 75 50 25 12000

MAKER ENG
SURVEY DESIGN DELIVER

DRAWN: MD	DESIGNED: CDW
DRAFT CHECK: KJM	DESIGN CHECK: KJM
APPROVED: KJM	

LENDLEASE CALDERWOOD VALLEY

COMMERCIAL ASSESSMENT

LOT & STAGING LAYOUT PLAN

DRAWING NUMBER	SHEET No.	ORIG. SIZE	REVISION
MKR00000-01-SK061	1 of 1	A1	P1

Appendix E Certificate of Registration on Change of Name (Australian Securities and Investments Commission 2 December 2024)

Certificate of Registration on Change of Name

This is to certify that

LENDLEASE COMMUNITIES (CALDERWOOD) PTY LIMITED

Australian Company Number 079 989 674

did on the second day of December 2024 change its name to

SRCP (CALDERWOOD) PTY LTD

Australian Company Number 079 989 674

The company is a proprietary company.

The company is limited by shares.

The company is registered under the Corporations Act 2001 and is taken to be registered in Australian Capital Territory and the date of commencement of registration is the thirtieth day of October, 1997.

Issued by the
Australian Securities and Investments Commission
on this second day of December 2024.

Joseph Longo
Chair

CERTIFICATE

Appendix F Calderwood EPBC Compliance Report Email (Stockland Development 9 April 2025)

From:	Taylah Taka
To:	Tuck, Kara; Lavers, Bethany; Kaitlin Rideout
Subject:	RE: Calderwood EPBC 2024-2025 Compliance Report (25WOL 10611)
Date:	Wednesday, 9 April 2025 10:42:51 AM
Attachments:	image002.png image003.png image004.png image005.png image006.png

Hi Kara,

Thank you for your email.

Yes, that was a typo; there hasn't been any clearing. I appreciate you confirming that.

Kaitlin is currently awaiting feedback from DCCEEW for the report. Once we receive it, I'll get back to you.

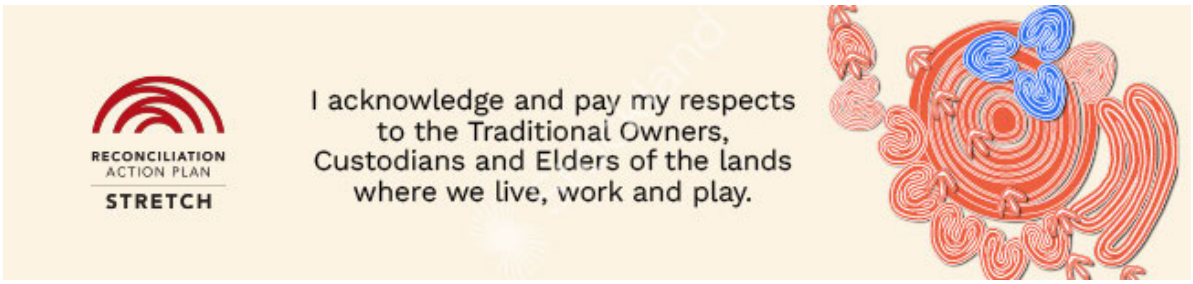
Thank you also for letting us know that the monitoring data is due on May 22, 2025.

Kind regards,

Stockland

Taylah Taka
Assistant Development Manager

[redacted]



From: Tuck, Kara [redacted]
Sent: Tuesday, 8 April 2025 3:46 PM
To: Taylah Taka [redacted] Lavers, Bethany

[redacted]
Cc: Kaitlin Rideout [redacted]
Subject: RE: Calderwood EPBC 2024-2025 Compliance Report (25WOL 10611)

Hi Taylah,

Thank you for your email last week. I have updated the report based on these responses.

Your comment in response to the last dot point (related to Condition 14) was *'Not required a clearing has occurred'.* I wanted to confirm that this was a typo and meant to instead read 'Not required as clearing has not occurred' ?

I'm aware that Stockland recently purchased Lendlease Development and that Lendlease is still the approval holder. Would you be able to provide a few sentences regarding this which we can include in the report?

I thought it would be worth mentioning that as the Vegetation Management Plan (VMP) monitoring data (related to Condition 9, 10 and 11) is due two years after the commencement of the action (22 May 2023), the monitoring data will be due 22 May 2025. For more information on the monitoring required see Section 5 of the Calderwood Valley Mod 4 VMP which I have attached to this email for ease of reference (Appendix H). This monitoring data isn't needed for the current 2024-2025 compliance report as the report is due 19 April 2025, however this monitoring data will be required for the 2025-2026 compliance report.

Pending a prompt response to the above questions we will be able to provide the report by Tuesday or Wednesday next week.

Thanks,

eco logical AUSTRALIA
A TETRA TECH COMPANY

Kara Tuck (She/her/hers)
Ecologist
[redacted]

From: Taylah Taka [redacted]
Sent: Tuesday, April 8, 2025 2:29 PM
To: Lavers, Bethany [redacted]
Cc: Kaitlin Rideout <[redacted] Tuck, Kara [redacted]
Subject: RE: Calderwood EPBC 2024-2025 Compliance Report (25WOL 10611)

Hi Beth,

My apologies for phone tennis today.

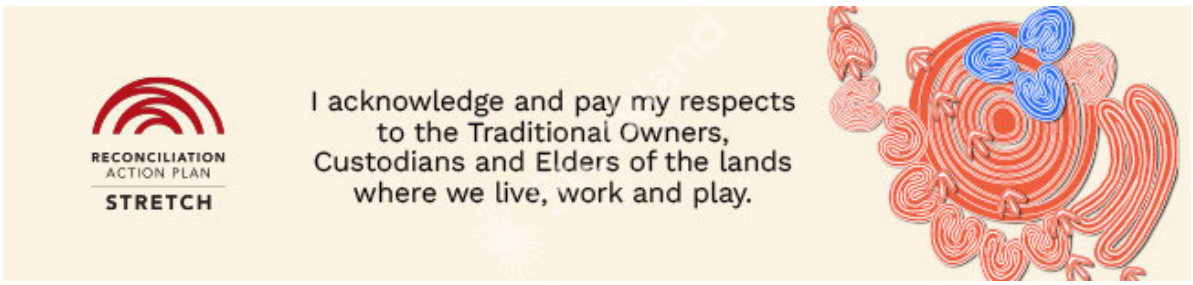
I just listened to your voicemail; it would be great if you can please provide a status update for both reports?

Thank you,

Stockland

Taylah Taka
Assistant Development Manager

[redacted]



From: Taylah Taka
Sent: Friday, 4 April 2025 12:34 PM
To: Tuck, Kara [redacted]
Cc: Lavers, Bethany [redacted] Kaitlin Rideout [redacted]
Subject: RE: Calderwood EPBC 2024-2025 Compliance Report (25WOL 10611)

Hi Kara,

Happy Friday!

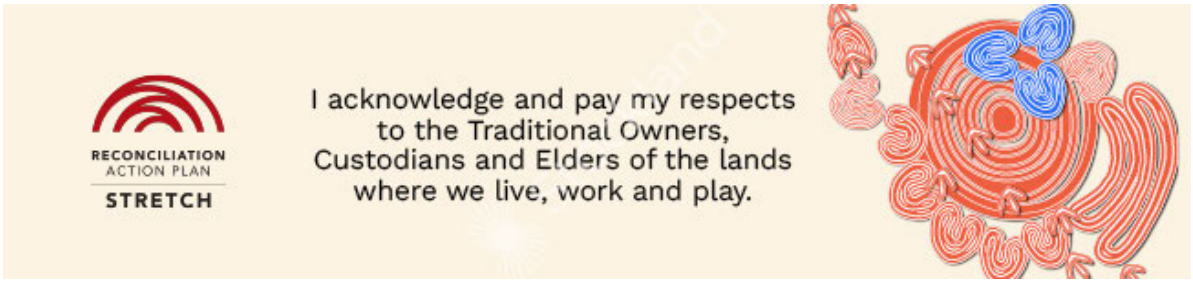
Please see below comments in blue.

If you require anything further, please don't hesitate to contact me.

Kind regards,

Taylah Taka
Assistant Development Manager

[redacted]



From: Tuck, Kara [redacted]
Sent: Wednesday, 2 April 2025 9:52 AM
To: Taylah Taka [redacted]
Cc: Lavers, Bethany [redacted] Kaitlin Rideout [redacted]
Subject: Calderwood EPBC 2024-2025 Compliance Report (25WOL 10611)

Hi Taylah,

I have included a list of information that we will need to start the EPBC Compliance Report. We can go through any questions you have in our meeting this afternoon.

ELA is aware that Stockland submitted the first annual compliance report (for the 2023-2024 reporting period) several months late. As long as we have all the information we need to complete the compliance report, we will be able to provide you with the report on time.

As ELA completed the first annual compliance report on 3rd December 2024, we will need to update the 2024-2025 report with any events that have happened since December 2024 which are relevant to the conditions of the approval (EPBC 2021/8981).

I have attached the conditions of the approval to this email for ease of reference (Appendix C).

Can you please provide/confirm the following;

- Please provide an update on the status of each of the development stages. The below table was from the first compliance report. If any of the stages have progressed we can

update this in the 2024-2025 report.

Stage	Status
Stage 4	Not commenced
Town Centre East	Not commenced salvage underway
Town Centre South	Underway Completed
Town Centre North	Not commenced
Town Centre Core	Not commenced
Education Precinct	Underway
7A	Not commenced test excavations completed, awaiting DA
7B	Not commenced
8-12	Not commenced

- Please confirm that clearing outside the Action area has not occurred since 3rd December 2024 (relates to Condition 1 of EPBC 2021/8981). Correct -no clearing has been undertaken
- Please confirm that Stockland has not cleared more than 0.28 ha of Illawarra Forest and has not cleared any Illawarra Forest outside of the Illawarra Forest impact areas since 3rd December 2024 (relates to Condition 2). No impact to this area.
- Did you have further details on lighting measures that aim to prevent artificial lighting impacts to fauna within the Illawarra Forest retained areas? At the time of the 2023-2024 report, we only had documents related to standard street lighting designs as per Council specifications. If no changes or updates have occurred since 3rd December 2024, we will keep what was in the previous report for this section (relates to Condition 4d). Please keep as previous
- Have lighting structures been installed since 3rd December 2024 (relates to Condition 4)? Yes, TCS and Education site the lighting is in.
- Has the Department requested electronic copies of compliance records since 3rd December 2024 (relates to Condition 8)? No, however, Kaitlin sent a link to the annual compliance report as it's been uploaded to the Calderwood Valley website.
- Please provide DWGs/shape files that show boundaries of any clearing, including clearing of any protected matters and/or their habitat if this has occurred since 3rd December 2024 (relates to Condition 14). Not required a clearing has occurred.
-

Thanks,

Kara Tuck (She/her/hers)
Ecologist
[redacted]
W: ecoaus.com.au

[redacted]

Eco Logical Australia acknowledges Traditional Custodians of Dharawal Country and recognises the continuing connection to lands, waters and communities. We pay our respect to Aboriginal and Torres Strait Islander cultures; and to Elders past and present. Through this acknowledgement we commit to ongoing learning and understanding on our journey to reconciliation.

Appendix G Calderwood Valley Mod 4 Vegetation Management Plan (Eco Logical Australia 8 November 2022)

Calderwood Valley Mod 4 Vegetation Management Plan

Prepared for Lendlease Communities (Calderwood)

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DOCUMENT TRACKING

Project Name	Calderwood Mod 4 Vegetation Management Plan
Project Number	22SYD-3038 (formerly 22SYD-2571)
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Approved by	**Alex Gorey**
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This document has been prepared by Eco Logical Australia Pty Ltd.

Template 2.8.1

Contents

List of Figures

List of Tables

Declaration of accuracy

EPBC Requirement	Project specific detail
EPBC Number	2021/8981
Project name	Calderwood Mod 4 Residential Development
Proponent and ABN	Lendlease Communities
Proposed action	Residential development and associated infrastructure at stages 4, Town Centre East, South, North and Core, and Stages 7A, 7B and 8-12.
Location of the action	Calderwood NSW
Date of preparation	8 November 2022

In making this declaration, I am aware that section 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Mark Anderson

Senior Development Manager, Lendlease Communities

Abbreviations

Abbreviation	Description
CUDP	Calderwood Urban Development Project
BC Act	NSW Biodiversity Conservation Act 2016
DCCEEW	Department of Climate Change, Energy, Environment and Water (formerly DAWE)
EEC	Endangered Ecological Community
ELA	Ecological Australia Pty Ltd
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
LLC	Lendlease Communities (Calderwood) Pty Ltd
LGA	Local Government Area
SCC	Shellharbour City Council
VMP	Vegetation Management Plan
WoNS	Weeds of Nation Significance

1. Introduction

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Lendlease Communities (Calderwood) Pty Ltd for the proposed Mod 4 residential subdivision and adjacent lands, within the Calderwood Urban Development Project. The action area is located within the Shellharbour City Council (SCC) Local Government Area (LGA).

1.1. Background

The 'action area' forms part of the Calderwood Urban Development Project (CUDP) and is in the Calderwood Valley, in the Illawarra Region of NSW; approximately 20 km southwest of Wollongong. The Calderwood Valley is bound by rural land to the north, east and west, the remaining stages of the CUDP to the south and to the south and south east, the existing suburbs of Tullimbar and Albion Park. The action area is 299.97 ha and mostly comprises land previously used for agricultural purposes and is dominated by exotic pasture grasses. The proposed action includes development of the area including a variety of lot sized dwellings, retail floor space and community parks. The action area also contains remnant patches of native vegetation along Marshall Mount Creek, and in three discrete patches across the action area. There are small patches of vegetation that have been opportunistically retained as part of the rural landscape and are generally in poor to moderate condition with some areas suffering from significant weed encroachment.

On 4 April 2022, the then DAWE (now Department of Climate Change, Energy, Environment and Water) determined that the proposed action is a *'controlled action'* and that it will be assessed by preliminary documentation (ELA 2022). DCCEEW considered that the Matters of National Environmental Significance (MNES) Threatened ecological community Illawarra and South Coast Lowland Forest and Woodland was likely to be significantly affected by the proposed action.

This Vegetation Management Plan (VMP) applies to the retained areas of Illawarra and South Coast Lowland Forest and Woodland and portions of open space that would not form part of a local park. An indicative 15 m buffer has been provided, and following the finalisation of the landscape plans for the local parks, management measures for the 15 m buffer will be included in this VMP. MZ3 is expected to be expanded in future to include this area.

1.2. Objectives of the Vegetation Management Plan

This VMP will guide restoration and revegetation of the retained Illawarra and South Coast Lowland Forest and Woodland areas. This VMP aims to control weed species and enhance the ecological values through a combination of bush regeneration and planting of native species.

The overall objectives of the VMP are to provide a management framework for the conservation of native vegetation and fauna habitat within retained native vegetation within the action area. The VMP area will be managed in perpetuity. This VMP covers the establishment period followed be the initial five-year period, or until the objectives and performance criteria outlined in this VMP are met. The objectives are summarised in Table 1.

Table 1: VMP objectives

Commitment	Objectives	Approach	Section in this report
Ensure the implementation of the VMP improves and maintains the condition of existing Illawarra and South Coast Lowland Forest and Woodland in the VMP area	Improve and maintain ecological health and integrity of 10.30 ha of Illawarra and South Coast Lowland Forest and Woodland patches.	• Control woody weeds, herbaceous weeds and exotic grasses within the VMP area. • Revegetation • Weed control • Protect existing native vegetation across the VMP area during construction and post construction through the installation of fencing, signage and sediment and erosion control measures	Sections 3 and 4
Manage indirect impacts during the construction phase	Manage indirect impacts on the retained and protected Illawarra and South Coast Lowland Forest and Woodland patches.	• Ensure VMP actions like weed control and reporting are undertaken to protect the VMP area. • Ensure fencing, signage and sediment and erosion control measures are established and maintained	Sections 3 and 4
Manage potential long-term indirect impacts	Revegetation of 1.3 ha of grazing pasture adjacent to the retained Illawarra and South Coast Lowland Forest and Woodland	• weed control • Revegetation of groundcover and small shrubs	Sections 3
Manage potential long-term impacts	Establish a 15 m buffer around each patch of Illawarra and South Coast Lowland Forest and Woodland and manage the buffer to form a derived native grassland	• Control woody and herbaceous weeds • Revegetate with native groundcover species and small shrubs	Section 4

1.3. Preparation and Implementation of this Plan

This VMP has been prepared by Restoration Ecologist/s with over 5 years' experience in environmental consultancy and a relevant Masters of Environment degree.

A suitably qualified and experienced bush regeneration contractor is required to implement this VMP. They should be a member of the Australian Association of Bush Regenerators (AABR) or should possess the required qualifications and experience for membership. In addition to this, team leaders should have, as a minimum, a *Certificate III in Conservation & Land Management or equivalent*. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009).

1.4. Key Terms

For the purpose of this VMP, the following terminology has been adopted:

- Action Area: The 299.97 ha development action area
- VMP Area: The three retained patches of Illawarra and South Coast Lowland Forest and Woodland covering 10.30 ha and an additional 1.3 ha of exotic pasture that will be revegetated

1.5. Consistency with EPBC Act Environmental Management Plan Guidelines 2014

This VMP has been prepared to meet the EPBC Act Environmental Management Plan Guidelines (Department of the Environment 2014; Table 2). The VMP has also been prepared to meet Council requirements.

Table 2: EPBC Act EMP Requirements

EMP requirement	Section in this report
Cover page and declaration of accuracy	Page vi
Document and version control	Page i
Table of contents	Pages ii – iii
Executive summary or introduction	Section 1
Conditions of approval reference table	Not applicable
Project description	Section 1.1
Objectives	Section 1.2
Environmental management roles and responsibilities	Appendix D
Reporting	Section 5.2
Environmental training	Section 3.4
Emergency contacts and procedures	Appendix C
Potential environmental risks, impacts and evaluation	Section 6.3
Environmental management measures	Section 4
Audit and review	Section 5.4

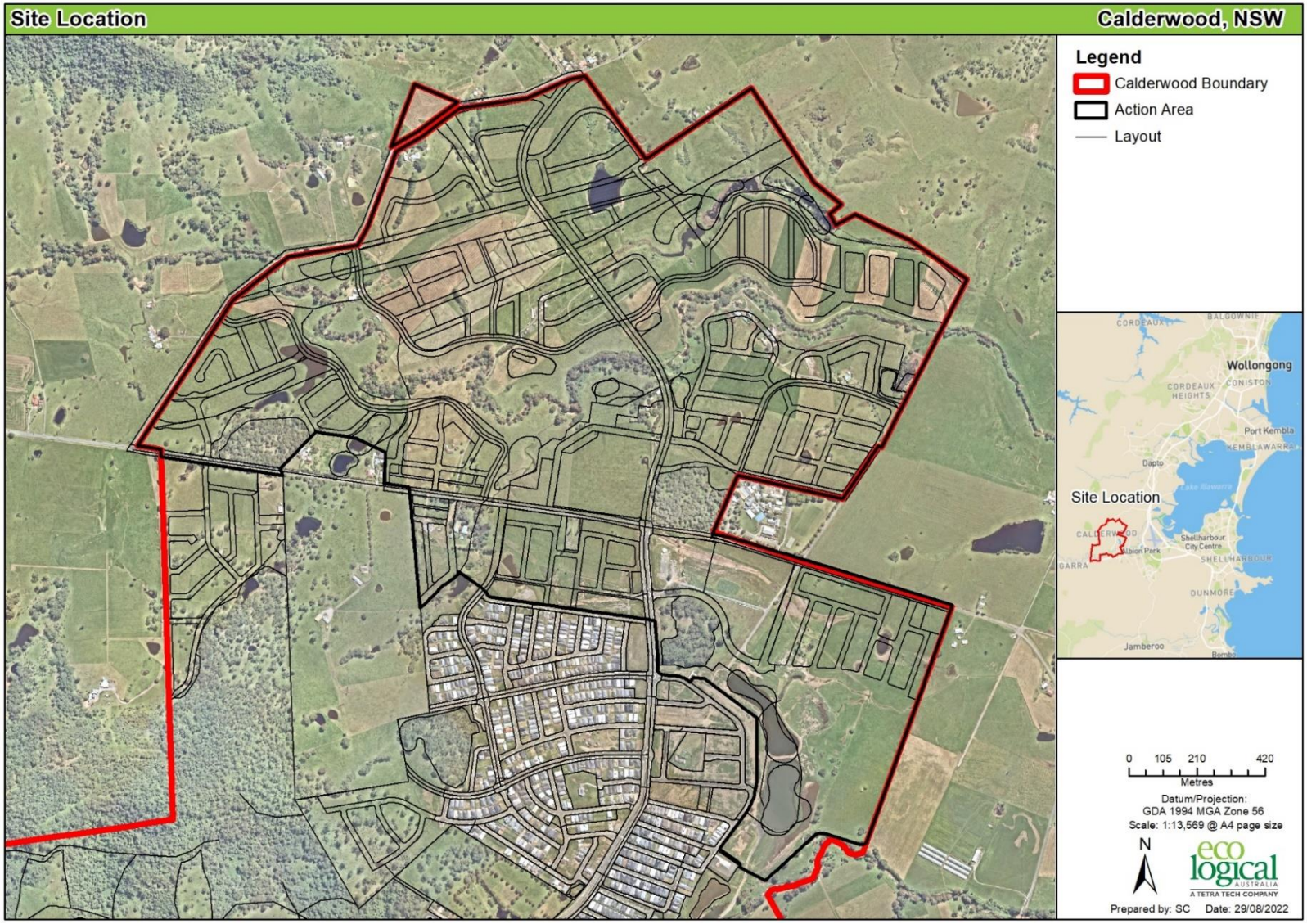

Figure 1: Location of the action area

2. Description of the Environment

2.1. Location

The Calderwood Valley extends north beyond Marshall Mount Creek (into Wollongong LGA), to the east by the Macquarie Rivulet, to the south by Johnston's Spur and to the west by the Illawarra Escarpment. Beyond Johnston's Spur to the south is the adjoining Macquarie Rivulet Valley within the suburb of North Macquarie. The Calderwood Urban Development Project land extends south from the Calderwood Valley to the Illawarra Highway.

2.2. Management History

Historically, the study area was utilised for agricultural land activities, (primarily cattle) which resulted in under-scrubbing of the shrub stratum, introduction of exotic plant species through pasture improvement techniques and incidental weed seed incursions.

2.3. Vegetation Communities

A description of vegetation communities is provided below, this includes information gathered from a previous survey by ELA in 2018 and recent field survey, undertaken by an ELA ecologist (Michael Gregor) on 31 August 2022. A summary of the native vegetation communities within the VMP area is displayed in Figure 2. Vegetation communities have been assigned to a Plant Community Type (PCT).

Table 3: Vegetation communities in the action area

PCT ID	PCT name	Vegetation Community	BC Act	EPBC ACT
1326	*Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion*	Illawarra Lowlands Grassy Woodland (BC Act) Illawarra and South Coast Lowland Forest and Woodland (EPBC Act)	EEC	CEEC
-	-	Cleared / Exotic	-	-

Key: EEC= Endangered Ecological Community; CEEC = Critically Endangered Ecological Community

2.3.1. Illawarra and South Coast Lowland Forest and Woodland (Patch 2)

Patch 2 is located adjacent to Town Centre and currently forms part of an agricultural landscape. The patch is currently subject to grazing pressures from horses and weed encroachment from the adjacent pasture grasses. The canopy was dominated by *Melaleuca linariifolia* (Flax-leaved Paperbark) and *Angophora floribunda* (Rough-barked Apple). The midstorey was largely absent with some scattered *Acacia binervata* and the groundcover was comprised of a mix of native and exotic species. Likely a result of horse grazing, a majority of the patch contained plumes of the exotic *Sida rhombifolia* (Paddy's Lucerne) above a groundcover dominated by *Microlaena stipoides* var. *stipoides*. Other grasses, sedges and forbs were present, including *Entolasia stricta* (Wiry Panic), *Oplismenus aemulus* (Basket Grass), *Dianella prunina*, *Dichondra repens* (Kidney Weed) and *Centella asiatica* (Native Pennywort). Exotic species included *Sida rhombifolia* (Paddy's lucerne), *Paspalum dilatatum* (Paspalum), *Cenchrus clandestinus* (Kikuyu), *Lantana camara* (Lantana) and *Setaria parviflora* (Pigeon Grass).

The canopy was consistent across the patch with most stems mature and some above the large tree benchmark (50 DBH). There was evidence of canopy recruitment in the groundcover. The patch did not contain any hollow bearing trees, and fallen woody debris was limited. The presence of groundcover was mostly consistent across the patch with some small areas that did not contain any vegetation.

2.3.2. Illawarra and South Coast Lowland Forest and Woodland (Patch 10)

Patch 10 is in Stage 7B, along Calderwood Road and currently forms part of an agricultural landscape. The patch is currently subject to grazing pressures from cattle and weed encroachment from the adjacent pasture grasses. The canopy was diverse and was dominated by *Eucalyptus bosistoana* (Coast Grey Box), *Angophora floribunda* (Rough-barked Apple), *Melaleuca linariifolia* and *Eucalyptus eugenioides* (Thin-leaved Stringybark). The midstorey was largely absent, with scattered occurrences of *Daviesia genistifolia* (Broom Bitter Pea) and the exotic *Lantana camara* (Lantana). The groundcover was diverse and contained a mix of native and exotic species. The groundcover was dominated by *Microlaena stipoides* var. *stipoides*, *Entolasia marginata* (Bordered Panic), *Eragrostis brownii* (Browns Lovegrass), *Commelina cyanea*, *Solanum prinophyllum* and *Veronica plebeia* (Trailing Speedwell). The exotic *Cynodon dactylon* (Couch) was present in moderate abundance across the patch, with other exotic species including *Conyza bonariensis* (Flax-leaf Fleabane), *Trifolium repens* (White Clover) and *Hypochaeris radicata* (Catsear).

The patch contained both mature and juvenile canopy, however no regeneration of the canopy was identified. There was a moderate amount of woody debris, however no obvious hollows throughout the patch.

The overall condition of patch 10 has decreased since the 2018 surveys. The groundcover has a higher proportion of exotic species. This is likely a result of land use, both within and surrounding the patch. The continued cattle grazing and pressure from adjacent exotic pasture grasses has likely lowered the condition of the patch.

2.3.3. Illawarra South Coast Lowland Forest and Woodland (Patch 11)

Patch 11 is in Stage Sp1 Extension and was previously part of an agricultural landscape. The patch is now fenced off with ATF fencing. The patch remains surrounded by exotic pasture grasses which continue to put pressure on the patch. The canopy was dominated by *Eucalyptus pilularis* (Blackbutt), with *Pittosporum undulatum* (Sweet Pittosporum) present in the midstorey. Some isolated occurrences of *Lantana camara* were also present in the midstorey. The groundcover varied in composition, with some areas being dominated by *Microlaena stipoides* var. *stipoides*, and other areas dominated by *Cenchrus clandestinus*. Where the groundcover was dominated by native species, *Microlaena stipoides* var. *stipoides* comprised approximately 90% of the groundcover, with other native species including *Imperata cylindrica* (Blady Grass), *Entolasia marginata*, *Glycine clandestina*, *Geranium homeanum* and *Echinopogon caespitosum* (Bushy Hedgehog Grass). The cover and abundance of exotic species varied. Where present, exotic species included *Andropogon virginicus*, *Setaria parviflora*, *Delairea odorata* and *Ehrharta erecta* (Panic Veldt Grass).

Across the patch, the canopy was mature with very few trees under a DBH of 50. There was some recruitment of the canopy in the groundcover. The patch also contained woody debris, some of which was a result of previous clearing practices.

2.3.4. Cleared / Exotic

Areas outside of the Illawarra and South Coast Lowland Forest and Woodland were generally disturbed and dominated by exotic species that did not constitute any native vegetation community. Dominant species within these areas include *Pennisetum clandestinum* (Kikuyu), *Rumex crispus* (Curled Dock), *Senecio madagascariensis* (Fireweed*), Cynodon dactylon* (Common Couch), *Paspalum dilatatum* (Paspalum) and *Sida rhombifolia* (Paddy's Lucerne).

2.4. Priority Weeds

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds. Under the Act all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Specific legal requirements apply to State determined priorities under the *South East Regional Strategic Weed Management Plan 2017-2022*. Weeds listed as 'other weeds of regional concern' under the plan warrant resources for local control or management programs and are a priority to keep out of the region. Inclusion in this list may assist Local Control Authorities and/or land managers to prioritise action in certain circumstances where it can be demonstrated the weed poses a threat to the environment, human health, agriculture etc.

Of the weeds identified during the field survey, three have been listed as state level priority weeds. The weeds present, their priority listing under the Act, the associated asset / value at risk and whether they are Weeds of National Significance (WoNS), are presented in Table 4**.**

Table 4: Priority weed species recorded in the VMP area.

Scientific Name	Common Name	WoNS	*Biosecurity Act 2015*
State level priority weeds (Whole of State)		**Objective**	
Lantana camara	Lantana	Yes	Asset protection
Rubus fruiticosus spp. agg.	Blackberry	Yes	Asset protection
Senecio madagascariensis	Fireweed	Yes	Asset protection

Asset protection: *These weeds are widely distributed in some areas of the State. As Weeds of National Significance, their spread must be minimised to protect* priority *assets.*

Containment: *These weeds are widely distributed in the region. While broad scale elimination is not practicable, minimisation of the biosecurity risk posed by these weeds is reasonably practicable.*

Authorities and/or land managers prioritise action in certain circumstances where it can be demonstrated the weed poses a threat to the environment, agriculture and/or the community/ human health.

*Refer to Greater Sydney Regional Strategic Weed Management Plan 2017 - 2022 for specific species legal requirements

2.5. Consistency with EPBC Act Conservation Advice

The objectives of the VMP are to improve or maintain the condition of Illawarra and South Coast Lowland Forest and Woodland across the VMP area. Therefore, this VMP has been assessed against the EPBC Act Conservation Advice. There is no Recovery Plan for this community under the EPBC Act. The EPBC Act Conservation Advice contains the following conservation actions:

1. Preventing vegetation clearance and direct habitat fragmentation

2. Preventing weeds, feral animals, tree dieback and other diseases
3. Preventing grazing damage
4. Re-vegetation and regeneration
5. Control invasive species and diseases.

Preventing vegetation clearance and direct habitat fragmentation

The prevention of vegetation clearance and direct habitat fragmentation is outside the scope of this management plan. Attempts to minimise impacts and avoid further fragmentation was addressed as part of the Preliminary Documentation (ELA 2022).

Preventing weeds, feral animals, tree dieback and other diseases

To ensure that the spread of weeds is managed, this VMP proposes direct management of weeds and implementation of mitigation strategies, as described below. This VMP includes the following measures to minimise the spread of weeds:

- Primary weed maintenance during the establishment period
- Secondary weed maintenance for years 1-2, performed every quarter
- Ongoing maintenance of weeds for years 2 – 5, performed every quarter.

The weeding program has been designed to achieve the following performance criteria:

- No greater than 40% exotic groundcover in year 1
- No greater than 30% exotic groundcover in year 2
- No greater than 20% exotic groundcover in year 3
- No greater than 10% exotic groundcover in year 4
- No greater than 5% exotic groundcover year 5.

Each year of weed maintenance and associated reduction in exotic cover, should result in an increased cover of native species. The performance criteria state that native cover should comprise no less than 80 % of each management zone.

The prevention of weeds will also be managed through the establishment of temporary fencing and signage, soil and water management and mitigation measures employed during the construction period. These measures are outlined in Section 3 and aim at preventing the inadvertent spread of weeds throughout the VMP area.

The VMP area is currently grazed by cattle and horses. There was no evidence of other feral animals present in the VMP area. Once the land is managed as part of the VMP, cattle and horse grazing would cease. Tree dieback is unlikely to occur, so long as indirect impacts from construction are managed.

Preventing grazing damage

The VMP area is currently grazed by cattle and horses. Once the land is managed as part of the VMP, cattle and horse grazing would cease. The current cattle grazing has affected the condition of the VMP area, with native midstorey sparse to absent and the native groundcover variable, with some areas dominated by exotic species. It has allowed plumes of *Sida rhombifolia* to dominate the groundcover,

and some patches of *Lantana camara* to emerge. It is expected that the removal of grazing and the development of the surrounding landscape as residential development will remove any grazing pressures.

Re-vegetation and regeneration

The VMP contributes to the regeneration of Illawarra and South Coast Lowland Forest and Woodland by managing 10.30 ha of the community across the action area. It is expected that an additional 15 m buffer would be managed as native grassland along the edge of existing patches, once the open space plans are finalised. The 15 m buffer would be revegetated and act as a buffer to the fully structured areas of the patch.

The purpose of this VMP is to manage the existing patches of Illawarra and South Coast Lowland Forest and Woodland such that the condition is improved over time. This will be achieved through the proposed vegetation management works described in Section 4. To summarise the proposed actions:

- Ongoing weed management throughout the establishment phase and years 1 - 5
- Installation of tubestock for canopy and midstorey species
- Installation of tubestock for herbs, scramblers and sedges
- Replacement of any tubestock that fails
- Installation of fencing and signage to prevent unauthorised access

Habitat augmentation through the collection of seed and salvaging of logs to be used in the VMP area **Control invasive species and diseases.**

The control of invasive species is specifically related to exotic flora species. The weed control methods described above will manage these invasive species. The spread of disease would be managed through the implementation of a Construction Environment Management Plan and a Sediment Erosion Control Plan.

Figure 2: Vegetation Communities (ELA, 2018)

3. Construction and Preliminary Works

Construction and preliminary works relating to the VMP are to occur either before or whilst development is occurring onsite. All works are assumed to be undertaken by the developer or the civil construction company.

3.1. Temporary Fencing and Signage

Temporary construction fencing is to be installed outside of the tree line

The edge of the VMP area where it borders the footprint is to be fenced with temporary construction fencing to prevent civil construction machinery from entering the VMP area unless under supervision from a suitably qualified ecologist or bush regenerator.

3.2. Soil and Water Management

An Erosion and Sediment Control Plan, preferably as part of a Construction Environmental Management Plan, must be developed and implemented prior to any on-ground works. These should be in accordance with best management practices as described in Landcom's Blue Book (2004).

Prior to construction commencing sediment fencing will be required around the construction area to prevent sediment running into the VMP area and limit the spread of weed propagules in soil sediments during the construction period.

Sediment fencing, and erosion controls should be inspected by suitably qualified ecologist prior to the commencement of construction activities. Outcomes of the inspection should be detailed in a compliance letter report.

3.3. Earthworks

All native timber should be retained onsite, with mulch stockpiled for use within VMP area, all viable seed and genetic material to be collected and all timber cut into logs to be utilised as habitat for native fauna.

3.4. Site inductions

All project personnel and contractors will undergo environmental induction training before commencing work on site. Information to be addressed during this training will include:

- areas of Illawarra and South Coast Lowland Forest and Woodland across the action area (including the development footprint)
- description of what Illawarra and South Coast Lowland Forest and Woodland, threats to the community and it's listing under the EPBC Act and BC Act
- areas subject to the VMP which are no-go areas
- procedures to be followed for disposal of waste, machinery set down, stockpiling of spoil, storage of chemicals etc (details to be outlined in the CEMP)
- requirements for fencing and signage maintenance and reporting any issues with fencing

4. Vegetation Management Works

The VMP area is approximately 11.60 ha, the works will consist of revegetation and assisted regeneration works. The management works for this VMP are re-vegetation and weed control. The VMP area consists of three management zones

- Management Zone 1 (MZ1) Woodland Regeneration
- Management Zone 2 (MZ2) Woodland Assisted Regeneration
- Management Zone 3 (MZ3) Buffer revegetation

The management zones are discussed below and shown in Figure 6, Figure 7 and Figure 8.

4.1. MZ1 – Woodland Regeneration

MZ1 is approximately 6.69 ha and is made up of moderate condition Illawarra and South Coast Lowland Forest and Woodland.

The Illawarra and South Coast Lowland Forest and Woodland is in moderate condition with an intact canopy and mixed native and exotic ground cover layer. The midstorey was largely absent, with scattered occurrences of *Daviesia genistifolia* (Broom Bitter Pea) and the exotic *Lantana camara* (Lantana). The groundcover was diverse and contained a mix of native and exotic species. The groundcover was dominated by *Microlaena stipoides* var. *stipoides*, *Entolasia marginata* (Bordered Panic), *Eragrostis brownii* (Browns Lovegrass), *Commelina cyanea*, *Solanum prinophyllum* and *Veronica plebeia* (Trailing Speedwell). The exotic *Cynodon dactylon* (Couch) was present in moderate abundance across the patch, with other exotic species including *Conyza bonariensis* (Flax-leaf Fleabane), *Trifolium repens* (White Clover) and *Hypochaeris radicata* (Catsear).

Sparse woody weeds, such as *Lantana camara* (Lantana) can be treated using hand pulling and cut and paint methods. Exotic groundcovers will be sprayed using a non-selective herbicide (e.g., Roundup Biactive®). This will likely require a minimum of at least two spray treatments, with follow-up required if further germination of weeds occurs.

For more information on specific weed control techniques, see Appendix A**.** A representative photo of MZ1 is shown in Figure 3.

Figure 3: MZ1 area in patch 10

4.2. MZ2 – Woodland Assisted Regeneration

MZ2 is approximately 3.61 ha and is made up of moderate condition Illawarra and South Coast Lowland Forest and Woodland.

The Illawarra and South Coast Lowland Forest and Woodland is in moderate condition with an intact canopy and mixed native and exotic ground cover layer. MZ2 is different from MZ1 due to the much higher abundance and cover of *Sida rhombifola* (Paddy's lucerne).

MZ2 maintains an intact canopy with an exotic shrub layer and mixed native and exotic ground cover layer. This patch contained plumes of the exotic *Lantana camara* (Lantana) and large stands of *Sida rhombifolia* (Paddy's Lucerne) above a groundcover dominated by *Microlaena stipoides* var. *stipoides*. Other grasses, sedges and forbs were present, including *Entolasia stricta* (Wiry Panic), *Oplismenus aemulus* (Basket Grass), *Dianella prunina*, *Dichondra repens* (Kidney Weed) and *Centella asiatica* (Native Pennywort). Other exotic species included *Paspalum dilatatum* (Paspalum), *Cenchrus clandestinus* (Kikuyu), *Lantana camara* (Lantana) and *Setaria parviflora* (Pigeon Grass).

woody weeds can be treated using hand pulling and cut and paint methods. Large, individual weed trees can be treated using drill and fill methods and left in situ to provide habitat. Exotic groundcovers will be sprayed using a non-selective herbicide (e.g., Roundup Biactive®). This will likely require a minimum of at least two spray treatments, with follow-up required if further germination of weeds occurs.

For more information on specific weed control techniques, see Appendix A. A representative photo of MZ2 is shown in Figure 4.

Figure 4: MZ2 area in patch 2 requiring *Sida rhombifola* (Paddy's Lucerne) control

4.3. MZ3 – Buffer Revegetation

MZ3 encompasses 1.30 ha of cleared / exotic vegetation. An indicative 15m buffer from the existing vegetation has been shown and MZ3 is expected to be expanded in future to include this area.

This zone is predominately comprised of exotic groundcover species with the occasional isolated canopy tree. The exotic species found in the ground cover include *Paspalum dilatatum* (Paspalum), *Cenchrus clandestinus* (Kikuyu), *Senecio madagascariensis* (Fireweed), *Hypochaeris radicata* (Cats Ears) and *Rumex crispus* (Curled Dock).

This zone will require slashing of all exotic grasses and boom spraying using a non-selective herbicide (e.g., Roundup Biactive®). A minimum of three spray treatments will be required to exhaust the weed seed in the soil. Approximately 100% of this zone is dominated by exotics.

Following weed removal, 100% of this zone is expected to require extensive revegetation. Planting assumptions have been identified in Table 5, with revegetation densities as identified in Table 6. All grass and groundcover seedlings need to be native species as per the recommended planting list included in Appendix B. A representative photo of MZ3 is shown in Figure 5.

Figure 5: MZ3 area in the buffer of patch 10 requiring revegetation.

4.4. Weed control

4.4.1. Primary and secondary weed control

All weeds, including woody weeds, herbaceous weeds and exotic grasses in the understorey will require treatment. Secondary weed control will be required following primary weed control and revegetation. During these weed control activities, care must be taken to avoid natural regeneration of native species.

Primary and secondary weed control will include woody weed, herbaceous weeds and exotic grasses, specifically the control of *Lantana camara* (Lantana), *Rubus fruiticosus* (Blackberry), *Sida rhombifolia* (Paddy's Lucerne). Juvenile *Lantana camara* plants can be hand-pulled, provided the whole root is removed. Large *Lantana camara* plants can be treated using cut and paint method. Chemical and mechanical control techniques will be required in follow up treatments. Follow up treatments of woody weeds including *Sida rhombifolia* seedling growth will be required.

For more information on specific weed control techniques, see Appendix A.

4.4.2. Maintenance

Following primary and secondary weed removal, all areas will require ongoing maintenance to control weed regrowth from the soil seed bank. Maintenance work is to be undertaken by a qualified bush regeneration contractor(s) as per specifications provided in Appendix A.

Maintenance will be undertaken on a regular basis in the peak growing seasons (spring and summer), with less frequent visits in cooler periods (autumn and winter). Maintenance programs will also comment on other site issues such as rabbit activity. Maintenance work will include actions to encourage native regeneration where it is not occurring naturally. These actions include techniques such as soil disturbance, niche seeding and transplanting

4.5. Revegetation

Revegetation works will be required across 100 % of MZ1, however it is estimated that only 15% of the zone requires extensive planting at 4 plants per m^2 with the remaining 85% only requiring 1 shrub per $20m^2$. Planting in this zone will include installation of shrub, grasses and sedges / Rushes and Reeds species consistent with the Illawarra and South Coast Lowland Forest and Woodland vegetation community. Planting of Hiko / Viro cells is the preferred revegetation method for ground cover species and grasses.

Revegetation works will be required across 100 % of MZ2, however it is estimated that only 15% of the zone requires extensive planting at 4 plants per m^2 with the remaining 85% only requiring 1 shrub per $20m^2$. Planting in this zone will include installation of canopy, shrub, and groundcover species consistent with the Illawarra and South Coast Lowland Forest and Woodland vegetation community. Planting of Hiko / Viro cells is the preferred revegetation method for ground cover species and grasses.

Revegetation works will be required over 100% of MZ3, this will include planting of canopy, shrub, and groundcover species consistent with the Illawarra and South Coast Lowland Forest and Woodland vegetation community. Planting of Hiko / Viro cells is the preferred revegetation method for ground cover species and grasses.

Areas receiving 'extensive' revegetation at 4 plants per m^2 will also require a ground treatment such as jute matting or mulch. Specifications for jute and mulch have been provided in Appendix A.

Table 5: Planting assumptions and mulch requirements.

Zone	Description	Total area (m^2)	Revegetation area (%)	Revegetation area (m^2)	Mulch / Jute (%)	Mulch / Jute (m^2)
1	Woodland Regeneration	66,900	15%	10,035	15%*	10,035
2	Woodland Assisted Regeneration	36,100	15%	5,415	15%*	5,415
3	Buffer Revegetation	13,000	100%	13,000	100%*^	13,000*^
Total		**116,000**	-	**28,450**	-	**28,450**

*Denotes mulch

^denotes jute mat

Table 6: Revegetation densities.

Zone	Description	Revegetation Area (m^2)	Plant densities (per m^2)				Total numbers
			Tree	Shrub	Grass	Ground cover	
1	Woodland Regeneration	10,035	-	1/20	2.00	2.00	***43,485***
2	Woodland Assisted Regeneration	5,15	-	1/20	2.00	2.00	***23,465***
3	Buffer Revegetation	13,000	1/20	1/20	2.00	2.00	***53,300***
	Total	**28,450**	**650**	**5,800**	**56,900**	**56,90**	***120,250***

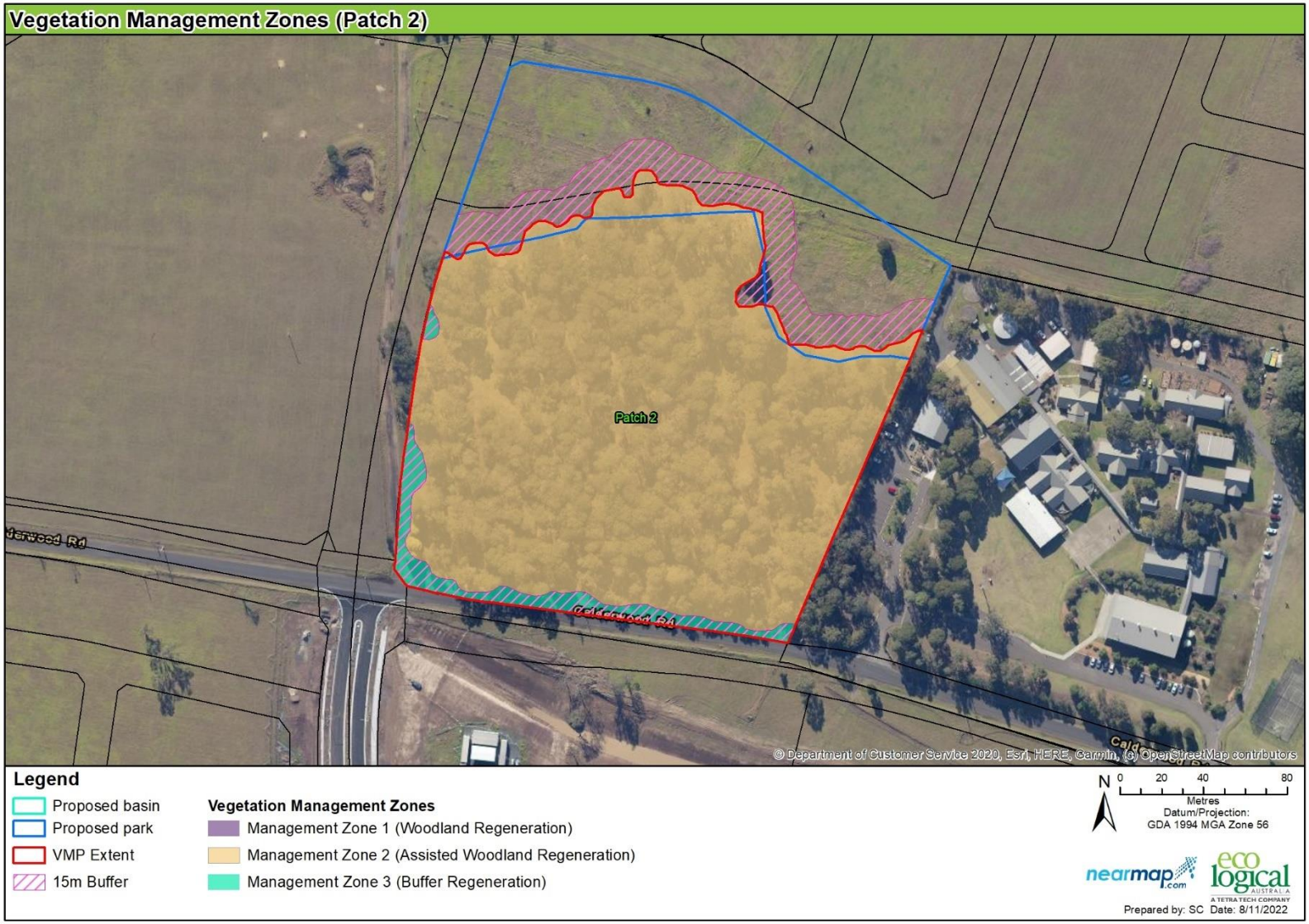

Figure 6: Vegetation Management Zones (Patch 2)

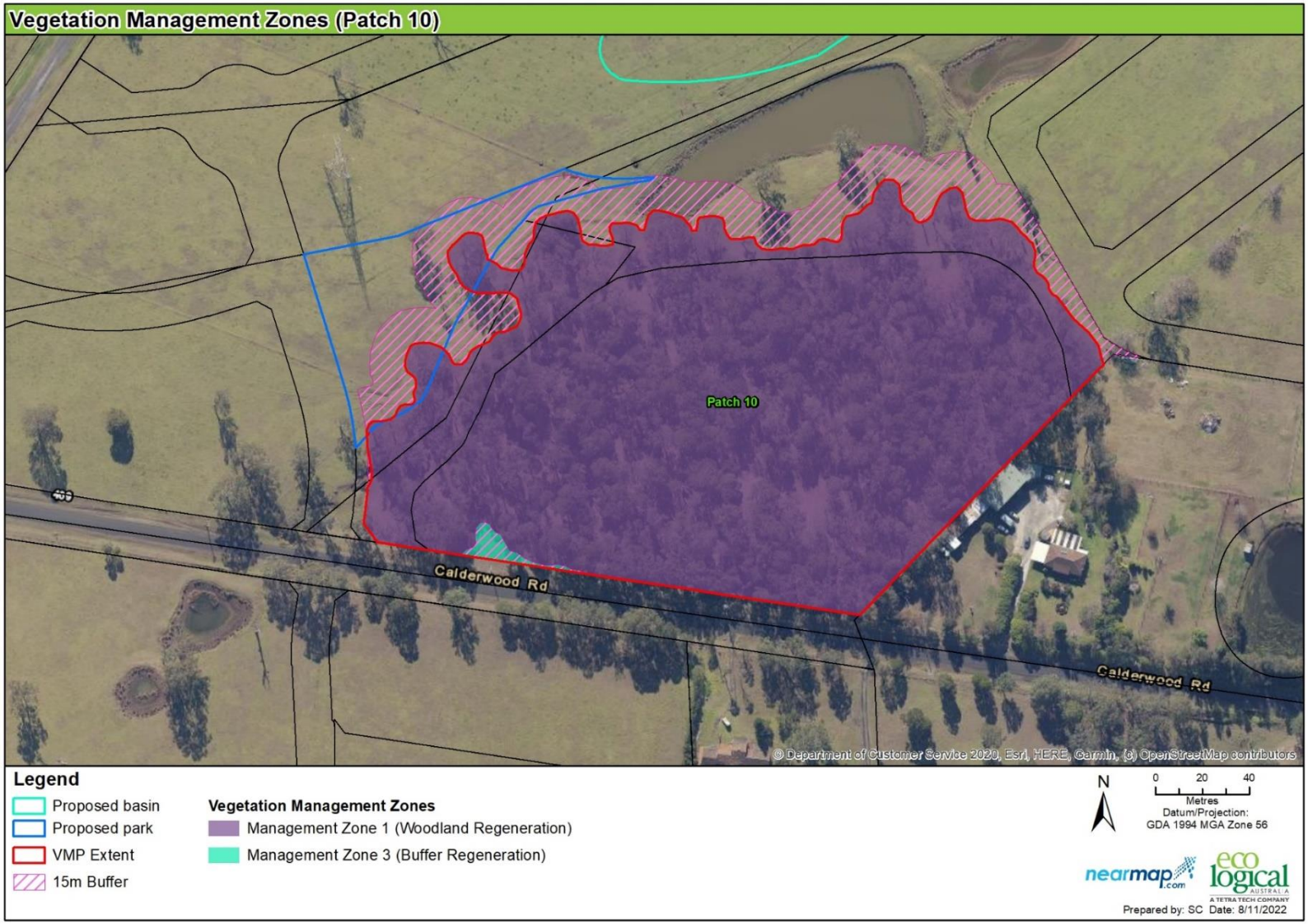

Figure 7: Vegetation Management Zones (Patch 10)

Figure 8: Vegetation management zones (Patch 11)

5. Monitoring and Reporting

The bush regeneration contractor and the land manager will monitor the vegetation for changes over time. Information gained through the monitoring and reporting process will identify works that have and have not been successful, and the reasons for their success or failure.

The aim of monitoring is to measure the effectiveness of the control actions being undertaken to achieve the desired outcome. It will identify non-conformance and provide the land manager with the ability to implement corrective actions. Information derived from the results of monitoring will also be used in adaptive management (i.e., learning from experience to inform future priorities and work plans). For example, as annual grass weeds are removed, herbaceous and perennial weeds may establish.

Finally, monitoring and reporting will help determine and quantify the costs related to weed management and the cost effectiveness of the VMP.

5.1. Monitoring

Monitoring will be undertaken by photo monitoring and vegetation surveys. Monitoring will need to be implemented at the end of the establishment works to establish a benchmark for performance, and to occur on an annual basis until the completion of the project. Monitoring results will be included in the progress report.

5.1.1. Photo Monitoring

- Photo monitoring points should be set-up using a permanent reference point to provide a visual reference of changes in the vegetation. Photo monitoring to include:
- set up a minimum of six photo monitoring points within the VMP area, at least two in MZ1, 2 in MZ2 and 2 in MZ3.
- install a six-foot star picket
- record the location (eastings and northings) of the star picket with a GPS and the bearing
- take a digital photo from the star picket looking towards the recorded bearing with the entire length of star picket in the photo
- label each digital image with a unique reference number that indicates where the photo was taken (i.e., the photo monitoring point) and the date it was taken (e.g., 01_220330 for a photo taken at the first photo monitoring point on 30 March 2022).

5.1.2. Vegetation surveys

Set up a minimum of six vegetation quadrats. Quadrat data points will be within the VMP area to monitor changes in the vegetation through time. The quadrat data forms the baseline for monitoring against the performance criteria for the first 5 years of the duration of the VMP. Floristic plot data is to be collected including species richness, cover and abundance in a 10x10 m quadrat.

5.2. Progress Reports

Progress reports are to be provided at the end of the establishment period and then on an annual basis through the maintenance period until the completion of the project. This reporting includes progress

towards meeting of the performance criteria specified in Section 6.2 and a description of the works that have been undertaken. These reports will be submitted to SCC. Reports will include at a minimum:

- the time period the report relates to
- qualifications and experience of contractors
- certification of seed and local provenance stock
- a summary of works carried out within the period including
  - date and time of site visits
  - works completed on the site at each visit
  - a table detailing total man hours for each task carried out on site
  - methods of weeding undertaken and details of herbicide use
  - numbers of tubestock planted if applicable
  - methods implemented for Assisted Natural Regeneration
- photo monitoring and vegetation survey results to date
- a description of any problems encountered in implementing the works recommended in the VMP and how they were overcome
- any observations made, including new plant species recorded (native and weed species), comments on rates of regeneration and any problems which impact on the implementation of the VMP
- if applicable, the results of the implementation work in relation to the relevant performance criteria.

5.3. Adaptive Management

As this is a long-term project that will be implemented over a number of years, an adaptive management approach will be implemented that enables the successful contractor to learn from and respond to successful and unsuccessful techniques used on the site. In its simplest form this may include the substitution of species identified in the planting table or for undertaking advanced direct seeding techniques in place of manual planting techniques for revegetation.

The success of the works will be determined by meeting the performance criteria identified in Section 6.2. Contractors have the flexibility to implement different techniques to those specified here providing that performance criteria are met. Any major departures from the VMP or proposed changes to performance criteria must be approved in writing by Liverpool City Council.

5.4. Audit and review

In addition to opportunistic changes under adaptive management, every five years a formal review of the VMP will be undertaken to evaluate success and determine if changes to the approach are required to ensure the objectives of the VMP are being met. This would involve review of the previous years' monitoring results and any remedial actions or changes that have been made to the techniques in response to monitoring results. The VMP could be formally revised if opportunity for improvement is identified.

6. Implementation Schedule and Performance Criteria

6.1. Implementation Schedule

The VMP will have an untimed establishment period, estimated to be six-months, and a five-year maintenance period or until the required objectives for the VMP area as identified in are met, whichever is longer. An indicative implementation schedule has been provided in Table 7.

Table 7: Implementation works

Treatment	Establishment		Maintenance																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
	1	2	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Install construction fencing																						
Install sediment fencing																						
Revegetation																						
Seed collection, cleaning, storage																						
Site Preparation																						
Install mulch and jute matting																						
Install tubestock																						
Replacement tubestock																						
Irrigation																						
Weed control																						
Primary																						
Secondary																						
Maintenance																						
Other works																						
Monitoring and reporting																						

6.2. Performance Criteria

The performance criteria are detailed in Table 9 and Table 10**.**

Failure to meet these performance criteria will mean that the maintenance period will be extended until they are achieved. Therefore, maintenance must continue until SCC agrees that the objectives and performance criteria have been met and the maintenance period has concluded. The author of this VMP or equally qualified and experienced person must prepare a statement certifying the compliance of the performance criteria at the end of the 5-year period.

If monitoring indicates that the VMP tasks are not resulting in achievement of the performance criteria, the task program will be revised. The civil contractor and the bush regeneration contractor, in consultation with SCC can adapt these criteria as required in response to the success of rehabilitation works.

6.3. Risk evaluation

The main risk identified for this VMP are:

- Failure to improve and maintain the condition of Illawarra and South Coast Lowland Forest and woodland due to weed competition on native regeneration and revegetation
- Failure to minimise indirect impacts and potential threatening processes through neglected maintenance of signage and fencing
- Failure to minimise indirect impacts due to not establishing and managing the 15 m buffer around each retained patch
- Failure to improve the condition of Illawarra and South Coast Lowland Forest and Woodland due to poor plant uptake or stochastic events such as unpredictable weather events, including drought, fire or floods.

The VMP includes weed control management throughout the life of the VMP. This will include increased weed control management in the first two years to ensure cover and abundance of pasture weeds is reduced. If the VMP is implemented appropriately, there would be low chance for the pasture weeds to outcompete plantings and natural regeneration occurring. The chances of weed invasion affecting the success of the VMP is considered **low** due to the low cover and abundance and in some areas, absence of high threat exotic weeds, such as *Lantana camara, Olea europaea* subsp. *cuspidata* and *Rubus fruticosus* spp. aggregate. In addition, the VMP area is currently grazed by cattle and horses, which has lead to the establishment of woody weeds in the groundcover and midstorey layers. If weed invasion were to occur, the risk to achieving the objectives of the VMP is moderate.

Possible extreme weather conditions and impacts from drought or flood are hard to predict and would have a **moderate** impact on the VMP area. The potential for extreme whether events to occur is incredibly difficult to determine. Appropriate management measures have been specified in the risk management table below. If extreme weather events were to occur, the risk to achieving the objectives in the VMP is moderate to high, and would depend on the frequency and severity of the events.

The Risk Assessment for the VMP area is summarised in Table 8 below.

Table 8 Risk assessment

Commitment	Objective	Potential Risk	Likelihood	Consequence	Risk level	Trigger	Management strategy (remedial actions)	Related Monitoring
Ensure the implementation of the VMP improves and maintains the condition of existing Illawarra and South Coast Lowland Forest and Woodland in the VMP area	Improve and maintain ecological health and integrity of 10.30 ha of Illawarra and South Coast Lowland Forest and Woodland patches.	Weeds outcompete native regeneration and revegetation	Possible	Moderate	Low	Weed cover are higher than the weed cover levels for each year and zone described in Table 9 and recorded during monitoring visits	Increase weed control measures and visits until weeds are under the required level	Monitoring outlined in Section 7.2.5
		Low planting success due to weather impacts	Unlikely	Moderate	Low	Regeneration lower than prescribed levels for each year and zone in Table 9 and noted during monitoring visit	Reassess timing for replacement revegetation. Wait until favourable conditions	Monitoring outlined in Section 7.2.5
		Damage to areas from public interactions	Unlikely	Moderate	Low	Noted human impact to vegetation during monitoring visit, including tyre tracks, dumped rubbish, litter, camp fires	Construct or repair permanent exclusion fence around VMP area	Monitoring outlined in Section 7.2.5
Manage potential long-term indirect impacts	Revegetation of 11.60 ha of grazing pasture adjacent to the retained Illawarra and South Coast Lowland Forest and Woodland	Planted species fail to survive due to weather conditions	Unlikely	Moderate	Medium	Any plant deaths noted during monitoring visit	Reassess timing for replacement revegetation. Wait until favourable conditions Increased visits for watering Increase protective measures, such as tree guards	Monitoring outlined in Section 7.2.5
		Planted species fail to survive due to weed invasion	Possible	Moderate	Medium	Any plant deaths noted during monitoring visit	Increase weed control measures and focus on control around revegetation areas	Monitoring outlined in Section 7.2.5

Commitment	Objective	Potential Risk	Likelihood	Consequence	Risk level	Trigger	Management strategy (remedial actions)	Related Monitoring
Manage potential long-term impacts	Establish a 15 m buffer around each patch of Illawarra and South Coast Lowland Forest and Woodland and manage the buffer to form a derived native grassland	Weeds presence increase across life of the VMP period	Possible	Moderate	Low	Weed cover are higher than the weed cover levels for each year and zone described in Section 6.2 recorded during monitoring visit	Increase weed control measures and visits until weeds are under the required level Mulch targeted areas for weed suppression	Monitoring outlined in Section 7.2.5
		15 m buffer not established	Unlikely	Moderate	Low	Within one year of receiving EPBC Act approval, buffers are not established*	Establish a buffer or increase weed control in the VMP area	Monitoring outlined in Section 7.2.5
		Weed encroachment in VMP area	Likely	Low	Low	New weed species detected during monitoring visit	Increase edge maintenance and weed management works to suppress new weed invasion	Monitoring outlined in Section 7.2.5

***this timeframe is subject to Council approval and may require additional time. Establishment will be measured by the erection of markers and delineation on plans of the buffer location**

Table 9: Performance criteria

Category	Establishment	Maintenance				
		Year 1	Year 2	Year 3	Year 4	Year 5
General	Commencement of all tasks outlined in the VMP or evidence of planning for their implementation Monitoring and reporting undertaken in accordance with Section 5.					
Civil construction	All construction and sediment fencing installed All rubbish and debris removed					
Revegetation	Install revegetation as per Section 4.5 Revegetation is to be undertaken with a minimum of 60% of the benchmark levels for species diversity shown in Table 10. Recommended species are provided in Appendix B.	Native groundcover density of 4/plants per m2 in each zone, including native regeneration No bare areas greater than 2m x 2m without surviving native groundcovers. Maintenance replanting is to replace plants by the same species, or where that species is not available, with the same growth form (i.e., tree for tree etc.) and must not decrease species diversity. Any new species to be planted must be from the community being emulated and of local provenance; Any maintenance replanting, of more than 20% of the planted vegetation must be established at least 12 months, and for more than 40%, of the planted vegetation, must be established at least 24 months before maintenance completion.				
Exotic cover	Implementation of primary weed control works	No greater than 40% exotic groundcover	No greater than 30% exotic groundcover	No greater than 20% exotic groundcover	No greater than 10% exotic groundcover	No greater than 5% exotic groundcover
Native cover	Maintain or improve native groundcover	Native groundcover vegetation cover no less than 20% of each zone	Native groundcover vegetation cover no less than 40% of each zone	Native groundcover vegetation cover no less than 60% of each zone	Native groundcover vegetation cover no less than 70% of each zone	Native groundcover vegetation cover no less than 80% of each zone

Table 10: Benchmark conditions for vegetation communities within the VMP area

PCT - ID	PCT – Common name (community)	Species Richness			Cover* (%)		
		Canopy	Shrub	Groundcover#	Canopy	Shrub	Groundcover
PCT 838	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	5	8	32	52	15	73

PCT - ID	PCT – Common name (community)	Species Richness			Cover* (%)		
		Canopy	Shrub	Groundcover#	Canopy	Shrub	Groundcover
PCT 1326	Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	5	8	32	52	15	73

* Based on monthly average following average rainfall year. # Includes grasses, forbs and ferns

7. Cost

The cost of implementation for five-year period is approximately **$1,363,00** exclusive of GST and CPI. An indicative annual costing timeline is provided in Table 11. Rates and costs are based on typical commercial rates. Assumptions that have been made regarding the estimation of costs have been outlined below.

7.1. Construction and preparation works

Civil construction activities are identified in Section 3 and have not been included in Table 11.

7.2. Vegetation management works

7.2.1. Site preparation techniques

Costings have assumed that truck access will be possible for the installation of mulch. If truck access is not available, then this may be an additional cost. If additional mulch or jute matting is required due to changes in the resilience of the site, this may be an additional cost

7.2.2. Weed control techniques

Bush regeneration contractors will implement the weed control treatments identified in this VMP. These works have been estimated to cost **$2,400** for a team of four bush regenerators, including a supervisor, per day. The cost of bush regeneration works includes the costs of herbicide, vehicles and equipment which are required to implement the VMP.

7.2.3. Revegetation treatments

Bush regeneration contractors will implement the revegetation treatments identified in this VMP. Tubestock costs have been budgeted at an estimated $3.50 per tree and shrub including, planting, water crystals, fertiliser and initial watering, and an estimated $2.50 per grass, sedge and groundcover including planting, water crystals and initial watering. A total of approximately 120,300 plants will be required to achieve the densities identified in the VMP. The total estimated cost of revegetation is approximately **$$259,900** for tubestock installation, including a 10% rate for replacement plantings to be installed over a period of three years following initial revegetation works.

7.2.4. Seed collection

Budget for the collection of seed has been included as a separate task. This is an indicative figure and does not take into account the risks from climactic variable. If further seed collection works are required, this may be an additional cost.

7.2.5. Monitoring and reporting

Bush regeneration contractors or ecologists will undertake the monitoring and reporting identified in this VMP. This includes:

- initial setup of the photo points and conducting the baseline surveys
- preparing a yearly report, including photo points and vegetation surveying until the completion of the project

Table 11: Indicative VMP costings

Treatment	Preliminary	Establishment	Maintenance					Total
			Year 1	Year 2	Year 3	Year 4	Year 5	
Revegetation								
Seed collection, cleaning, storage	$18,038	$ -	$ -	$ -	$ -	$ -	$ -	$18,038
Site Preparation		$14,225	$ -	$ -	$ -	$ -	$ -	$14,225
Jute Matting / Mulch		$199,150	$ -	$ -	$ -	$ -	$ -	$199,150
Direct Seeding, supply and install		$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tubestock, supply and install		$307,075	$ -	$ -	$ -	$ -	$ -	$307,075
Replacement tubestock, supply and install		$ -	$10,236	$ 10,236	$10,236	$ -	$ -	$30,708
Irrigation		$24,183	$1,423	$1,423	$1,423	$ -	$ -	$28,450
Weed control								
Preliminary		$ -	$ -	$ -	$ -	$ -	$ -	$ -
Establishment		$67,025	$ -	$ -	$ -	$ -	$ -	$67,025
Maintenance - Year 1 - 2		$ -	$158,180	$129,420	$ -	$ -	$ -	$287,600
Maintenance - Year 3 - 5		$ -	$ -	$ -	$115,335	$104,850	$94,365	$314,550
Associated costs								
Disbursements		$6,703	$15,818	$12,942	$11,534	$10,485	$9,437	$66,918
Monitoring & Reporting		$4,833	$4,833	$4,833	$4,833	$4,833	$4,833	$29,000
Totals	**$18,038**	**$623,193**	**$190,490**	**$158,854**	**$143,360**	**$120,168**	**$108,635**	**$1,362,738**

References

Brodie, L. 1999. *The National Trust Bush Regenerators Handbook*. National Trust of Australia (NSW).

Buchanan, R.A. 2000. Bush regeneration: recovering Australian landscapes. 2nd ed., TAFE NSW, Sydney.

Eco Logical Australia 2022. *Calderwood Urban Development Project Mod 4 Preliminary Documentation EPBC 2021/8981*

South East Local Land Services 2017. South East Regional Strategic Weed Management Plan 2017 - 2022.

Appendix A Techniques and Specifications

WEED CONTROL

Weed control involves a combination of mechanical, physical and chemical techniques to remove the weeds and prevent regrowth. Weed control will be undertaken across the entire zone. A selection of the best suited weed control method within the site depends on a number of factors including:

- the species or combination of weeds being targeted
- the density of the weeds
- resources available (time, labour, equipment and finances)
- weather conditions of the day

WEED CONTROL TECHNIQUES

Detail of specific weed control techniques to be used such as cut and paint, scrape and paint, herbicide spraying, and hand weeding are given in Brodie (1999). The principles of bush regeneration and techniques to trigger natural regeneration are to be in accordance with the Bradley Method and other techniques described in Buchanan (2000). Management techniques for different types of weeds are provided below.

ANNUAL GRASSES

Annual grasses should be hand removed or spot sprayed where isolated or in low concentrations. Larger patches of annual grasses may be slashed/brush cut in late spring to early summer, after flowering, but prior to seed set. For most species, slashing/brush cutting prior to late spring through to early summer will promote vigorous growth and should not occur. However, some annual grasses can grow and produce seed at any time of the year dependent on climatic conditions such as high rainfall and warm temperatures. Monitoring of annual species should be undertaken and if new growth occurs, the same treatment will be applied to the new growth to prevent seed production. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

PERENNIAL GRASSES

Perennial grasses, such as *Cynodon dactylon* (Common Couch), *Paspalum dilatatum* (Paspalum), *and Pennisetum clandestinum* (Kikuyu Grass) will be hand removed where isolated or in low concentrations. Larger patches may be slashed prior to seed production in spring or summer (depending on the growth cycle of the species) and the regrowth spot-sprayed 2-3 weeks later when it is actively growing and approximately 10 cm in length. Monitoring of these species will occur and if new seed production occurs, the same treatment will be applied again as required. However, slashing will not reduce the presence of exotic grasses on its own and must always be combined with targeted removal to reduce densities and allow for native regeneration. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

WOODY WEEDS

Follow up treatment of woody weeds, including *Sida rhombifolia* (Sida) and *Lantana camara* (Lantana) will be controlled by the cut and paint or drill and fill method using a non-selective herbicide. The most appropriate method to be used depends on the size of the individual to be removed and will be determined by the bush regeneration contractor. Primary weed control should use techniques that will

not encourage flushes of secondary weed growth. All seedlings of woody weeds will be hand pulled or spot-sprayed with a non-selective herbicide.

CREEPERS AND CLIMBERS

The control of creepers varies depending on the species. For the most part, seedlings will be hand pulled, while mature plants can be controlled by the stem-scrape method or spot spraying using a non-selective herbicide. The precise method to be used will be determined by the bush regeneration contractor depending on the species, size and reproductive status of the individual. All vegetative material removed should be bagged, removed from site and disposed of appropriately.

HERBACEOUS WEEDS

Where individual plants of herbaceous weeds, including *Senecio madagascariensis* (Fireweed), *Solanum* sp. and *Bidens pilosa* (Cobbler's Peg) are found, they will be hand pulled prior to flowering. Where large swaths of these species occur, they will be sprayed using a non-selective herbicide. If high densities of mature stands occur, weeds may be slashed first using a brush cutter and any subsequent regrowth sprayed. Regular monitoring of these species will be required to prevent seed production. *Cirsium vulgare* (Spear Thistle) will not be hand-pulled due to its thorns and instead will be treated using cut and paint methods or spot sprayed for larger infestations using a non-selective herbicide. All vegetative material that is pulled out and has the potential to regrow if deposited on ground will be bagged and removed from site.

MANAGEMENT OF WEED WASTE

All weed propagules, especially priority weeds, will be bagged and disposed of as directed by legislation at facility licensed to receive green waste. All weed waste without propagules will be composted onsite in small unobtrusive piles.

WEED CATEGORISATION

Weeds within the SCC LGA, which are deemed to have a strong negative impact on the environment, agriculture, economy or human health, are categorised under Council's Biosecurity Priority Weeds Local Plan. The plan was developed under the direction of the NSW *Biosecurity Act 2015* and South East Regional Weeds Plan 2017. The weed species listed in the plan are included in the Priority Weeds list as 'Schedule 1 (State Priority Weeds)'. The weeds listed in the Greater Sydney Regional Strategic Weed Management Plan are included in the Priority Weeds list as 'Schedule 2 (Regional Priority Weeds)'. In addition to the State and Regional guidance, the Biosecurity Act allows for the flexibility to respond to the protection of local assets such as Western Sydney biodiversity and our valuable production landscapes. As such, these weeds have been verified using the same system as the broader jurisdictions but performed at a local scale. They have been listed as 'Schedule 3 (Local Priority Weeds)'.

ACTION ON PRIORITY WEEDS

Council will ensure compliance with the *Biosecurity Act 2015* in the following ways:

- prevent, eliminate, minimise and manage priority weeds by direct control on Council owned land

achieve compliance with priority weeds on private property by a process of routine, equitable and strategic inspections

develop, coordinate and measure weed programs by creating and maintaining policy, processes, operational plans and regular reporting

maintain records on its control, education and inspection functions and make these available to NSW Department of Primary Industries and the community as required.

REPORTING NOTIFIABLE WEEDS

A notifiable weed is a weed which lists a notification requirement in the guidelines for its management under Schedules 1, 2 and 3. All notifiable weeds within Council's jurisdiction must be reported

HERBICIDE USE

The use of herbicide to control weeds should be carefully considered. Herbicide must only be used for the purpose described on the product label, as per the NSW *Pesticides Act 1999.* Herbicide use should assess potential long-term impacts of the technique, including whether the proposed works address the source of the weed infestation. However, herbicide application forms an important and useful component of an integrated weed management approach and can be the most appropriate method for the control and eventual eradications of some weed species.

Herbicide use should occur during the active growing season for plants to encourage the chemical uptake into the plant. The selection of herbicides should also consider the type of weed and the location. Where non-selective herbicides are required for use, glyphosate is the most suitable. A glyphosate-based herbicide, formulated for use near waterways, will be used if works require herbicide application near waterways, a (e.g. Roundup Biactive®).

Broad-leaf selective herbicide may be used as per the NSW Weed Control Handbook (DPI 2018). However, this type of herbicide is extremely toxic to aquatic life and must not be used in, or adjacent to, waterways.

Registration and records must be kept in accordance with the NSW *Pesticides Regulation 2017*.

REVEGETATION WORKS

Revegetation has the dual aim of both re-establishing the original native vegetation community at the site and reducing erosion along the length of the riparian corridor, which will carry greatly increased peak flows due the increased run-off from the hard surfaces created by the associated residential development.

Revegetation works within the Managed Ecological Zone must be undertaken in accordance with NSW Rural Fire Service's *Planning for Bushfire Protection* (2006). Any plantings should consist of local provenance stock.

Planting of Hiko for trees and shrub species and Hiko or Viro cells for grasses and other groundcover species is the preferred method. Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each plant should be at least 1.5x the width and 2x the depth of the root ball. Fertiliser should be added to each hole dug as per the label specifications. Water crystals or wetting agents should be added to each plant hole. This will increase the water holding capacity of the soil and reduce watering schedules. Initial irrigation of the plantings is essential to ensure that the soil forms around the root ball and air pockets are removed. This will be required unless sufficient rainfall (approx. 10mm) occurs on the day of planting.

Following the revegetation works, irrigation needs to be undertaken for at least 8 weeks following planting to ensure the establishment of the plants. The level of irrigation will be determined by rainfall and temperature experienced at the planting site.

A temporary irrigation system should be installed to assist in the establishment of vegetation. Timing of the planting of these areas will need to take into consideration surrounding civil works and erosion/sediment control requirements, these areas will not be planted until earthworks have been completed. A minimum rate of attrition of 10% is to be expected, even with pro-active management.

Mulch can be derived from vegetation removed from the development area, if available. Alternately, mulch should be comprised of un-composted wood (preferably wood waste), with a particle size of 15 mm to 40 mm, with no fines, and good air-filled porosity. Mulch should not contain any weed seeds, nor be derived from diseased trees or from any part of the tree lower than 1 m above the ground. Mulch, where required, should be installed to a depth of 100 mm.

Jute matting is to be installed in any areas of potential erosion i.e. steep creek banks. Jute matting, where required, must be comprised of 100% biodegradable jute fibres with a minimum weight of 680g/m2 (~6 mm thickness). Jute must be pegged with at least 3 x 150 mm pins per m2 and each roll overlapped by 100 mm.

SEED COLLECTION

For the growth of the plants used in the revegetation works, seed must be collected from local provenance species. Groundcovers, shrubs and trees should be collected as within proximity (i.e. <20km) to the site. However, soil type, climate and aspect of the collection site(s) should also be considered. Native grasses and wetland species typically have much larger dispersal mechanisms and are to be collected from within the Sydney Basin.

Where species identified in this VMP cannot be sourced, they may be substituted for other SSTF species as identified by Tozer (2003). Species must be substituted with species of a similar form, e.g. trees for tree, grasses for grasses, etc. Only wild native species are to be used. Plants are not to be substituted with horticultural varieties under any circumstances.

Record keeping of seed collection and planting locations are to follow the Florabank guidelines (Mortlock, 2000). A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to undertake seed collection works. The bush regeneration contractor is responsible for recording this information and providing it to Liverpool City Council.

BUSH REGENERATION CONTRACTORS

All vegetation management works in the establishment phase will be undertaken by suitably qualified and experienced bush regeneration contractors who are members of the Australian Association of Bush Regenerators (AABR) or fulfil the membership criteria. Additionally, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009). A flexible approach to this site is recommended since techniques may need to be changed or modified to suit site conditions. This approach is consistent with adaptive management and allows the contractor to develop and build on site knowledge whilst implementing this VMP. Monitoring will assist in the development of the VMP actions in subsequent years.

HYGIENE PROTOCOLS

To avoid introducing soil pathogens / diseases in particular *Phytophthora cinnamomi* (Root rot disease) onto site a hygiene protocol should be undertaken as per the guidelines developed by the Royal Botanic Gardens in '*Best Practice Management Guidelines for Phytophthora cinnamomi with the Sydney Metropolitan Catchment Management Authority*'.

For Bush Regenerators all tools and boots should be washed down and thoroughly cleaned of soil / mud using a solution of water and disinfectants prior to undertaking works onsite. All machinery should be thoroughly cleaned of all soil / mud / debris prior to working within the VMP area.

RABBIT EXCLUSION FENCING

Rabbit proof fencing may be required to be installed to the guidelines in the Commonwealth Department of the Environment Catalogue of fence designs. The fencing will need to be a minimum of 90mm high, with a 180 mm skirt as per the figure below.

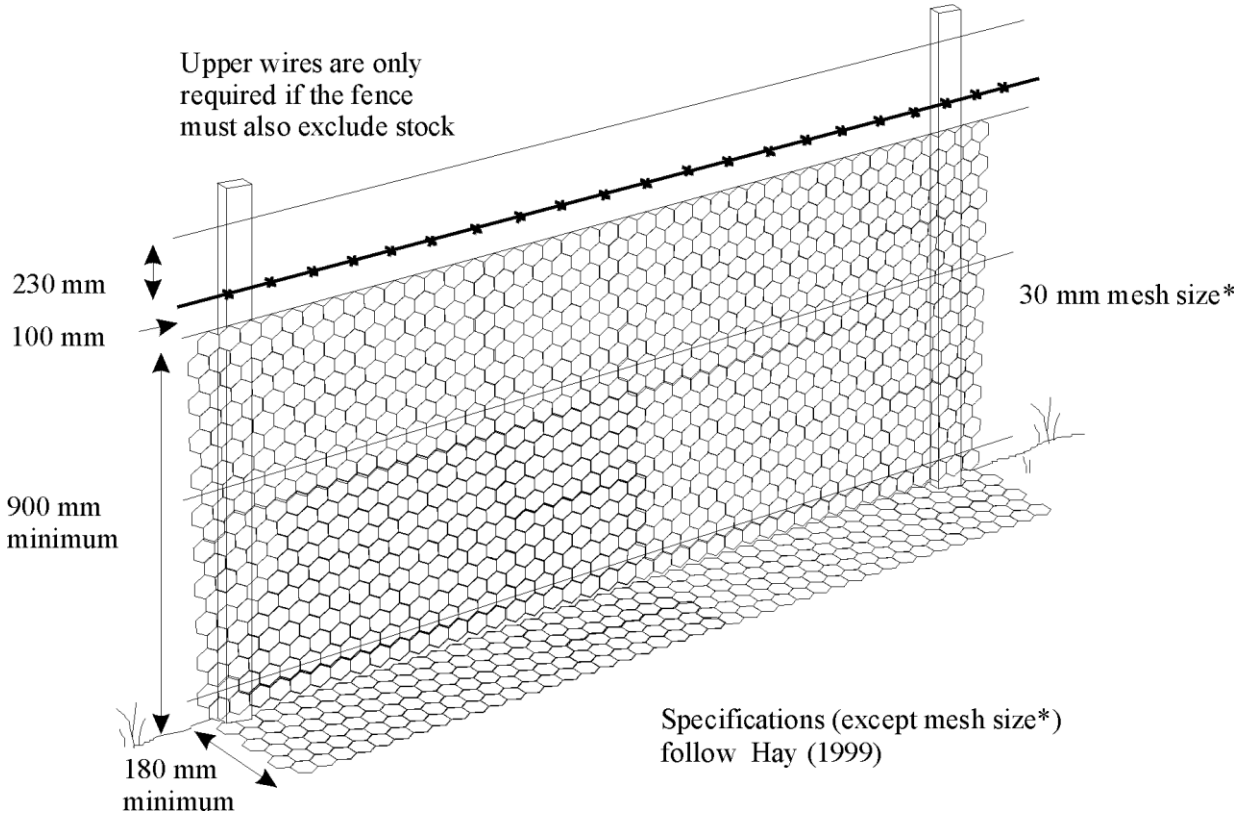

Figure 9: Recommended fencing for rabbit exclusion (DoEE 2004)

Appendix B Recommended planting list (Illawarra and South Coast Lowland Forest and Woodland)

Form	Scientific name	Common name
Trees	*Acacia maidenii*	Maiden's Wattle
	Acacia mearnsii	Black Wattle
	Allocasuarina littoralis	Black Sheoak
	Eucalyptus amplifolia	Cabbage Gum
	Eucalyptus bosistoana	Coast Grey Box
	Eucalyptus eugenioides	Thin-leaved Stringybark
	Eucalyptus longifolia	Woollybutt
	Eucalyptus tereticornis	Forest Forest Red Gum
	Melaleuca decora	Feather Honey-Myrtle
Shrubs	*Bursaria spinosa subsp. spinosa*	Native Boxthorn
	Dodonaea viscosa subsp. angustifolia	Native Hop
	Indigofera australis	Native Indigo
	Melaleuca linariifolia	Snow-in-Summer
	Melicytus dentatus	Tree Violet
	Bursaria spinosa subsp. *spinosa*	Native Boxthorn
Grasses and groundcovers	*Aristida ramosa*	Threeawn speargrass
	Aristida vagans	Purple wiregrass
	Austrodanthonia caespitosa	Common wallaby grass
	Carex longebrachiata	Bergalia Tussock
	Commelina cyanea	Scurvy Weed
	Dichondra repens	Kidney Weed
	Echinopogon caespitosus	Tufted Hedgehog Grass
	Einadia hastata	Berry Saltbush
	Gahnia radula	Rough Thatch Saw-sedge
	Hibbertia scandens	Climbing Trailing Guinea Flower
	Imperata cylindrica var. *major*	Blady Grass
	Lomandra longifolia	Mat Rush
	Microlaena stipoides	Weeping Grass
	Oplismenus aemulus	Basket Grass
	Parsonsia straminea	Common Silkpod
	Pandorea pandorana subsp. *pandorana*	Wonga Wonga Vine
	Poa labillardieri var *labillardieri*	Tussock grass

Form	Scientific name	Common name
	Rytidosperma racemosa var. *racemosum*	Wallaby grass
	Themeda australis	Kangaroo Grass

Appendix C Emergency contact list

To be provided prior to VMP implementation commencing, to ensure details are up to date and correct.

Appendix D Environmental management roles and responsibilities

Safeguards to manage potential environmental impacts are detailed in this report together with who is responsible for their implementation and at what stage of works. Roles and responsibilities are outlined in

Table 12: Roles and responsibility

Role	Name/ Position/ Company	Responsibility
Project Manager (Development)	Project manager, TBA	• reviews VMP • notifies relevant contractors of changes to the project scope and updates to CEMP, if required • requires the contractor to adhere to the planning approval • accountable for contractor's and subcontractor's environmental performance • reports any non-compliance to Department of Agriculture, Water and Environment and Council.
Site Supervisor (Contractor)	TBA	• issues stop work orders, if required • records any community complaints and notifies Project Manager (Development) and other relevant consultants. • responsible for site management, VMP and subcontractors • facilitates environmental induction and tool box talks for site personnel • ensures community are notified of commencement of works
Team members (Contractor)	TBA	• complies with the VMP • monitors and maintains fencing and signage • reports incidents to Site Supervisor • stops work and reports to Site Supervisor in the event of unexpected finds (eg, potential contamination or heritage items) • records any community complaints and notify the Site Supervisor

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Appendix H Calderwood Town Centre South Vegetation Management Plan (Eco Logical Australia 27 March 2023)

Calderwood Town Centre South – VMP

Lendlease Communities (Calderwood) Pty Ltd

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DOCUMENT TRACKING

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Approved by	**Meredith Henderson**
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Template 2.8.1

Contents

List of Figures

List of Tables

Abbreviations

Abbreviation	Description
BC Act	*Biodiversity Conservation Act 2016*
DPI	Department of Primary Industries (now called Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
LGA	Local Government Area
NRAR	Natural Resources Access Regulator
OEH	NSW Office of Environment and Heritage (now called Environment, Energy and Science)
RFS	Rural Fire Service
SCC	Shellharbour City Council
TS	Tubestock planting
VMP	Vegetation Management Plan
WoNS	Weeds of National Significance

1. Introduction

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia (ELA) Pty Ltd on behalf of Lendlease Communities (Calderwood) Pty Ltd for the proposed Town Centre South (TCS) residential subdivision, within the Calderwood Urban Development Project. Calderwood Town Centre South is located within the Shellharbour City Council (SCC) Local Government Area (LGA).

1.1 Background and Context

Calderwood TCS is located at Calderwood Road, Calderwood, on Lot 3328 DP1225478 & Lot 3129 DP1225477. The development is proposed for the south of Calderwood Road. The Calderwood TCS VMP area is excluded from the *Shellharbour Local Environmental Plan 2013* as it falls within an area covered by the *State Environmental Planning Policy (State Significant Precincts) 2005*. Land Zoning is C3 Environmental Management and B4 Mixed Use.

A Consolidated Concept Plan (CCP) (JBA 2011) (also known as Approved Concept Plan) has been approved for the site and where there is conflict between the Approved Concept Plan and any local or state level instruments, the Concept Plan will prevail to the extent of the inconsistency. The Approved Concept Plan also requires retention of certain riparian corridors. There is one first order steam (Stream Reach 13) (Figure 6 within Approved Concept Plan) which has not been determined to be a stream of hydrological importance. It was also confirmed during a ground-truthing field survey to have no defined channel and thus does not meet the definition of a river under the *Water Management Act 2000*. On this basis Stream Reach 13 was approved for removal under the CCP. There is one second order stream (labelled Stream Reaches 7 and 8) which has been determined to perform a requisite hydrological function and will be retained. The Statement of Commitments is relevant to the retained riparian corridor covered by the Approved Concept Plan.

This VMP has been designed to comply with the Approved Concept Plan and the *Guidelines for riparian corridors on waterfront land* (DPI, 2012).

1.1.1 Calderwood Town Centre South proposed scope of works

The proposed scope of works in the western portion of Calderwood Town Centre South (Figure 1) will include extensive earthworks to modify the landform to accommodate residential lots. A batter would be constructed within the VMP area.

1.1.2 Calderwood Town Centre South and Stage 3A

The TCS development area is adjoined by Stage 3A to the south (Figure 1) and Stage 2C to the east. Stage 2C contains an area which is covered by a separate VMP; however, the riparian area adjoining the Stage 3A development has been included in this VMP to ensure that all parts of the riparian corridor are being managed and rehabilitated. Where there is cross-over between the VMP areas, the VMP that is commenced first should be implemented in full. Any subsequent VMP work for an adjoining stage should implement vegetation management strategies in any areas disturbed by the works for that stage. Where revegetation works have been completed and are not impacted by construction works for the adjoining stage, these zones should remain in place and additional revegetation is not required.

2. Site description

2.1 Location

The Calderwood Valley extends north beyond Marshall Mount Creek (into Wollongong LGA), to the east to the Macquarie Rivulet, to the south by Johnston's Spur and to the west by the Illawarra Escarpment. Beyond Johnston's Spur to the south is the adjoining Macquarie Rivulet Valley within the suburb of North Macquarie. The Calderwood Urban Development Project land extends south from the Calderwood Valley to the Illawarra Highway. Calderwood TCS is subject to one VMP. This document relates to the riparian corridor located to the west of Calderwood TCS, indicated as 'VMP Boundary' in Figure 1. The VMP area sits at the western extent of the broader development area, hereafter referred to as the 'study area' (Figure 2).

Figure 1. Calderwood Town Centre South boundary and location of VMP areas

2.2 Management history

Historically, the study area was used for agricultural land activities, (primarily cattle and horse grazing) which resulted in under-scrubbing of the shrub stratum, introduction of exotic plant species through pasture improvement techniques and incidental weed incursions. A small cemetery, which was established in 1880, is in the development area.

2.3 Landscape context

The study area contains two water courses including one first order (Stream reach 13, approved for removal) and two second order streams (Stream reaches 7 and 8) according to the Strahler system. The VMP area drains into Macquarie Rivulet (Figure 2). The topography of the study area consists of a gently undulating landscape which is intermittently bordered by constructed dams and creeks. The Calderwood Valley is a conglomerate of the Permo - Triassic Sydney Basin overlain with alluvium and, in sections, superimposed with slopewash and rockfall debris (Douglas Partners, 2010).

The VMP area contains remnant native vegetation, some of which has been mapped as Environmentally Significant Land (ESL) in the Approved Concept Plan (**Figure 4**). The Approved Concept Plan provides for the protection of these lands, which are intended for long term retention.

Figure 2. Validated watercourses within Calderwood Town Centre South

Figure 3. Calderwood Environmentally Significant Lands (ESL)

2.4 Vegetation

Three vegetation types were validated within the study area by ELA Senior Restoration Ecologist Alastair Jones and Ecologist Rachel Brown. The vegetation communities included:

- Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowland
- Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats
- Exotic cover.

Vegetation mapping of the study area is provided in Figure 4.

A list of all native and non-native species identified on site is provided in **Appendix A.**

2.4.1 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowland

The field survey confirmed the presence of PCT 838: Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowland across approximately 0.44 ha within the study area. This vegetation community corresponds to Illawarra Lowlands Grassy Woodland, listed as an Endangered Ecological Community (EEC) under the BC Act. The community was present in one condition state - disturbed.

The disturbed condition vegetation contained a canopy of *Eucalyptus tereticornis* (Forest Red Gum). The canopy also contained two individual exotic *Pinus radiata* (Pine Tree) and a single *Erythrina x sykesii* (Coral tree). The native mid-storey contained scattered *Pittosporum undulatum* (Native Apricot) adjacent to Calderwood Road. Much of the midstorey was dominated by *Lantana camara* (Lantana), *Rubus fruticosus* agg sp. (Blackberry) and *Ligustrum sinense* (Small-leaved Privet), though individual *Myrsine variabilis* (Muttonwood), *Pittosporum undulatum* (Sweet Pittosporum) and, *Rubus parvifolius* (Native Raspberry) also occurred sparsely.

Native ground cover consisted of <10% native grasses and forbs including *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Cymbopogon refractus* (Barbed Wire Grass *Cheilanthes sieberi* (Rock Fern), *Desmodium rhytidophyllum*, *Dichelachne micrantha* (Shorthair Plumegrass), *Entolasia stricta* (Wiry Panic), *Commelina cyanea* (Scurvy weed), *Doodia aspera* (Prickly Rasp Fern), *Echinopogon ovatus* (Forest Hedgehog Grass), *Eragrostis leptostachya* (Paddock Lovegrass), *Poa labillardierei* (Common Tussock Grass), *Oplismenus imbecillis* (Basket Grass), *Dichondra repens* (Kidney weed), *Glycine clandestina* (Twining glycine), *Hardenbergia violacea* (False Sarsaparilla) *Parsonsia straminea* (Common Silkpod), *Pratia purpurascens* (Whiteroot), *Themeda triandra* (Kangaroo Grass) and *Wahlenbergia gracilis* (Sprawling Bluebell) and *Einadia nutans* (Climbing Saltbush).

The understorey also contained a variety of weeds including *Senecio madagascariensis* (Fireweed), *Bidens pilosa* (Cobblers Pegs), *Cynodon dactylon* (Couch), *Chloris gayana* (Rhodes Grass), *Conyza bonariensis* (Flax-leaf Fleabane), *Ehrharta erecta* (Panic Veldt Grass), *Axonopus fissifolius* (Narrow-leafed Carpet Grass), *Cenchrus clandestinus* (Kikuyu Grass), *Hypochaeris radicata* (Catsear), *Paspalum dilatatum*, *Plantago lanceolata* (Lamb's Tongues) and *Sida rhombifolia* (Paddy's Lucerne).

2.4.2 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats

The field survey confirmed the presence of PCT 835: Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats across approximately 0.61 ha within the study area. The community was located predominantly within drainage lines. The community was present in a disturbed condition. This

vegetation community corresponds with River-flat Eucalyptus Forest, listed as endangered under the BC Act.

The disturbed condition vegetation consisted of a canopy of *E. tereticornis*, *Angophora floribunda* (Rough-barked Apple), *Casuarina cunninghamiana* (River Oak) and *C. glauca* (Swamp Oak). Exotic species including *Populus alba* (Silver Poplar) and *Salix alba* (White Willow) were also present in the canopy.

The midstorey did not contain any native species and was dominated by the exotics *L. camara, L. sinense* and *R. fruticosus*. The groundcover is composed of sparse forbs, scramblers and grasses including *M. stipoides*, *D. repens*, *Glycine microphylla* (Small-leaved Glycine) and *Goodenia hederacea* (Forest Goodenia). The groundocver was dominated by exotic species including *Araujia sericiflora* (Moth Vine), *B. pilosa*, *Cenchrus clandestinus* (Kikuyu), *C. bonariensis*, *C. dactylon*, *Paspalum diliatum* (Caterpillar Grass), *Senecio madagascariensis* (Fireweed), *Setaria parviflora* (Slender Pigeon Grass), *Sida rhombifolia* (Paddy's Lucerne) and *Verbena bonariensis* (Purpletop).

2.4.3 Aquatic vegetation

Native aquatic and semi-aquatic vegetation were present in the unnamed dam located in the study area and consisted of *Vallisneria nana* (Ribbonweed), *Juncus usitatus* (Common Rush) and *Typha orientalis* (Broadleaf Cumbungi).

2.4.4 Exotic/native

Areas not mapped as Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowland or Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats comprised exotic vegetation within the study area. This vegetation community covered 16.1 ha across the TCS development area and was found to be heavily impacted by previous clearing and grazing activities and contained >80% exotic cover. Where present, the overstorey was dominated by *Erythrina x sykesii* (Coral Tree) with scattered *Malus domestica* (Apple Tree) also present. The midstorey was dominated by *L. camara*. The understorey contained a variety of exotic grass and herbaceous species including *Atropa belladonna* (Deadly Nightshade), *B. pilosa*, *C. gayana*, *C. bonariensis*, *C. dactylon*, *E. erecta*, *P. dilitatum*, *C. clandestinus*, *S. parviflora*, *Stenotaphrum secundatum* (Buffalo Grass), *S. rhombifolia*, *V. bonariensis* and *Vicia sativa* (Common Vetch).

Figure 4. Study area validated vegetation communities

2.5 Sensitive environmental features

Two sensitive environmental features were identified in the study area, namely Illawarra Lowlands Grassy Woodland and River-flat Eucalypt Forest. Both communities are listed as Endangered Ecological Communities (EECs) under the BC Act and Illawarra Lowlands Grassy Woodland is listed as Critically Endangered under the EPBC Act 1999 but the community present at the site does not meet the EPBC criteria condition. River-flat Eucalypt Forest is not listed under the EPBC Act.

Hollow Bearing Trees (HBTs) and waterbodies (the creek, natural pond and temporary sediment basin) were also identified on site (Figure 4). The HBTs located near waterbodies are likely to provide suitable habitat for the BC Act listed, vulnerable Southern Myotis (*Myotis macrocarpus*).

2.6 Threats

The main threat to native vegetation at the study area was the presence of a variety of weed species at high densities. The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds (**Table 1**). Under the Act all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Specific legal requirements apply to State determined priorities under the Greater Sydney Regional Strategic Weed Management Plan 2017-2022. Weeds listed as 'other weeds of regional concern' under the plan warrant resources for local control or management programs and are a priority to keep out of the region. Inclusion in this list may assist Local Control Authorities and/or land managers to prioritise action in certain circumstances where it can be demonstrated the weed poses a threat to the environment, human health, agriculture etc.

Of the weeds identified during the field survey, one has been listed as a State level priority weed and two listed as other weeds of regional concern. The weeds present, their priority listing under the Act, the associated asset / value at risk and whether they are Weeds of National Significance (WoNS), are presented in **Table 1**. A full list of weeds recorded during the field survey is provided in **Appendix A.**

Table 1: A list of priority weeds and Weeds of National Significance identified within the VMP

Scientific Name	Common Name	WoNS	Biosecurity Act 2015
State level priority weeds (Whole of State)			
Lantana camara	Lantana	Yes	Asset Protection
Other weeds of regional concern			
Chloris gayana	Rhodes Grass	No	Environment
Erythrina x sykesii	Coral tree	No	Environment

2.7 Resilience Potential

The areas of disturbed condition PCT 838 and 835 have minimal potential to regenerate naturally due to historical heavy grazing and soil compaction. Therefore, tubestock planting is recommended, primarily in the form of native shrubs and groundcover species, which are lacking at present.

3. Aims, goals and objectives of the VMP

3.1 Aims

The aim for this VMP is to provide a working document that will successfully protect, maintain and enhance the VMP area's native vegetation both for immediate rehabilitation purposes and for maintenance into the future.

Specific aims of this VMP are to:

- be consistent with environmental legislation and policies, including the BC Act, *Biosecurity Act 2015* and *Water Management Act 2000*
- ensure flooding affectation upon surrounding and/or proposed residential lots is not increased
- mitigate development impacts on bushland/natural areas
- satisfy the requirement of NRAR in relation to riparian corridors.

3.2 Goals

The overall goals of this VMP are to establish native species cover and density along the riparian corridor, within the E3 (Environmental Management) area through revegetation works. Specific goals for this VMP are to:

- Regenerate and revegetate the riparian corridor with species characteristic of Illawarra Lowlands Grassy Woodland (PCT 838) in accordance with CCP commitments.
- Regenerate and revegetate the riparian corridor with species characteristic of River-flat Eucalypt Forest (PCT 835) in accordance with CCP commitments.
- Maintain weeds at low levels for a period of three years to enable establishment and survival of planted native species.
- Stabilise bed and banks along approximately 460 m of riparian corridor by planting native vegetation and installing jute matting.
- Improve the integrity of aquatic fringing vegetation by removing weeds and minimising disturbance.

3.3 Objectives

The overall objective of this VMP is to replicate natural variations in vegetation densities and distribution that is complementary to flood mitigation and open spaces. This VMP covers the initial three-year period. The objectives for the VMP are to:

- Achieve less than 20-30% cover of exotic plant species and zero recruitment of new priority weed species in all management Zones by the end of Year 3.
- Provide assisted regeneration by planting at a density of at least 1 stem per 10 m^2 of shrubs and at least six native groundcovers per m^2 in Zones 3 and 5 within three years.
- Revegetate weed dominated areas by planting at a density of at least 1 stem per 20 m^2 of trees and 1 shrub per 10 m^2 and at least six native groundcovers per m^2 in Zones 2 and 4 within 3 years.

- Characteristic Illawarra Lowlands Grassy Woodland and River-flat Eucalypt Forest species assemblage from each stratum established in all zones. Species assemblages as per NSW Government Scientific Committee Determinations (OEH 2011).
- Provide replacement plantings for area of Environmentally Significant Land (ESL) which will be removed by the development.

4. Restoration Treatment Prescription

4.1 Management zones

The VMP area of approximately 3.28ha, will be entirely managed, apart from the existing northern pond (0.072 ha) which will be retained and not subject to stream reshaping or earthworks. The southern dam will be modified to form a channel consistent with the natural streamline.

Vegetation management will be carried out across 3.2 ha of land. Vegetation management works for this VMP are focused mainly on weed management, with revegetation in the riparian zone to replicate natural variation in vegetation densities and distribution and revegetation in the non-riparian zone to provide an open canopy to facilitate recreational use of the area. Trees will only be planted in management zones 2, 4 and 6. The VMP area consists of six management zones as identified below and in Figure 5.

- **Zone 1 – Instream Revegetation**. 0.29 ha of revegetation consisting of aquatic macrophytes such as sedges, rushes and reeds which are tolerant to periodic inundation.
- **Zone 2 – River-flat Eucalypt Forest Revegetation (riparian).** 1.54 ha of revegetation with a variety of trees, shrubs and groundcovers. Trees at a density of 1 per 20 m^2, and shrubs 1 per 10 m^2 and groundcovers at a density of 6 per m^2. Species consistent with those of PCT 835.
- **Zone 3 – River-flat Eucalypt Forest Regeneration**. 0.23 ha of regeneration with a variety of shrubs and groundcovers. Shrubs at a density of 1 per 10 m^2 and groundcovers at a density of 6 per m^2. Species consistent with those of PCT 835.
- **Zone 4 – Illawarra Lowlands Grassy Woodland Revegetation.** 0.25 ha of revegetation with a variety of trees, shrubs and groundcovers. at a density of 1 per 20 m^2, and shrubs 1 per 10 m^2 and groundcovers at a density of 6 per m^2. Species consistent with those of PCT 838. This zone includes replacement plantings for ESL removed by the development.
- **Zone 5 – Illawarra Lowlands Grassy Woodland Regeneration**. 0.16 ha of regeneration with a variety of shrubs and groundcovers. Shrubs at a density of 1 per 10 m^2 and groundcovers at a density of 6 per m^2. Species consistent with those of PCT 838.
- **Zone 6 – River-flat Eucalypt Forest Revegetation (non-riparian).** 0.79 ha of revegetation with a variety of trees, shrubs and groundcovers planted at densities compliant with Outer Protection Area standards (canopy cover less than 30%, shrub cover less than 20%). Species consistent with those of PCT 835.

4.2 Riparian Averaging

A riparian averaging exercise has been undertaken whereby permissible non-riparian activities within the outer 50% of the corridor will be offset in an area adjoining the riparian corridor. Non-riparian uses include a detention basin and an APZ, both of which are explicitly permitted by NRAR's Guidelines for riparian corridors on waterfront land. Detail pertaining to the APZ may be found in the bushfire report (Peterson, 2021), the assumptions and conclusions of which are consistent with this VMP.

The averaging exercise provides a surplus of land to be managed as riparian corridor. This is illustrated in Figure 5 where a total of 0.22 ha of riparian land is encroached and a total of 0.3 ha of adjoining land

is provided to offset the encroachment. All of the available riparian land and offset areas will be subject to vegetation management for the purposes of restoration.

Figure 5. Vegetation Management Zones

4.3 Construction Management Actions

The civil construction company shall be responsible for management actions outlined in Sections 4.3.1 to 4.3.5.

4.3.1 Temporary construction fencing

The edge of the VMP area where it borders the development footprint is to be fenced with temporary construction fencing to prevent civil construction machinery from entering the VMP area unless under supervision from a suitably qualified ecologist or bush regenerator.

Informational signage must be installed on the construction fencing that identifies that there is to be no entry into the VMP area without an ecologist or bush regenerator present.

4.3.2 Preclearance and earthworks supervision

During construction activities, when clearing areas of existing vegetation, earthworks and tree removal should be undertaken with the fauna ecologist or wildlife carer to supervise works. All timber should be retained onsite, with native mulch stockpiled for use within VMP area, all viable seed and genetic material to be collected and all timber cut into logs to be utilised as habitat for native fauna.

Designated pedestrian/cycleways and green spaces should be clearly marked as part of the preclearance to delineate these as separate from the VMP area.

4.3.3 Soil preparation

ELA understands that bulk earthworks, including the importation of topsoil, will occur across the whole VMP study area. For areas of revegetation in the VMP area, top soil will need to be suitable for native species, loose, friable and free of weed propagules suitable for planting. Top soil is to be kept free of weed propagules whilst retained on site.

4.3.4 Pest control

Pest control is the responsibility of the land holders, which is to be undertaken by relevant contractors in consultation with Local Land Services (LLS) and Shellharbour Council.

Rabbits have potential to impede the success of the VMP. It is recommended that tree guards, construction fencing, and sediment fencing be installed in such a way that can also exclude rabbits (see **Appendix C**). A rabbit control program may be required for the site. If required, it should be implemented based on identification and fumigation of rabbit warrens, particularly once the exclusion fencing has been installed. This is to be undertaken in consultation with LLS.

The site is to be monitored for evidence of rabbit activity, which will be included in annual monitoring reports. Any damage by rabbits, primarily due to grazing young plants, will require rectification.

4.3.5 Fauna habitat enhancement

The protection of native biodiversity is important in the long-term health and rehabilitation of native ecological communities. Although at present the VMP contains a high proportion of exotic vegetation, native fauna, namely birds, reptiles and amphibians, have adapted to these environments. The removal of a large coverage of weeds from within the VMP area in a relatively short timeframe may result in the displacement of native fauna species. This is a concern for maintaining local biodiversity, considering the amount of urban development in adjacent areas.

It is recommended that to minimise the impacts to native fauna during bush regeneration works, management actions should be conducted:

- in a staged or mosaic pattern for weed removal on degraded sites, involving areas no larger than 20m x 20m
- by concentrating the removal of dense woody weed infestations outside peak bird breeding times
- by spraying herbicides in cooler seasons to reduce impacts on amphibians;
- by retaining burn piles as fauna habitat and for erosion control
- by working in areas where native resilience is higher before targeting degraded patches.

Additionally, any native trees earmarked for removal within the development area should be used as habitat structures within the VMP area. This includes the use of fallen woody debris as habitat or for mulch. Mulch should be free of weed propagules. Large woody material (>10 cm diameter) removed from within the development area / impact area can be used as habitat structures within the VMP area. Woody material provides microhabitat for fauna species, soil stability and nutrient cycling. Exotic vegetation will be taken off-site and should not be used in habitat enhancement.

4.4 Vegetation Management Actions

4.4.1 Seed collection

Seed for revegetation works will be collected from the local area to ensure the material is of local provenance. Where seed and propagule sources are not available within the local area, collection of material may extend to a 20 km radius of the site (e.g. for species which are typically widely dispersed).

Seed collection must be undertaken in accordance with Florabank Guidelines (Mortlock 2000).

Seed should only be collected from strong, healthy plants and less than 20% of the seed is to be collected from any one plant to allow natural regeneration at the donor site. Seeds must only be collected from fruits that are close to maturity to ensure that viable seed is collected. If seeds are to be stored, bags containing seed should be kept in a well-ventilated location to avoid fungal contamination (DECC 2008). Seed collection must take place up to 9 months before revegetation for seeds to germinate.

4.4.2 Primary and secondary weed control

Weed control will involve a combination of mechanical, physical and chemical techniques to remove weeds and prevent regrowth. Weed control will be undertaken in all management zones. A selection of the best suited weed control method within the site depends on several factors including:

1. the species or combination of weeds being targeted (refer to **Appendix A** for a list of flora species recorded on site)
2. the density of the weeds
3. resources available (time, labour, equipment and finances)
4. weather conditions of the day.

Key priority weed species to target in VMP zones and their associated control techniques are provided in Table 2. Further details of specific weed control techniques to be used such as cut and paint, scrape and paint, herbicide spraying, and hand weeding are given in Brodie (1999). The principles of bush regeneration and techniques to trigger natural regeneration are to be in accordance with the Bradley

Method and other techniques described in Buchanan (2000). A detailed summary of management techniques for the different types of weeds identified in the VMP area, are provided in **Appendix C**.

Table 2. Primary weeds in the VMP area and associated control methods

Scientific Name	Common Name	VMP Zone	Control Method
Anredera cordifolia	Madeira Vine	4, 5	Herbicides can be effective and the main application techniques are scrape and paint and foliar spraying. Best results are achieved during the warmer months. Physical removal of Madeira vine is difficult because of the extent of underground tubers and aerial bulbils but may be practical at smaller or immature infestation sites or as a follow-up measure to remove persistent tubers. Tubers, bulbils and vegetative material must be disposed of appropriately, as they will regrow if they are left in contact with the soil
Conyza bonariensis	Flax leaf Fleabane	1, 2, 3	Herbicide application (e.g. Flumioxazin, D-amine, Glufosinate – ammonium)
Lantana camara	Lantana	2, 3, 4 ,5	Physical removal (hand pulling, slashing or bulldozing). Chemical control (foliar spray, cut and paint).
Pennisetum clandestinum	Kikuyu Grass	1, 2, 3, 4, 5, 6	Spray with glyphosate plus Penetrant in September, December and March each year. Encourage shrub and tree species to reduce light levels.
Rubus fruticosus agg.	Blackberry	2, 3, 4, 5	Herbicides are the most reliable blackberry control method. Use herbicides in combination with other control methods. There are many herbicides registered for use on blackberry. A mixture of triclopyr + picloram used with or without aminopyralid gives the best long-term control. Spray healthy, actively growing plants with new leaves on the cane tips. Apply to both the outer and inner leaves
Senecio madagascariensis	Fireweed	2, 3, 4, 5, 6	Hand weeding, slashing, mulching, herbicide application in late autumn.

4.4.3 Management of weed waste

All exotic vegetation material should be removed from site and composted at a registered green waste disposal facility. Fruiting parts and tubers should be bagged before being removed from site.

4.4.4 Herbicide use

The use of herbicide to control weeds should be carefully considered. Herbicide use should assess potential long-term impacts of the technique including whether the proposed works address the source of the weed infestation. However, herbicide application forms an important and useful component of an integrated weed management approach and can be the most appropriate method to control some weed species.

Herbicide use should occur during the active growing season for plants to encourage the chemical uptake into the plant. The selection of herbicides should also consider the type of weed and the location. Where non-selective herbicides are required for use, glyphosate is the most suitable. If

herbicides are required to be used near waterways, a glyphosate-based herbicide formulated for use near waterways will be used (e.g. RoundUp© Biactive™).

Broad-leaf selective herbicide may be used as per the *Noxious and environmental weed control handbook* (DPI 2010). However, this type of herbicide is extremely toxic to aquatic life and must not be used in, or adjacent to, waterways. Registration and records must be kept in accordance with the NSW *Pesticide Regulation 2009*. Herbicide use for different types of weeds, is provided in **Appendix C**.

4.4.5 Revegetation

Revegetation or assisted regeneration works are required in all management zones. This would include planting Illawarra Lowlands Grassy Woodland and/or River-flat Eucalypt Forest species across those zones, once adequate weed control has been achieved.

The targeted vegetation community for revegetation in Zone 1 is aquatic macrophytes representative of Illawarra Lowlands Grassy Woodland and River-flat Eucalypt Forest. Zone 2 revegetation will comprise planting of RFEF species and planting in Zone 4 will comprise planting of Illawarra Lowlands Grassy Woodland species. Planting in Zones 2 and 4 will be at densities to ensure flooding affectation upon the surrounding properties in the locality is not increased. This will include avoiding the planting of short-lived species such as Acacias to minimise the flood hazard from woody debris in the watercourse. Planting of shrub and groundcover species would be carried out in Zones 3 and 5 where the mid-storey and understorey have been heavily impacted by weed infestation and grazing. Species for revegetation in this area will be based on characteristic species of the River-flat Eucalypt Forest and Illawarra Lowlands Grassy Woodland communities. Planting within Zone 6 will be compliant with Outer Protection Area standards which will provide a more open landscape to facilitate recreational use of the area whilst reducing bushfire risk. Planting assumptions and are provided in **Table 3**.

Revegetation works will include planting of native groundcover, grass, shrub and canopy species using tube stock and Hiko / Viro cells. Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each tubestock should be at least 1.5x the width and 2x the depth of the rootball. Fertiliser should be added to each hole dug as per the label specifications.

Initial irrigation of the tubestock is not needed if plantings are undertaken before sufficient rainfall.

Tree guards will need to be installed on each shrub to protect seedlings from extreme weather (frosts and heat), herbivorous grazing and herbicide drift during maintenance. Bio-degradable tree guards are recommended to protect the seedlings. Depending on the weather, irrigation needs to be undertaken for at least 4-6 weeks following planting to aid establishment of the plants.

Mulch, where needed, is to be applied providing a depth of 100mm. Mulch can be sourced from native vegetation earmarked for removed from the development area or externally sourced. Mulching should not be undertaken along the creekbanks or within areas of high potential erosion. In these areas, it is recommended that jute matting be used prior to revegetation. Jute matting, where required, must comprise 100% biodegradable jute fibres with a minimum weight of 680g/m^2 (~6 mm thickness). Jute must be pegged with at least 3 x 150 mm pins per m^2 and each roll overlapped by 100 mm.

Planting is to be undertaken using the species identified in **Appendix B** at the densities shown in **Table 4**. If species are unavailable, others may be substituted but they must be typical species of Illawarra

Lowlands Grassy Woodland and /or River-flat Eucalypt Forest and be a 'like-for-like' substitution, i.e. a tree can only be substituted for a tree. All plantings are to be sourced from local provenance stock, as per WCC guidelines and Florabank guidelines (Mortlock, 2000). More information on revegetation and seed collection specifications is provided in **Appendix B.** Any plantings should consist of local provenance stock.

Record keeping of seed collection and planting locations is to be as per the Flora Bank guidelines (Mortlock 2000). The bush regeneration contractor is responsible for recording this information and providing it to Wollongong City Council. A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to undertake seed collection works.

Table 3: Planting assumptions and management requirements

Zone Number	Description	Sum of Area (m²)	Direct seeding Area (m²)	Tubestock planting Area (m²)
Zone 1	Instream revegetation	2,901	-	2,901
Zone 2	River-flat Eucalypt Forest revegetation (riparian)	15,489	-	15,489
Zone 3	River-flat Eucalypt Forest regeneration	2,316	-	2,316
Zone 4	Illawarra Lowlands Grassy Woodland revegetation	2,530	-	2,530
Zone 5	Illawarra Lowlands Grassy Woodland regeneration	1,560	-	1,560
Zone 6	River-flat Eucalypt Forest revegetation (non-riparian)	7,964		7,964
Total		**32,760**	**0**	**32,760**

Table 4: Revegetation densities

Zone	Description	Revegetation Area (m²)	Revegetation densities (m²)*				Totals
			Tree	Shrub	Herbs / scramblers / grasses	Rushes/sedges	
Zone 1	Instream revegetation	2,901				5.00	14,505
Zone 2	River-flat Eucalypt Forest revegetation (riparian)	15,489	1/20	1/20	6.00		94,481
Zone 3	River-flat Eucalypt Forest regeneration	2,316	0	1/10	6.00		14,129
Zone 4	Illawarra Lowlands Grassy Woodland revegetation	2,530	1/10	1/5	6.00		15,938
Zone 5	Illawarra Lowlands Grassy Woodland regeneration	1,560	0	1/5	6.00		9,674
Zone 6	River-flat Eucalypt Forest revegetation (non-riparian)	7,964	1/50	1/70	4.00		32,130
Totals	**-**	**32,760**	**-**	**-**	**-**	**-**	**180,856**

*Includes equivalent amount of direct seeding

4.4.6 Maintenance

Following secondary weed removal and revegetation, all areas will require ongoing maintenance for a minimum two-year period, to control weed regrowth from the soil seed bank. Maintenance work is to be undertaken by a qualified bush regeneration contractor(s) as per specifications provided in **Appendix C**.

Maintenance will be undertaken on a regular basis in the peak growing seasons (spring and summer), with less frequent visits in cooler periods (autumn and winter). Maintenance programs will also comment on other site issues such as rabbit activity and condition of sediment control structures. Maintenance work will include actions to encourage native regeneration where it is not occurring naturally. These actions include techniques such as soil disturbance, niche seeding and transplanting. Maintenance works will also include infill planting if more than 10% loss of stock occurs to ensure targeted densities are achieved.

Specific management timeframes and responsibilities for this period are provided in Table 5**.**

4.5 Bush regeneration contractors

All vegetation management works is to be undertaken by suitably qualified and experienced bush regeneration contractors or individuals. In addition to this, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009). A flexible approach to this site is recommended since techniques may need to be changed or modified to suit site conditions. This approach is consistent with adaptive management and allows the contractor to develop and build on site knowledge whilst implementing this VMP. Monitoring will assist in the development of the VMP actions in subsequent years.

Works in the maintenance period will be the responsibility of the land owner in accordance with this VMP.

4.6 Implementation Schedule

An indicative implementation schedule for the first three years is included in **Table 5**. Note that initial plantings will be installed in Year 1 of the project to allow for adequate weed control to occur. Replacement plantings will be installed in Year 2 to ensure target plant densities are achieved in each of the management zones.

Table 5: Implementation schedule

Treatment	Preliminary	Year 1				Year 2				Year 3			
		1	2	3	4	1	2	3	4	1	2	3	4
Construction works													
Temporary fencing installation													
Earthworks supervision													
Revegetation													
Seed collection, cleaning, storage													
Site Preparation													
Jute Matting / Mulch													
Direct Seeding, supply and install													
Tubestock, supply and install													
Replacement tubestock, supply and install													
Irrigation													
Weed control													
Preliminary													
Establishment													
Maintenance - Year 1 - 2													
Maintenance - Year 3													
Associated works													
Monitoring & Reporting													
Construction activities													
Vegetation management works													

4.7 Performance criteria

The progress and compliance with the VMP will be monitored and reviewed at six-monthly intervals. The vegetation management works will be monitored and reported on by a suitably qualified and experienced restoration ecologist, who is not the bush regeneration contractor, a land manager or a land owner of any area to which the VMP applies.

The performance criteria listed are best practice and are not linked with any specific legislation. The bush regeneration contractor, in consultation with Shellharbour Council, can adapt these criteria as required in response to the success of rehabilitation works. The performance criteria for the first three years are outlined in Table 6. Additional performance criteria will be incorporated into this plan as part of a revision to accommodate Phase 2 restoration works. In addition, monitoring and reporting are to be undertaken in accordance with **Section 5**.

Based on the success of the management works, further performance criteria may need to be developed for the maintenance period. If required, this should be identified in the reporting as per Section 5.

The contractor is responsible for meeting the performance criteria.

Table 6. Performance Criteria

Action	Zone	Year 1	Year 2	Year 3
Primary works	All zones	• Civil construction works completed • Commencement of all tasks outlined in the VMP or evidence of planning for their implementation • All construction and sediment fencing installed • All earthworks completed under the supervision of an ecologist or bush regenerator • Pest control management plan in consultation with LLS, with rabbit fencing installed as required • Soil preparation works completed to specifications in Section 4.3.3 • All rubbish and debris removed		
Weed control – woody weeds	2, 3, 4, 5, 6	• 100% of all adult woody weeds to be controlled. • No plants allowed to set seed and all seeding individuals removed • No establishment of new noxious species	• All regrowth to be maintained to no greater than 20% coverage • No plants allowed to set seed • No establishment of new noxious species	• <5% cover and zero recruitment of new species
Weed control – exotic groundcovers	All zones	• Maximum exotic groundcover covers <20% and zero recruitment of new species	• Maximum exotic groundcover covers <10%	• Maximum exotic groundcover covers <5%
Revegetation	All zones	• Installation of all plants not including replacement plants. If timing does not coincide with planting periods (Spring and Autumn) • A minimum of 85% survival rate of all revegetation	• Any localised plant failure within planting areas are addressed with no area larger than 2 m x 2 m without surviving plants • Replanting is to replace plants by the same species, or where that species is not available, with the same growth form (i.e. tree for tree etc) and must not decrease species diversity. Any new species must be from the community being emulated and of local provenance	• Final target densities as per **Table 4** achieved in each management zone. • Characteristic Illawarra Lowlands Grassy Woodland and/or River-flat Eucalypt Forest species assemblage from midstorey and understorey established. Species assemblage as per NSW Government Scientific Committee Determination.

5. Monitoring and reporting

The bush regeneration contractor and the land manager will monitor the vegetation for changes over time. Information gained through the monitoring and reporting process will identify works that have and have not been successful, and the reasons for their success or failure.

The aim of monitoring is to measure the effectiveness of the control actions being undertaken to achieve the desired outcome. It will identify non-conformances and provide the land manager with the ability to implement corrective actions. Information derived from the results of monitoring will also be used in adaptive management (i.e. learning from experience to inform future priorities and work plans). For example, as annual grass weeds are removed, herbaceous and perennial weeds may establish.

Finally, monitoring and reporting will help determine and quantify the costs related to weed management and the cost effectiveness of the VMP.

5.1 Monitoring

Monitoring will be undertaken by vegetation surveys and photo monitoring. Monitoring will need to be implemented prior to works commencing to establish a benchmark for performance, and to occur on an annual basis until the completion of the project. Monitoring results will be included in the progress report.

5.1.1 Photo monitoring

Photo monitoring points should be set-up using a permanent reference point to provide a visual reference of changes in the vegetation. Photo monitoring to include:

- set up a minimum of five photo monitoring points within the VMP area
- place two six-foot star pickets 10 m apart
- record the location (eastings and northings) of the first star picket with a GPS as well as the bearing to the second star picket
- take a digital photo from the first star picket looking towards the second star picket, the entire length of the transect.
- label each digital image with a unique reference number that indicates where the photo was taken (i.e. the photo monitoring point) and the date it was taken (e.g. 01_200405 for a photo taken at the first photo monitoring point on the 5th April 2020.

5.2 Evaluation

Annual monitoring and reporting will be followed by a review of the management approach, by a qualified Restoration Ecologist in consultation with the Vegetation Management Contractors, to evaluate the performance of management actions and to inform potential adaptive management responses. The aim of these reviews is to continually improve on-ground management and ecological outcomes. For example, as annual grass weeds are removed, herbaceous and perennial weeds may establish. Evaluation of completed monitoring and reporting will help determine and quantify the costs related to weed management and the cost effectiveness of the VMP.

5.3 Reporting

Progress reports are to be provided on a six-monthly basis until the completion of the project. This reporting includes the implementation of the monitoring actions specified in **Section 5.1** and a description of the works that have been undertaken. These reports will be submitted to Council and NRAR. Reports will include at a minimum:

- the time period the report relates to
- qualifications and experience of contractors
- certification of seed and local provenance stock
- a summary of works carried out within the period including
- date and time of site visits
- works completed on the site at each visit
- a table detailing total person hours for each task carried out on site
- methods of weeding undertaken and details of herbicide use
- numbers of tubestock planted if applicable
- methods implemented for Assisted Natural Regeneration
- photo and quadrat monitoring results to date
- a description of any problems encountered in implementing the works recommended in the VMP and how they were overcome
- any observations made, including new plant species recorded (native and weed species), comments on rates of regeneration and any problems which impact on the implementation of the VMP
- If applicable, the results of the implementation works in relation to the relevant performance criteria.

6. Costs

The cost of implementation for the Phase 1 restoration over a three-year period is approximately **$1,125,000** exclusive of GST and CPI. An indicative annual costing timeline provided in Table 7.

Rates and costs are based on typical commercial rates. Assumptions that have been made regarding estimating costs have been outlined below.

6.1 Vegetation management works

6.1.1 Weed control techniques

Bush regeneration contractors will implement the weed control treatments identified in this VMP. These works have been estimated to cost **$2,500** for a team of four bush regenerators, including a supervisor, per day. The cost of bush regeneration works includes the costs of herbicide, vehicles and equipment which are required to implement the VMP.

6.1.2 Revegetation treatments

Bush regeneration contractors will implement the revegetation treatments identified in this VMP. Tubestock costs have been budgeted at an estimated $3.50 per tree and shrub including tree guards, planting, fertiliser and initial watering, and an estimated $2.50 per grass, sedge and groundcover including planting and initial watering.

A total of approximately **180,000** plants will be required to achieve the densities identified in the VMP. The total estimated cost of revegetation is approximately **$500,000** for tubestock installation, including a 15% rate for replacement plantings to be installed by year three following initial revegetation works.

6.1.3 Seed collection

Budget for the collection of seed has been included as a separate task. If further seed collection works are required, this may be an additional cost.

6.1.4 Monitoring and reporting

Bush regeneration contractors or ecologists will undertake the monitoring and reporting identified in this VMP. This includes:

- initial setup of the photo points and conducting the baseline surveys
- preparing a six monthly and annual report, including photo points until the completion of the project.

6.2 Pest control works

Costs for pest control works over the length of the maintenance period are difficult to predict and as such have not been included in the costings. The need and level of pest control works will be assessed in the monitoring reports and an approach will be determined in consultation with Lendlease and Shellharbour Council.

Table 7. Indicative costs for Phase 1 VMP implementation

Treatment	Preliminary	Maintenance			Total
		Year 1	Year 2	Year 3	
Revegetation					
Seed collection, cleaning, storage	$ 27,128	$ -	$ -	$ -	*$ 27,128*
Site Preparation	$ -	$ 16,380	$ -	$ -	*$ 16,380*
Jute Matting / Mulch	$ -	$ 213,493	$ -	$ -	*$ 213,493*
Direct Seeding, supply and install	$ -	$ -	$ -	$ -	*$ -*
Tubestock, supply and install	$ -	$ 455,265	$ -	$ -	*$ 455,265*
Replacement tubestock, supply and install	$ -		$ 45,527	$ -	*$ 45,527*
Irrigation	$ -	$ 32,760	$ -	$ -	*$ 32,760*
Weed control					
Preliminary	$ 65,520	$ -	$ -	$ -	*$ 65,520*
Establishment	$ -	$ 65,520	$ -	$ -	*$ 65,520*
Maintenance - Year 1 - 2	$ -	$ 49,140	$ 49,140	$ -	*$ 98,281*
Maintenance - Year 3	$ -	$ -	$ -	$ 65,520	*$ 65,520*
Associated costs					
Disbursements	$ 6,552	$ 11,466	$ 4,914	$ 6,552	*$ 29,484*
Monitoring & Reporting	$ -	$ 4,023	$ 4,023	$ 4,023	*$ 12,069*
Totals	**$ 99,201**	**$ 848,048**	**$ 103,604**	**$ 76,095**	***$1,126,948***

Appendix A : Site species list

Scientific name	Common name
NATIVE SPECIES	
Angophora floribunda	Rough-Barked Apple
Brachychiton acerifolius	Illawarra Flame Tree
Casuarina cunninghamiana	River Oak
Casuarina glauca	Swamp Oak
Commelina cyanea	Scurvy Weed
Cymbopogon refractus	Barbed Wire Grass
Dianella sp.	Flax Lily
Dichondra Repens	Kidney Weed
Einadia nutans	Climbing Saltbush
Entolasia stricta	Wiry Panic
Eucalyptus tereticornis	Forest Red Gum
Glycine microphylla	Small-Leaf Glycine
Hardenbergia violacea	Purple Coral Pea
Juncus usitatus	Common Rush
Microlaena stipoides	Weeping Grass
Oxalis sp.	Wood Sorrels
Persicariam sp.	Knotweed
Pittosporum undulatum	Sweet Pittosporum
Typha orientalis	Broadleaf Cumbungi
Vallisneria nana	Ribbonweed
EXOTIC SPECIES	
Araujia sericifera	Moth Vine
Atropa belladonna	Deadly Nightshade
Bidens pilosa	Cobbler's Pegs
Cenchrus ciliaris	Buffel Grass
Chloris gayana	Rhodes Grass
Conyza bonariensis	Fleabane
Cynodon dactylon	Couch
Ehrharta erecta	Panic Veldt Grass
Erythrina x sykesii	Coral Tree

Scientific name	Common name
Hypochaeris radicata	Flatweed
*Lantana camara**	Lantana
Ligustrum sinense	Small-Leaved Privet
Malus domestica	Apple Tree
Modiola caroliniana	Red-Flowered Mallow
Onopordum acanthium L.	Scotch Thistle
Paspalum dilitatum	Caterpillar Grass
Pennisetum clandestinum	Kikuyu
Pinus radiata	Pine
Populus alba	Silver Poplar
Ricinus communis	Castor Oil Plant
Rubus fruiticosus	Blackberry
Salix alba	White Willow
Salvia sp.	
*Senecio madagascariensis**	Fireweed
Setaria parviflora	Pigeon Grass
Sida rhombifolia	Paddy's Lucerne
Solanum mauritianum	Tobacco Bush
Solanum pungetium	Eastern Nightshade
Trachelospermum jasminoides	Star Jasmine
Verbena bonariensis	Purpletop
Verbena rigida	Tuberous Vervain
Vicia sativa	Common Vetch

*indicates Weeds of National Significance (WoNS)

Appendix B : Revegetation species list

		Management Zone					
Botanical Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**
	Woodland Trees						
Angophora floribunda	Rough-barked apple		✓				✓
Casuarina glauca	Swamp sheoak		✓		✓		✓
Eucalyptus bosistoana	Coast Grey Box				✓		
Eucalyptus eugenioides	Thin-leaved Stringybark				✓		
Eucalyptus longifolia	Woollybutt				✓		
Eucalyptus tereticornis	Forest Red Gum		✓		✓		✓
Melaleuca styphelioides	Prickly-leaved Paperbark		✓		✓		✓
	Woodland shrubs						
Breynia oblongifolia	Coffee bush		✓	✓			✓
Bursaria spinosa subsp. *spinosa*	Native Boxthorn		✓		✓	✓	✓
Dodonaea viscosa subsp. *angustifolia*	Native Hop				✓	✓	
Indigofera australis	Native Indigo				✓	✓	
Melaleuca linariifolia	Snow-in-Summer				✓	✓	
Melicytus dentatus	Tree Violet				✓	✓	
Ozothamnus diosmifolius	Rice flower		✓	✓			✓
Rubus parvifolius	Native raspberry		✓	✓			✓
	Grasses and Groundcovers						
Aristida ramosa	Threeawn speargrass				✓	✓	
Aristida vagans	Purple wiregrass				✓	✓	
Austrodanthonia caespitosa	Common wallaby grass				✓	✓	
Carex longebrachiata	Bergalia Tussock				✓	✓	
Commelina cyanea	Scurvy Weed				✓	✓	
Dichondra repens	Kidney Weed		✓	✓	✓	✓	✓
Einadia hastata	Berry Saltbush				✓	✓	
Gahnia aspera	Rough Saw-sedge				✓	✓	
Glycine clandestina			✓	✓			✓
Hibbertia scandens	Climbing Guinea Flower				✓	✓	
Imperata cylindrica var. *major*	Blady Grass				✓	✓	
Lomandra longifolia	Mat Rush				✓	✓	

		Management Zone					
Botanical Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**
Microlaena stipoides (locally growing var.)	Weeping Grass		✓	✓	✓	✓	✓
Oplismenus aemulus	Basket Grass		✓	✓	✓	✓	✓
Oxalis perennans	Grassland Wood-sorrel		✓	✓	✓	✓	✓
Poa labillardieri var labillardieri	Tussock grass				✓	✓	
Rytidosperma racemosa var. racemosum	Wallaby grass				✓	✓	
Themeda triandra (not the tall growing hybrid form)	Kangaroo Grass				✓	✓	
Aquatic and Instream							
Carex appressa	Tall Sedge	✓					
Juncus usitatus	Common Rush	✓					
Eleocharis sphacelata	Tall Spike-rush	✓					
Schoenoplectus validus	River Club-rush	✓					
Persicaria decipiens	Water Peppers	✓					
Triglochin procera	Water Ribbons	✓					
Baumea articulata	Jointed Twig-rush	✓					
Ludwigia peploides subsp. *peploides*	Water Primrose	✓					
Paspalum distichum	Water Couch	✓					

Appendix C : Techniques and specifications

Various weed control techniques are required to control weed infestations in natural areas. Weed infestations usually consists of a number of different weed species, densities and weed forms.

Weed control techniques are summarised below. These techniques are guidelines only. An adaptive weed management program should include a combination of different weed control techniques and involves consideration of monitoring and reporting outcomes and potential changes to the weed management program based on those result.

Depending on the area, density and priority, objectives of weed control may change. For example, it may be more cost-effective to contain zones with a high weed infestation but with a low risk of spreading into adjacent habitats or impacting on threatened species or communities, rather than attempting to eradicate all weeds. Alternatively, it is cost effective in the long-term to eradicate weeds in small infestations before they become larger and more widespread.

To effectively manage the issue of weed invasion an understanding of the types of vectors responsible is important. The movement of wind and water is often considered the greatest mode of weed dispersal into new habitats. Water is commonly responsible for the transport of weed propagules along the riparian corridors and contributes to weeds establishing downstream watercourses. However, there are many options for weed dispersal by vectors other than wind or water. A list of some of the potential weed vectors and examples of weeds species is shown the table below.

Weed vectors table

Vector	Weed Examples	Description	Ecological Implications
Watercourse	Trad	Fleshy stems can be transported along watercourse	Widely dispersed into native and disturbed environments
Drain	Moth Vine	Light feathery capsules float on water	Widely distributed along creek lines and into downstream habitats
Wind	Pampas Grass	Very light seeds are windborne over long distances	Readily invades disturbed open habitats, particularly along road verges
Track	Cobblers Pegs	Burrs stick to animals and humans	Invades disturbed bushland along tracks and is carried into adjacent habitats
Birds	Blackberry, Lantana	Edible fruits are dispersed over large areas	Birds increase weed dispersal into new habitats
Mammals	Blackberry,	Eat fruit or transport burrs on fur	Mammals spread seeds or burrs into new habitats
Humans	African Lovegrass	Transport propagules on clothes and shoes	Humans spread seeds or burrs into new habitats

HYGIENE PROTOCOLS

A strict hygiene protocol must be implemented to control the spread of weed propagules between habitats and the accidental introduction of invasive species into sensitive areas. Best management practices recommend work from should target areas of high native resilience to areas then move towards high weed infestation. Weed propagules may be spread on the clothes or boots of humans or in the soil on vehicles. It is important that all vehicles, especially earth movement, are thoroughly washed down before moving to a new site. This also applies to humans. Clothes must be free of weed propagules before entering a new site.

PRINCIPLES OF WEED CONTROL WITHIN NATURAL AREAS

Weed control programmes within natural areas follow the principles of bush regeneration including the Bradley Method and other techniques to promote natural regeneration as described in Buchanan (2000). These are summarised below:

- Where available, refer to best practice guidelines for individual weed species which may need to be adapted to a natural setting and ecological outcome
- Ensure correct plant identification – many weed species are difficult to identify because they resemble native species or typically occur in a vegetative (i.e. non-flowering) form.
- Limit the creation of bare patches of soil and soil disturbance in general, since this will encourage weeds to establish and grow – do not create unnecessary tracks with vehicles or other machinery;
- As a first option for weed control, consider methods that do not use herbicide (e.g. hand pulling and crowning) and which create very little soil disturbance;
- When using herbicides, use the least toxic chemical whenever possible and always follow the instructions;
- When working on or near drainage lines, use an approved herbicide for this environment;
- Refer to Australian Pesticides and Veterinary Medicines Authority (APVMA) website (www.apvma.gov.au) for information on off-label permits;
- Apply herbicides when the plants are actively growing and prior to seed set to achieve the best results;
- Regularly monitor for new infestations; and
- Where woody weeds are providing habitat for native birds and animals, use the drill and fill technique to enable the same structure to remain in situ while the tree or shrub dies – this will enable the plant to provide shelter for a period of time, while giving the birds and animals a chance to move on of their own accord. Where this is not practical considering the size of an infestation consider a mosaic approach to control.

INTEGRATED WEED MANAGEMENT

Integrated weed management may use a combination of any of the following techniques; mechanical, chemical, manual handling and biological methods. According to the Department of Primary Industries‟ (DPI) *Noxious and environmental weed control handbook* the best management practices considers a long-term perspective and does not rely solely on herbicide application (DPI 2010).

Weed control can be broken down into three main categories:

- **Primary Treatment:** the first weeding of the site.

- **Secondary Treatment:** the second weeding of the site which may be very intensive as all regrowing/germinating weeds should be removed before they seed and out-compete native plants.
- **Maintenance/Follow-up Treatment:** every re-weeding of the site after the secondary phase.

The first time an area is weeded (primary treatment) can be labour intensive and time consuming and depending on the target species and site conditions. It may take over several months to complete for one species (Buchanan 2009). In areas of high weed infestation and with no native resilience and/or native plants present, primary weeding may be accelerated as preparatory works for revegetation. However, in areas where native plants may occur, primary weeding should be undertaken at a pace that assists with the natural regeneration of the site.

Secondary treatment of an areas can take longer than primary treatment as new species can be present that more difficult to treat than the original weed (Buchanan 2009). Secondary treatment needs to be carefully timed to:

- Prevent weeds from setting seed;
- Suppress vegetative regrowth while plants are still small; and
- Allow native plants to recruit without being smothered or out-competed by weeds.

However, secondary treatment should allow enough time for the soil profile to recover following primary treatment and the establishment of weed growth from the soil seed bank.

Maintenance treatment refers to weed control that is carried out after the secondary treatment (Buchanan 2009). The goal of follow-up treatments is to remove weedy recruits so that native species can re-colonise the area; frequent visits are likely to be needed at first, although the amount of time and resources used should gradually decrease through time.

CHEMICAL WEED CONTROL – HERBICIDE APPLICATION

Herbicide Selection

Any herbicide used in weed management activities must be registered for use in the appropriate situation for the species being treated. It is the responsibility of the weed control operator to check that the herbicide intended for use is registered at the time of control. Where herbicide application is used, many hardy species may require re-treatment between six and twelve months after the initial treatment to ensure mortality of individual plants.

Spot Spray Application

Hand operated spray gun connected to a knap-sack or vehicle (e.g. truck, ATV, etc.) mounted herbicide storage tank is used to direct diluted herbicide spray to defined areas. When applied under correct conditions, individual plants or parts of plants may be treated using this method with minimal risk of overspray and non-target damage. Spot spraying is an effective and targeted way of treating weeds on a landscape level, though non-target damage is possible on an individual plant level. This can be mitigated in some situations through the use of selective herbicides.

This method is most suitable for low growing or juvenile grasses, herbs, and woody weeds that have copious, but compact, foliage. In most cases, spot spraying should be undertaken after new growth is

produced but before flowering. Because the plant is left *in situ* after spraying, there is potential of seed to mature on the plant if spraying is left to late. In some cases the target plant may also take weeks or months to die off.

Boom Spray Application

A nozzle spray apparatus is connected to the rear of a vehicle-mounted herbicide storage tank to apply a diluted herbicide application. Where terrain is suitable for vehicle access, large areas are typically treated using this technique (e.g. open paddock situation). Boom spraying is a fast and economical way of treating large areas of weeds on a landscape scale. However, boom spraying does not allow the operator to avoid individual plants and so has a high potential for non-target damage. This can be mitigated in some situations through the use of selective herbicides. This method is most suitable for large areas of weed infestation without any native regeneration potential.

Figure 6: Boomless spray nozzle attached to a truck

Splatter Gun Application

Individually operated splatter or gas guns are connected to a 5L backpack which may be equipped with a canister of LPG. The hand gun applicator is charged with a dose of herbicide and a splatter of low volume-high concentration herbicide solution is applied. The LPG forces the herbicide out of the pack up to several meters distance; however, instead of a fine spray mist, as in the case of spot spray application, the herbicide is applied in a large droplet form leaving a line of herbicide on the plant.

“Stripes” of herbicide are applied across large plants instead of coating all parts of the plant in a fine mist.

Splatter guns are very effective as the application of the herbicide is more directed and produces limited off target damage. This treatment provides a good alternative to spot-spraying where access is difficult or materials have to be carried in, as they use much less water. Splatter guns can also provide an alternative to mechanical removal or herbicide treatments requiring access to the stem of the plant (e.g. cut and paint, drill and frill, etc.) amongst dense, low growing woody weeds such as Bitou and Lantana. This treatment is not effective on vegetation with sparse foliage cover.

Cut and Paint

In the cut and paint treatment, the stem of the plant is cut all the way through and herbicide applied to the stump. The plant should be cut as close to the base as possible, below any branches and the cut should be horizontal. The remaining stump should not exceed 10mm in height. The tools required to make the cut may be a handsaw, secateurs or chainsaw. Any dirt on the stump needs to be removed and the herbicide needs to be directly applied within 30seconds to the stump using a dabber bottle. Some plant species re-sprout after this treatment and follow up work may be required to kill the plant effectively. A non-specific herbicide should be used for the cut and paint method.

The cut and paint method is suitable for the control of woody weeds, large herbaceous weeds and vines/climbers. When done with vines/climbers it is referred to as „skirting". This treatment is commonly used when the biomass is to be removed from the site following the primary weed control. It is most suitable for plants with a small diameter at the base and a single stem or trunk. Given that to be effective the herbicide has to be applied as soon as possible after cutting, this method is not effective where extensive cutting is required.

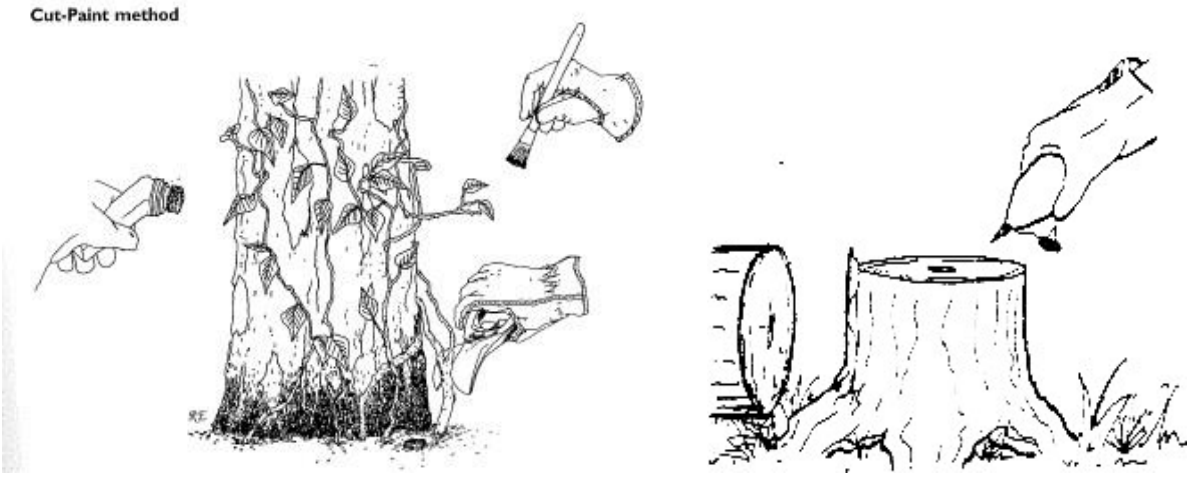


Figure 7: The cut and paint method (Muyt 2001, Sydney Weeds Committee 2013)

Drill and Fill

The drill and fill method involves drilling a hole into the base of a tree below any branches with a hand drill using a 9 or 10mm drill bit at an angle of 40-60^0. The hole should only penetrate through the sap wood and not through to the heart wood. The hole should then be filled immediately with the appropriate herbicide. An eye dropper or a squeeze bottle with a narrow nozzle can be used to fill the hole. If the plant re-sprouts follow up work will be required to kill the plant. A non-specific herbicide should be used for this treatment method.

The drill and fill method is suitable for woody weeds with a large diameter at ground height or for plants with multiple stems at the base. This control method is useful where dead trees are intended to be left standing as habitat trees and would be a suitable method for the eradication of large Camphor Laurels or Broad-leaved Privet trees, providing the dead trees do not present a hazard to the public at a later stage.

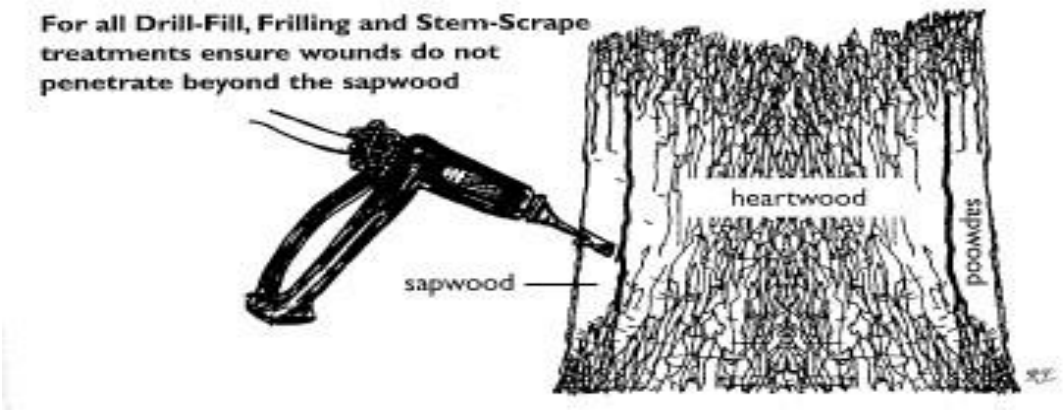
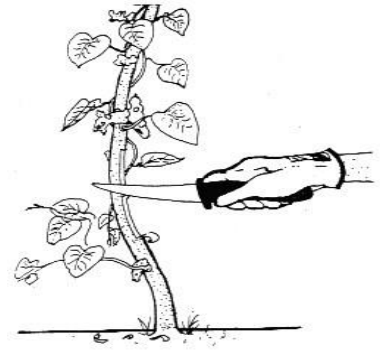


Figure 8: Drill and fill method for large woody trees (Muyt 2001)

Stem Scrape

The stem scrape method involves using a sharp knife to scrape back the top layer of bark from the vine 20-30cm long. An appropriately mixed herbicide needs to be applied immediately (within 30 seconds) using a dabber bottle. The root system of the plant should not be disturbed until the plant has died as this may reduce the effectiveness of the herbicide. Skirting method may be used in conjunction with stem scrape. This method is especially important to remove large infestations of vines within the canopy layer. Skirting involves cutting the vines within the canopy at chest height. This will allow an increase in the amount of light and resources to the canopy trees through the reduction of vine biomass



The stem scrape method is most useful when used to treat species that need greater herbicide coverage than can be provided by the cut and pain method (e.g. Green Cestrum, Ochna), or a species that has reproductive material (e.g. tubers) that must be poisoned as well (e.g. Madeira Vine). For the latter, this is especially important if it is not possible to collect the reproductive material. However, for most woody weeds and vines, this method is not necessary.

Figure 9: Stem scrape (Sydney Weeds Committee, 2013)

MANUAL AND MECHANICAL WEED CONTROL

This technique physically removes plants from the soil and depending on the weed species may require special conditions for disposal (e.g. some noxious weeds must not be transported off-site and must be disposed of by deep burial). Manual treatment effectively removes the entire plant using hand tools such as shovels or the use of heavy machinery. This technique is most productive when treating small area infestations and successfully removes the entire plant effectively preventing future seed set.

Certain parts of plants may also be targeted for removal to prevent flowering or seed set (i.e. post flowering but prior to mature seed being released from the fruit or seed head). Re-treatment may be required if mature plants have previously released viable seed into the soil which may germinate post soil disturbance.

To reduce the risk of localised increased fuel load no debris should stockpiled on site.

Hand Removal / manual methods

Hand removal of weeds involves pulling the plant as close to the base as possible and ensuring the entire tap root is pulled out of the soil. This usually results in soil disturbance and the soil should be replaced and compressed to prevent further weed invasion.

The successful hand removal of some other weeds may require the removal of the plant's roots, bulbs or tubers. This method includes digging and crowning with the use of a hand mattock, knife or trowel. Crowning involves using a knife to cut the roots around the crown of the plant.

The hand removal or pulling of weeds is suitable for many species of weeds as long as they have a shallow root system. This includes woody weeds, grasses and herbaceous species. It is useful for follow up work on woody weeds to control seedlings

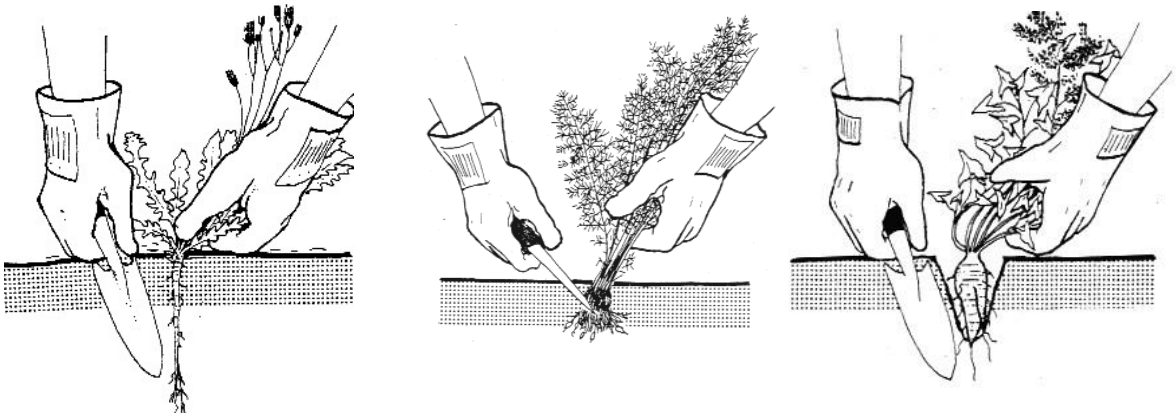


Figure 10: Hand pull (left), crown cut (middle) and rhizome / tuber trace (right) (Sydney Weeds Committee 2013)

Mechanical Removal

This technique physically removes or destroys individual plants via a process utilising large machinery or chainsaws. The use of large-scale machinery can be extremely successful for the localised eradication of dense infestations of woody weed species such as African Olive and Blackberry.

Weeds may be grubbed or raked out, and then removed from site or mulched *in situ*. Species such as African Olive will resprout and will require follow up treatment with herbicide.

Mechanical removal is most effective with areas of high weed density, especially with woody weeds where herbicide spray is not practical. Where machinery access is possible, this is preferred as it has the added benefit of being able to mulch the woody weeds *in situ*. However, in creek lines or other steep sites chainsaws can be used to cut down woody weeds. When using chainsaws in this way it is recommended that only the outer layer of woody weeds and the smaller woody weeds in the interior be completely cut down. This will provide access into the interior. The larger woody weeds in the interior of the area should be treated by drill and frill and left standing. This allows for access through the creek line for follow up treatments. It is recommended to leave woody debris *in situ* or spread out loosely. The creation of large piles of woody debris is not recommended as it can impede follow up.

Generally, work sites where this technique is used requires a maintenance component to monitor and control the potential reshooting root material, the germination of residual seed of the weed species and the colonisation of the site by other weed species. In some circumstances the control program requires follow up erosion, weed control, and revegetation programs to mitigate the risk of the aforementioned issues.

Figure 11: Tritter machine mulching African Olive

Slashing

Slashing involves removing some or all of the vegetative portion of a plant using mechanical blades. The use of machine drawn slashers or on a smaller scale individually operated brush cutters can prove extremely successful in reducing the seed load of key species.

The success of this technique is dependent on the timing of the slashing coinciding with the early flowering of the key species, in turn removing the flower heads prior to seed set. The timely use of slashing when combined with the use of herbicide application can provide an extremely cost effective and environmental favourable program of weed control. Slashing reduces the vegetative material of a plant, encourages new growth and removes dead thatch. All these factors make herbicide spraying after

slashing more efficient, effective and economical. It should be noted that as slashing is indiscriminate it can result in non-target damage. However, unlike herbicide which kills the entire plant slashing only removes the top portion and so can be used around native grasses especially with less risk. This can be further mitigated through setting of the slashing height and timing of the slashing to avoid native seed set.

Figure 12: Slashing Paspalum amongst native grasses

BIOLOGICAL CONTROL

Biological control agents may be used for the management of some weed species. These control agents may have limited effectiveness due to their sensitivity to environmental conditions, and so the efficacy of this control technique depends on the ability of the control agent to establish self-perpetuating populations.

Biological control agents are generally best applied to high density weed infestations and the control agents (eg, Blackberry Rust) may need to be actively bred and reapplied regularly to counter natural mortality and periods of dormancy in target species.

Release of biological controls is particularly effective in treating weed populations in areas of high environmental sensitivity or to assist in the management of the identified weeds as part of a larger scale control program. These agents need to demonstrate high host specificity and pose little or no threat to other desirable plant species. If so, this is an ideal option for use in areas of threatened species or within sensitive habitats such as along water courses. The use of biological controls is strongly regulated to prevent the introduction of pests or diseases which impact on non-target species.

HERBICIDE INFORMATION

Herbicides

Herbicide application often forms an important component of an integrated weed management approach and can be the most appropriate method to control some weed species. Many herbicides are harmful not only to plants, but also fauna, particularly fish and amphibians.

Any herbicide used in weed management activities must be registered for use in the appropriate situation for the species being treated. These registration requirements are provided on the product label or an „Off-label Permit". Some species which are known to be difficult to control may be treated using combinations of herbicides registered for use in „Off-label Permits" which are issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA). It is the responsibility of the weed control operator to check that the herbicide intended for use is registered at the time of control.

The situation of control should be carefully considered to ensure correct herbicide usage. In all cases the application technique must be aligned to the registration requirements of the individual herbicides selected for the weed control program. Where a sensitive environment coincides with weed infestation only herbicides suitable for use in sensitive areas (as dictated by the product registration) should be used. For example, to target a weed infestation in close proximity to water courses such as a creek line, a product such as Roundup® Biactive® could be used as it is registered for use in this type of situation.

Residual herbicides can be present in the soil profile for several months post application to reduce the incidence of regrowth of the target weed species. A residual selective herbicide would not, however, be appropriate if plans for the area involved revegetation, particularly with species intolerant to the herbicide. This would pose a serious threat to rehabilitation maintenance works where the area was to be revegetated with species which are susceptible to herbicide impact. Application of a residual herbicide may reduce recruitment of these species, further compounding the maintenance issues. In this situation a non-residual herbicide would be recommended to reduce the impact on establishing vegetation.

Herbicides fall into two main categories with regard to their impact on particular plants

- Non-selective herbicides which will, at appropriate rates, kill all plants. Glyphosate is a non-selective herbicide.
- Selective herbicides which will target either grass (monocot) species or broad-leaf (dicot) species.

Herbicide use should occur during the active growing season for plants to encourage the chemical uptake into the plant. Where herbicide application is used, many hardy species may require retreatment between six and twelve months after the initial treatment to ensure mortality of individual plants. Off target damage is common with herbicide use and consideration should be given to the following factors to avoid this damage.

- Correct identification of target species
- Spray drift in high winds
- Environmental conditions at time of application

A number of selective herbicides have been approved for grasses and for broad-leaf species in the NSW Department of Primary Industries (DPI) *Noxious and environmental weed control handbook.*

These selective herbicides represent a range of environmental toxicities and the Material Safety Data Sheets (MSDS) should be referred to in each instance. For instance, Metsulfuron-methyl poses a low risk to the environment, while Triclopyr is considered to be relatively toxic and has the potential to pose

a moderate risk to the environment. Dimethylamine salt is in the same category as triclopyr, but is moderated by mixing it with metsulfuron-methyl.

Registration and records of any herbicide use must be kept in accordance with the NSW *Pesticide Regulation 2009*.

HERBICIDES IMPACT ON ECOSYSTEM

The correct training and appropriate application of herbicides must be followed at all times. There is a high risk of ecological impacts associated with use of herbicides. These risks include accidental death of plants due to spray-drift or due to incorrect handling technique or sensitive plants. There is also evidence that there are indirect impacts on microbats due to herbicide poisoning and reduced numbers of prey items for microbat species. Where possible consider alternative methods to herbicide use.

STAFF TRAINING

All weed control operators must be properly trained and hold required certification e.g. ChemCERT® and comply with requirements of the Pesticides Regulation 2009 (NSW) and Pesticides Act 1999 (NSW).

REVEGETATION WORKS

Revegetation has the dual aim of both re-establishing the original native vegetation community at the site and reducing erosion along the length of the riparian corridor, which will carry greatly increased peak flows due the increased run-off from the hard surfaces created by the associated residential development. Any plantings should consist of local provenance stock.

Planting of Hiko for trees and shrub species and Hiko or Viro cells for grasses and other groundcover species is the preferred method. Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each plant should be at least 1.5x the width and 2x the depth of the root ball. Fertiliser should be added to each hole dug as per the label specifications. Initial irrigation of the plantings is essential to ensure that the soil forms around the root ball and air pockets are removed. This will be required unless sufficient rainfall (approx. 10mm) occurs on the day of planting.

Tree guards will need to be installed on each tree or shrub to protect seedlings from extreme weather (frosts and heat), herbivorous grazing and herbicide drift during maintenance works. Bio-degradable tree guards are recommended to protect the seedlings. Following the revegetation works, irrigation needs to be undertaken for at least 8 weeks following planting to ensure the establishment of the plants. The level of irrigation will be determined by rainfall and temperature experienced at the planting site.

A temporary irrigation system should be installed to assist in the establishment of vegetation. Timing of the planting of these areas will need to take into consideration surrounding civil works and erosion/sediment control requirements, these areas will not be planted until earthworks have been completed. A minimum rate of 10% attrition is to be expected, even with proactive management, and should be allowed for by the contractor.

Mulch can be derived from vegetation removed from the development area, if available. Alternately, mulch should be comprised of un-composted wood (preferably wood waste), with a particle size of 15 mm to 40 mm, with no fines, and good air-filled porosity. Mulch should not contain any weed seeds,

nor be derived from diseased trees or from any part of the tree lower than 1 m above the ground. Mulch, where required, should be installed to a depth of 100 mm.

Jute matting, where required, must be comprised of 100% biodegradable jute fibres with a minimum weight of 680g/m2 (~6 mm thickness). Jute must be pegged with at least 3 x 150 mm pins per m2 and each roll overlapped by 100 mm.

SEED COLLECTION

For the growth of the plants used in the revegetation works, seed must be collected from local provenance species. Groundcovers, shrubs and trees should be collected as within close proximity (i.e. <20km) to the site. However, soil type, climate and aspect of the collection site(s) should also be considered. Native grasses typically have much larger dispersal mechanisms and are to be collected from within the Cumberland Plain of Sydney. Wetland species are to be collected from within the Cumberland Plain component of the Hawkesbury Nepean Catchment.

Where species identified in this VMP cannot be sourced, they may be substituted for other SSTF and River-flat Eucalypt Forest species as identified by Tozer (2003). Species must be substituted with species of a similar form, e.g. trees for tree, grasses for grasses, etc. Only wild native species are to be used. Plants are not to be substituted with horticultural varieties under any circumstances.

Record keeping of seed collection and planting locations are to follow the Florabank guidelines (Mortlock, 2000). A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to undertake seed collection works. The bush regeneration contractor is responsible for recording this information and providing it to THSC.

BUSH REGENERATION CONTRACTORS

All vegetation management works in the establishment phase will be undertaken by suitably qualified and experienced bush regeneration contractors who are members of the Australian Association of Bush Regenerators (AABR) or fulfil the membership criteria. Additionally, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009). A flexible approach to this site is recommended since techniques may need to be changed or modified to suit site conditions. This approach is consistent with adaptive management and allows the contractor to develop and build on site knowledge whilst implementing this VMP. Monitoring will assist in the development of the VMP actions in subsequent years.

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Appendix I Calderwood Urban Development Project Mod 4 – Construction and Environmental Management Plan EPBC 2021/8981 (Eco Logical Australia 29 June 2023)

Calderwood Urban Development Project Mod 4 - Construction and Environmental Management Plan EPBC 2021/8981

Prepared for Lendlease Communities (Calderwood) Pty Ltd

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DOCUMENT TRACKING

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Reviewed by	Alex Gorey
Approved by	Katherine Lang
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ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Lendlease Communities Calderwood

Template 2.8.1

Contents

List of Figures

List of Tables

Abbreviations

The following abbreviations are utilised throughout this Construction and Environmental Management Plan.

Abbreviation	Description
APZ	Asset Protection Zone
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
CEMP	Construction Environmental Management Plan
DA	Development Application
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DPE	NSW Department of Planning and Environment
ELA	Eco Logical Australia
EP&A Act	Commonwealth *Environmental Protection and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
SS	Site Supervisor
PA	Project Arborist
PE	Project Ecologist
PM	Project Manager
RFS	Rural Fire Service
VMP	Vegetation Management Plan
Buffer Zones	Buffer zones means the areas represented in Figure 4 to Figure 6 by the zones enclosed within the solid pink lines labelled '30 m Buffer'

Declaration of Accuracy

I declare that:

To the best of my knowledge, all the information contained in, or accompanying this Management Plan (*Calderwood Urban Development Project Mod 4 - Construction and Environmental Management Plan EPBC 2021/8981)* is complete, current and correct.

I am duly authorised to sign this declaration on behalf of the approval holder. I am aware that:

a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.
b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) where the person knows the information or document is false or misleading
c. The above offences are punishable on conviction by imprisonment, a fine or both.

Signed

X _____

Full name

Alex Gorey, **Eco Logical Australia Pty Ltd**

Signed

X _____

Full Name

Mark Anderson, Lendlease Communities Pty Ltd

Report Version: Eco Logical Australia 2023. Calderwood Urban Development Project Mod 4 - Construction and Environmental Management Plan EPBC 2021/8981. Prepared for Lendlease Communities (Calderwood) Pty Ltd. Version 1, dated 15 May 2023.

1. Introduction and purpose of the plan

Eco Logical Australia (ELA) has been commissioned by Lendlease Communities (Calderwood) Pty Ltd (Lendlease), the approval holder, to prepare a Construction Environmental Management Plan (CEMP). The CEMP is required to avoid and mitigate potential direct and indirect impacts on EPBC Act Protected Matters in the Vegetation Management Plan areas as a result of 'construction' (as defined in Part C of the approval) for the Calderwood residential and commercial subdivision, including associated ancillary infrastructure in Calderwood Valley, NSW as required by condition 4 of the EPBC approval.

It is noted that some consent conditions may have been omitted from this version of the CEMP, such as detail pertaining to artificial lighting measures and piped stormwater management infrastructure as these plans have not yet been developed and will be prepared as part of the staged detailed Development Application. The staging layout is presented in Figure 2. These measures will be included in an update to the CEMP when available.

1.1. Project description and proposed action

The Action Area forms part of the Calderwood Urban Development Project (CUDP) and is located at Calderwood, in the Illawarra Region of NSW; approximately 20 km south west of Wollongong. Calderwood is bound by rural land to the north, east and west, the remaining stages of the CUDP to the south and to the south and south east, the existing suburbs of Tullimbar and Albion Park. Marshall Mount Creek runs through the centre of the action area. Existing main roads include Calderwood Road, Marshall Mount Road and Escarpment Drive.

A referral to the then Commonwealth Department OF Agriculture, Water and Environment (DAWE) was made by Lendlease Communities (Calderwood) for the Mod 4 action area. On 4 April 2022, the then DAWE (now Department of Climate Change, Energy, Environment and Water) determined that the proposed action is a '*controlled action*' that was assessed by preliminary documentation (PD Report). Subsequently, a PD was prepared and the action was approved with conditions on 19 April 2023. Consistent with the PD, this CEMP applies to the following stages:

- Stage 4
- Town Centre East
- Town Centre South
- Town Centre North
- Town Centre Core
- Stage 7A and 7B
- Stage 8 - 12

For the purposes of this report, the aforementioned stages will be referred to as the 'action area'.

1.2. Purpose of this plan

This plan has been prepared to satisfy Condition 4 which states:

The approval holder must implement a Construction Environment Management Plan (CEMP). The environmental outcomes of implementing the CEMP must be to avoid all avoidable potential impacts

and to mitigate all unavoidable impacts to protected matters as a result of taking the Action. The CEMP must (See Table 1).

Table 1 outlines the specific requirements that the CEMP must meet and the relevant section of this plan where the requirement is addressed.

Table 1: Condition 4 requirements (EPBC 2021/8981)

Condition No.	Requirement	Section in this report
4a	include measures and specify the timing of installation of temporary and permanent fencing, to restrict access, along the boundaries of the inner 15 m of the retained vegetation in the buffer zones,	Section 4.2
4b	detail the method, effort, and timing to identify and record the location of any hollow-bearing trees within the Action area,	Section 4.3
4c	detail the method(s) which will be implemented to relocate any hollow-bearing trees cleared within the Action area to the Illawarra Forest retained areas without causing any harm to Illawarra Forest,	Section 4.3
4d	include measures to install and maintain piped stormwater management infrastructure along all roads surrounding the Illawarra Forest retained areas and buffer zones to ensure stormwater falling or flowing on roads cannot flow into the Illawarra Forest retained areas,	Section 4.1
4e	specify a de-watering plan for any farm dams removed from within the Action area,	Section 4.4
4f	include a fauna pre-clearance protocol to ensure fauna are afforded the opportunity to safely vacate any tree or area within the Action area prior to that tree or area being cleared,	Section 4.3
4g	detail the lighting measures to prevent artificial lighting impacts to fauna within the Illawarra Forest retained areas during the operational phase,	Section 4.2
4h	specify measurable, achievable and timebound performance criteria to achieve the environmental outcomes, and	Section 3.3
4i	include the methods, effort, and a schedule of monitoring to determine whether the performance criteria and environmental outcomes have been or are likely to be achieved and to detect any non-compliance with the commitments made in the CEMP.	Section 5 and 7
4j	detail measures to manage potential indirect impacts to the Illawarra Forest retained areas and the inner 15m of the retained vegetation in the buffer zones.	Entire plan

The approval holder must implement the CEMP until the expiry of this approval.

1.3. Development footprint and proposed activities

The development footprint and proposed activities includes:

- Residential development
- Extension and upgrades of associated supporting infrastructure
- Site preparation (earthworks and grading and associated noise, light and dust disturbance)
- Residential lots in proximity to the existing township already completed within the CUDP
- Town Centre with large commercial and retail floor space

- Utilities and services
- Roads, bridge and pathways
- Car parks and local parks / open space
- Ancillary infrastructure
- Conservation land protection

The action area is approximately 299.97 ha with 232.21 ha approved for development (development footprint / disturbance footprint) and 68.23 ha approved for retention as open space and conservation purposes.

1.4. Threatened Ecological Community (TEC) and TEC Buffer Zones

The action area contains three patches of the *Illawarra and south coast lowland forest and woodland ecological community* (Illawarra Forest) which is listed as a critically endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The patches are referred to as Patch 2, Patch 10 and Patch 11.

A 15 m buffer is provided between the Illawarra Forest patches and the development footprint to mitigate against indirect impacts to retained areas of Illawarra Forest. The retained patches of Illawarra Forest in relation to the Action Area are presented in Figure 2. Patch 2, Patch 10 and Patch 11 with their respective buffer zones is provided in Figure 3, Figure 4 and Figure 5 respectively.

The approval holder must implement a Vegetation Management Plan (VMP) for the Illawarra Forest retained patches and the inner 15 m of all retained vegetation within the buffer zones. Indirect impacts to these areas will be mitigated by the implementation of actions subject to the VMP.

This CEMP should be read in accordance with the Vegetation Management Plan, prepared by Eco Logical Australia (2022).

1.5. Construction timeframe and duration

The construction phase is expected to commence in late 2023 – early 2024 and the development completion is expected to be completed over approximately 10 years.

1.6. Work Duration and Working Hours

All work on site will only occur between the following hours presented in Table 2 (pending Council confirmation).

Table 2: Work hours

Day	Work hours
Monday – Friday	7.00 am to 6.00 pm
Saturday	8.00 am to 1.00 pm
Sundays or Public Holidays	No work

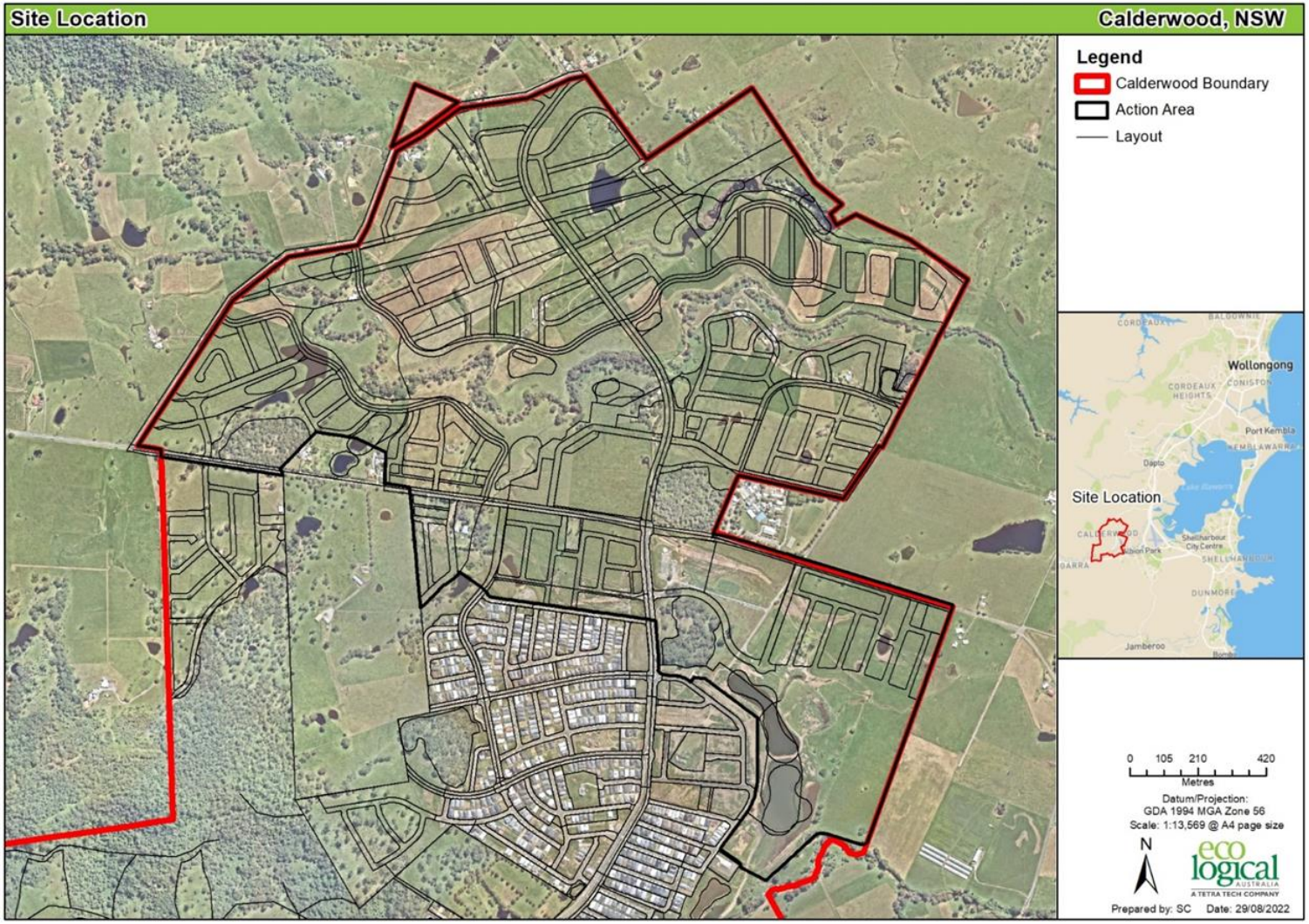
Site Location
Calderwood, NSW
Legend
Calderwood Boundary
Action Area
Layout
Wollongong
Port Kembla
Site Location
0 105 210 420
Metres
Datum/Projection:
GDA 1994 MGA Zone 56
Scale: 1:13,569 @ A4 page size
N
eco logical AUSTRALIA
A TETRA TECH COMPANY
Prepared by: SC Date: 29/08/2022

Figure 1: Location of the Action Area

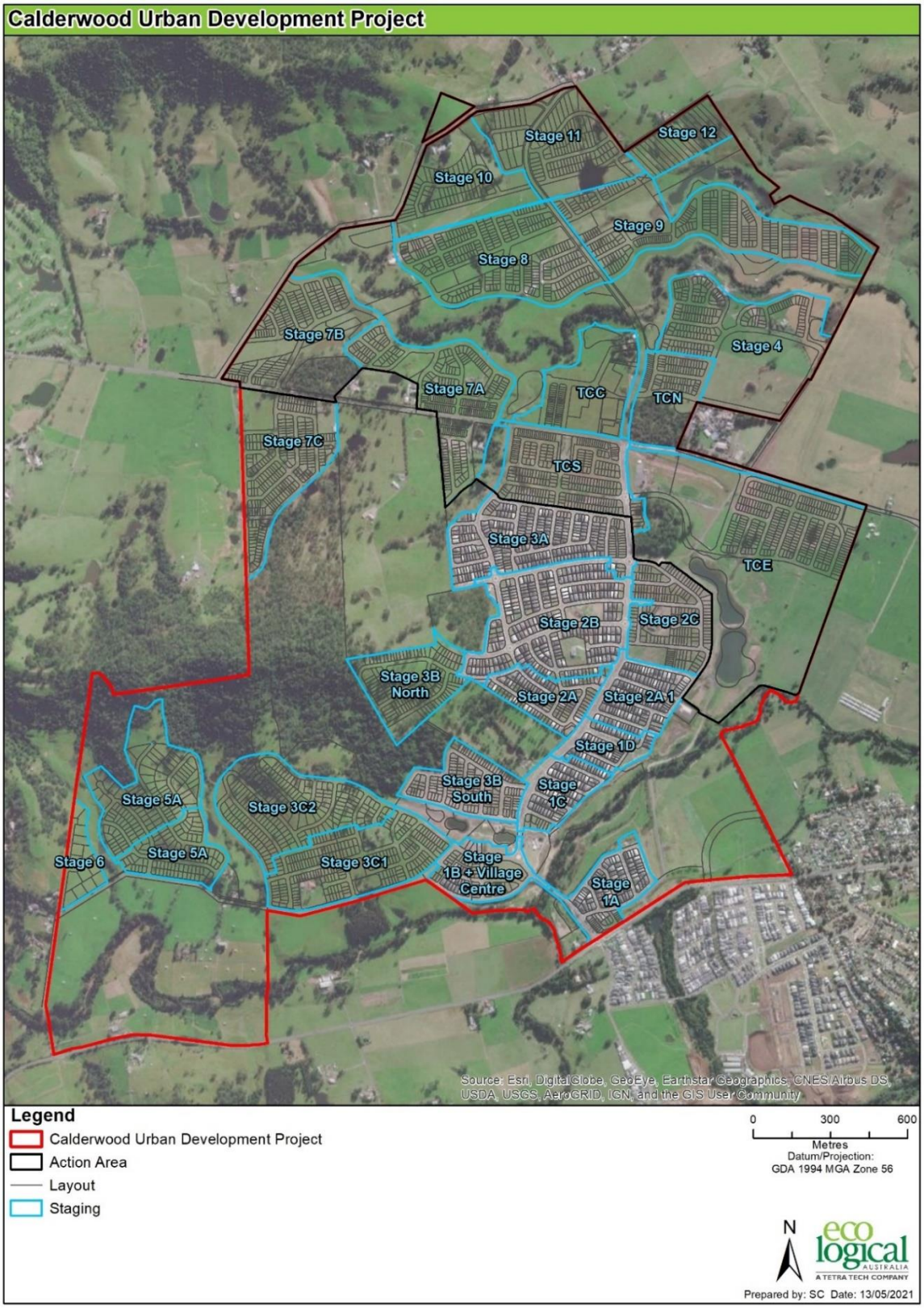

Figure 2: Staging across the CUDP

Figure 3: Retained areas of Illawarra and South Coast Lowlands Forest and Woodland to be protected during construction

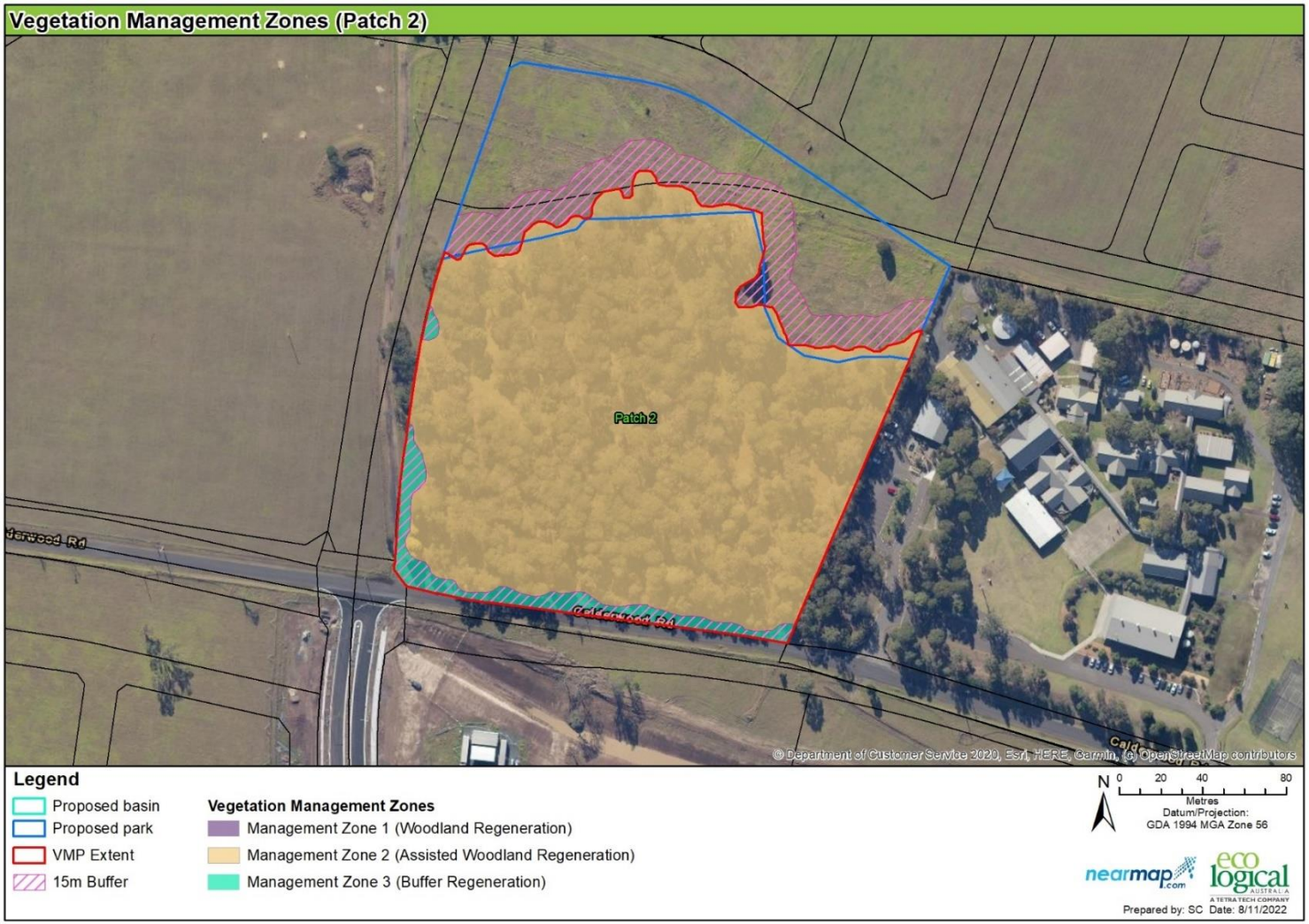

Figure 4: 15 m buffer zone around patch 2, and existing and proposed land use

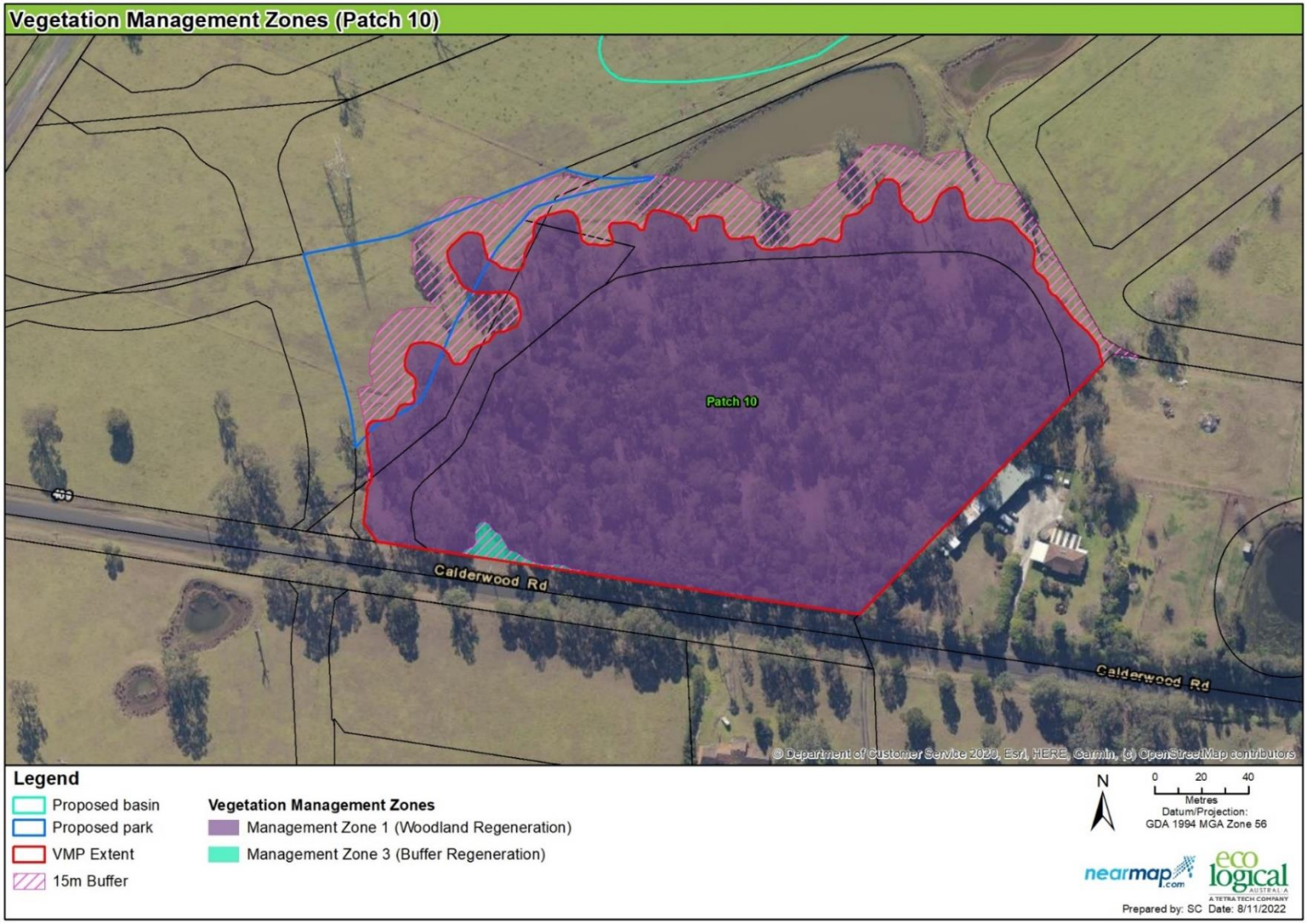

Figure 5: 15 m buffer zone around patch 10, and existing and proposed land use

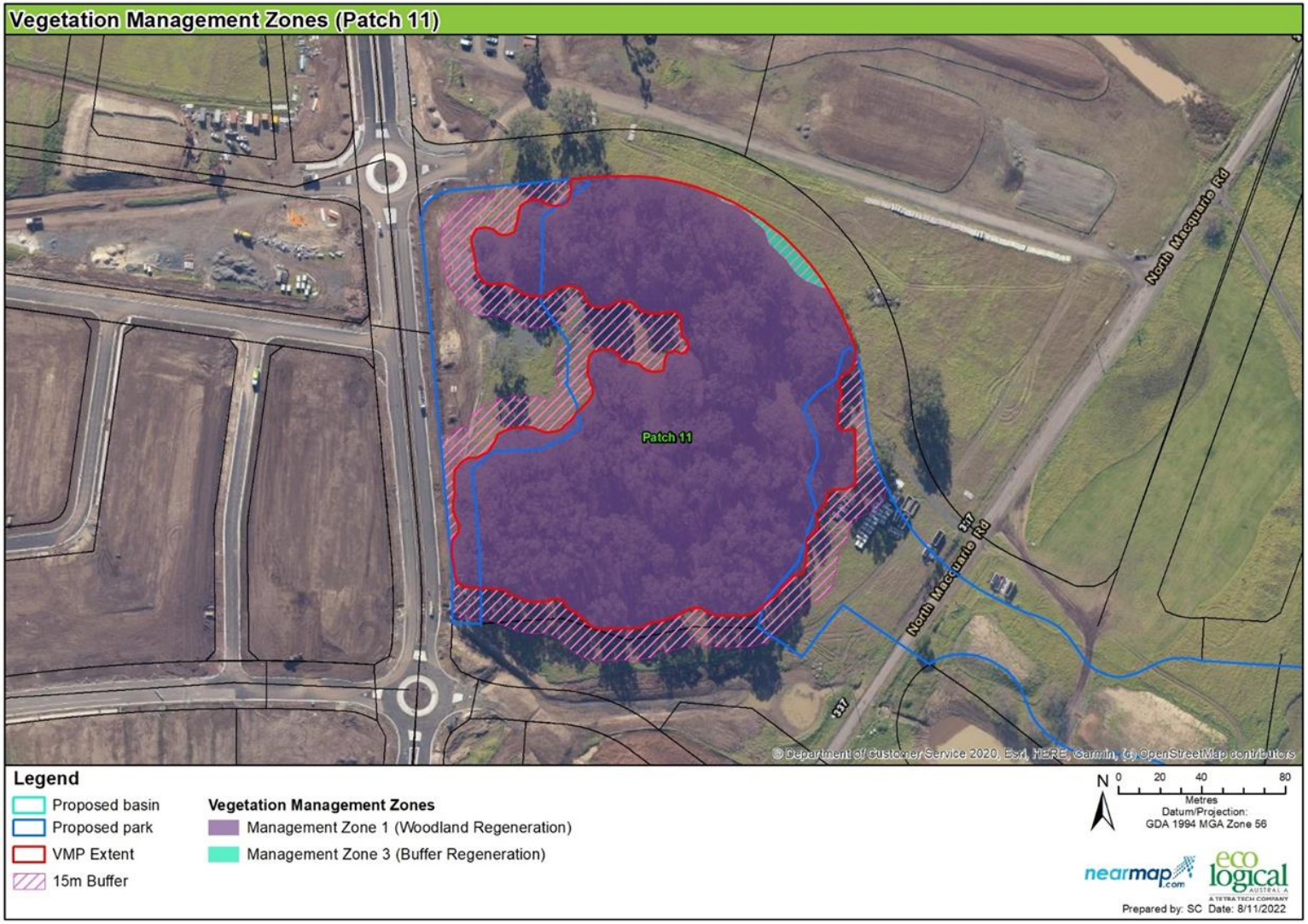

Figure 6: 15 m buffer zone around Patch 11, and existing and proposed land use

2. Objective

The aim of this CEMP is to outline the measures to avoid and mitigate potential indirect impacts on Protected Matters (Illawarra Forest) in the retained VMP areas as a result of construction in accordance with Condition 4 of approval 2021 / 8981.

2.1. Outline of the CEMP

This CEMP sets out:

- Construction and VMP areas
- A description of potential environmental impacts and risks
- Environmental management measures for each potential risk
- Environmental monitoring and corrective actions
- Environmental management roles and responsibilities
- Environmental training and induction requirements
- Environmental incident and emergency procedures
- Internal and external reporting arrangements; and
- Audit and review of the CEMP.

3. Risk assessment

3.1. Potential impacts

Potential impacts to be managed to reduce adverse impacts to biodiversity values include:

- Threatened Ecological Communities (Illawarra Forest)
    - Clearing of remnant vegetation beyond approved development footprint
    - Weed dispersal and introduction throughout the Action Area
    - Erosion and sedimentation impacting VMP areas
    - Possible dumping of soils or other materials within VMP areas
    - Introduction of plant pathogens such as *Phytophthora cinnamomi* into the VMP areas or other areas of retained vegetation
    - Spread of litter and rubbish into VMP areas
    - Construction dust affecting plant health and growth in VMP areas
    - Stormwater flow into VMP areas from detention areas
    - Increased access to / recreational use of VMP areas
- Fauna
    - Loss of fauna habitat beyond approved development footprint
    - Injury /death of fauna in vegetation clearing
    - Indirect impacts to fauna associated with construction noise and light
    - Direct impact from vehicle collisions
    - Contamination by hazardous material (fuels, chemicals, oils) spills
    - Contamination by rubbish / waste
    - Pollution through sedimentation and stormwater runoff

3.2. Risk assessment for potential impacts

A qualitative risk assessment in accordance with *Environmental Management Plan Guidelines, Department of the Environment Commonwealth of Australia 2014* is applied to the environmental risks associated with the proposed construction works.

Each environmental risk identified in Section 3.1 has been rated in terms of likelihood of occurring and the consequence to the Protected Matter if it did occur using the criteria in Table 3 and Table 4. These ratings were then combined to generate a risk rating of low, medium, high or severe (Table 5).

Table 6 then lists the risk assessment for each of the potential environmental impacts before and after mitigation; describes the mitigation measures proposed to minimise each risk and assesses the residual risk levels after implementation of mitigation measures.

Table 5 also identifies risks to achieving the environmental objectives of the CEMP in terms of the scientific, ecological or budgetary uncertainties that may prevent the desired outcome from being achieved, how the desired outcome is being monitored/detected by trigger values and likely adaptive management measures if the desired outcome is not met.

Table 3: Definition of likelihood of occurrence

Likelihood	Definition
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project
Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances

Table 4: Definition of consequence

Consequence	Definition
Minor	Minor incident of environment damage that can reversed
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts.
High	Substantial instances of environmental damage that could be reversed with intensive efforts
Major	Major loss of environmental amenity and real danger of continuing
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage

Table 5: Risk framework

		Consequence				
		Minor	**Moderate**	**High**	**Major**	**Critical**
Likelihood	**Highly Likely**	Medium	High	High	Severe	Severe
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

3.3. Environmental objectives, performance targets and indicators

Table 7 provides the environmental objectives relevant to each protected matter and approval condition, the performance targets for each objective, the commitments (management actions) made to achieve each objective, the responsible party for undertaking the management action, the performance indicators for each management action, and the timing and frequency of each action.

3.4. Managing uncertainty and adaptive implementation

Table 6 identifies the risks to achieving the environmental objectives of the CEMP in terms of the scientific, ecological or budgetary uncertainties that may prevent the desired outcome from being achieved, how the desired outcome is being monitored/detected by trigger values and likely adaptive management measures if the desired outcome is not met.

The main area of uncertainty in achieving the objectives of the CEMP are:

1. Insufficient funds provided by the approval holder to implement the management actions identified

2. Inadequate induction/training of project staff leading to miscommunications of the actions to be implemented and/or matters to be protected
3. Poor implementation of identified mitigation measures.

The risk of these uncertainties arising is reduced by the monitoring program proposed in Section 5 that will ensure that staff training, and induction programs are implemented, records of these programs are retained (Section 5.2), and daily, weekly, monthly monitoring and site audits against a checklist (Section 5.3 and Appendix G) are undertaken to detect any incidents of non-compliance with appropriate corrective actions identified and implemented through an adaptive management program.

3.5. Contingency response and corrective actions

The monitoring inspection checklist provided at Appendix G provides the opportunity to identify appropriate corrective / adaptive management actions that are specific to the issue should an incident of non-compliance arise.

Table 6provides some indicative adaptive management measures for each of the potential impacts identified as project risks.

Table 6: Potential impacts and proposed mitigation measures for protected matters during construction

Potential Impact	Risk Before Mitigation Measures			Management Objective / Desired Outcome	Scientific, Ecological and/or Budgetary Uncertainties That May Prevent Desired Outcome	Management Action / Mitigation Measure Commitment	Residual Risk After Mitigation	Trigger, Detection / Monitoring Activity	Adaptive Implementation Program & Measures / Corrective Actions
	Likelihood, Consequence and Risk								
Protected Matter - Ecological Communities (Illawarra Forest)									
Clearing of remnant vegetation beyond approval footprint (Condition 1 and 2)	Possible	High	Major	To ensure that no clearing occurs beyond the approved footprint	None	• Ensure that all staff are inducted and aware of ecological sensitivities, including the location of all retained patches of Illawarra Forest, including buffer zones (Figure 3). • Temporary and permanent protective fencing and signage must be erected around all areas identified for retention (VMP areas) prior to commencement (examples of the suggested permanent fencing required for VMP areas is provided in Appendix C). • Any trees in the clearing area identified for protection within Open Space areas to be clearly marked prior to clearing activities commencing. • Any trees in the clearing area identified as 'to be retained' following project ecologist pre-clearing protocol, shall be included on an environmental control map, and clearly marked with an easily visible and removable means of identification. • The Tree Clearing Protocol (Section 4.3) is to be implemented for any tree clearing. • Location and identification of 'trees to be retained' to be discussed during daily pre-start where relevant.	Low	• Staff induction & training records • Weekly inspection of VMP site fencing • Incident reports	• Repairs to fence (as/if required) • Restoration of damaged vegetation/habitat
Weed dispersal and introduction throughout the project area (Condition 3)b)ii))	Possible	Moderate	Medium	To prevent the introduction and spread of invasive weeds to VMP areas	Not undertaking daily inspections and cleaning of vehicles/equipment	• Prior to entering and leaving the site, all vehicles and equipment involved in clearing and weed removal works must be cleaned to remove soil and plant material (Refer to Hygiene Protocol- Appendix B). • During vegetation clearing and weed removal, weed species must be stockpiled separately and disposed of at an appropriate waste disposal facility.	Low	• Pre-start checklists • Daily checks of vehicles • Weekly inspection records Incident reports • VMP site monitoring and annual reports	• Weed control and monitoring of VMP areas
Introduction of soil pathogens to VMP areas (including Phytophthora spp.)	Possible	High	High	To prevent the introduction of soil pathogens to VMP areas	Not undertaking daily inspections and cleaning of vehicles/equipment	• Prior to entering and leaving the site, all vehicles and equipment involved in construction, clearing and weed removal works must be cleaned to remove soil and plant material (Refer to Hygiene Protocol- Appendix C). • Implementation of Erosion and Sediment Control Plan (ESCP –Appendix D).	Low	• Pre-start checklists • Daily checks of vehicles Weekly inspection records Incident reports • VMP site monitoring and annual reports	• Monitoring of VMP areas and chemical treatment of any Phytophthora outbreaks
Fauna and fauna habitat									

Potential Impact	Risk Before Mitigation Measures			Management Objective / Desired Outcome	Scientific, Ecological and/or Budgetary Uncertainties That May Prevent Desired Outcome	Management Action / Mitigation Measure Commitment	Residual Risk After Mitigation	Trigger, Detection / Monitoring Activity	Adaptive Implementation Program & Measures / Corrective Actions
	Likelihood, Consequence and Risk								
Loss of fauna habitat beyond approved development footprint	Possible	High	Major	To ensure that no clearing occurs beyond the approved footprint	None	• Ensure that all staff are inducted and aware of ecological sensitivities, including the location of all VMP areas (Figure 3) • Temporary fencing and permanent signage must be erected around the perimeter of the VMP areas • Fencing is detailed in the VMP (ELA 2022). Fencing will be constructed prior to the commencement of bulk earthworks. Signage will be installed prior to completion of construction. • Any trees, or parts thereof, that would be appropriate for use as fauna habitat, are to be identified by a suitably experienced ecologist and salvaged for re-use within the VMP areas (See Section 4.3)	Low	• Staff induction & training records • Weekly inspection of VMP site fencing • Incident reports	• Repair to fence • Restoration of damaged vegetation/habitat
Injury/death of threatened fauna in vegetation clearing	Likely	High	High	To avoid any direct death/injury to wildlife, in particular Koala during clearing activities	Insufficient funds allocated to pre-clearance surveys	• Hollow-bearing trees within the action area that potentially contain roosting and breeding habitat for fauna must be identified by a suitably qualified ecologist prior to clearing activities. • The Tree Clearing Protocol is to be implemented for any habitat tree clearing. Any threatened species identified during the Project will be recorded in compliance and audit reports	Low	• Staff induction & training records • Pre-clearance survey reports • Incident reports	• Increase level of inspection of hollows prior to clearing • Ensure slow/soft-drop technique of tree clearing is being followed
Indirect impacts to fauna associated with construction lighting	Possible	Minor	Low	To avoid potential indirect impacts to fauna from lighting directed into VMP areas	None	• Work involving the use of machinery of any description will only be carried out from 7.00 am to 5.00 pm, Monday to Friday, 7.00 am to 1.00 pm Saturday, with no work to be carried out on Sundays or Public Holidays as required by Council. • Lighting to comply with Australian Standard 4282 – Control of the obtrusive effects of outdoor lighting. • Position and direct lights away from the VMP area	Low	• Checking of position and angle of lights installation of street lighting	• Adjust angle of lights
Indirect impacts to fauna associated with construction noise	Possible	Minor	Low	To avoid potential indirect impacts to fauna from excessive construction noise	None	• Work involving the use of machinery of any description will only be carried out from 7.00am to 5.00pm, Monday to Friday, 7.00am to 1.00pm Saturday, with no work to be carried out on Sundays or Public Holidays as required by Council. • All plant and equipment to be maintained and operated as per manufacturer's specifications and to be inspected prior to work. Any faulty plant or equipment is be stood down until repaired. • Limit idling/ revving of engines on mobile and stationary machines and shut down any equipment not in use. • Limit the use of horns or other audible signals on mobile equipment to the maximum practical extent. • Promptly respond to complaints and modify practices.	Low	• Pre-start checklists • Maintenance logbooks • Incident reports • Random Checks	• Any faulty plant or equipment is be stood down until repaired • Promptly respond to complaints and modify practices

Potential Impact	Risk Before Mitigation Measures			Management Objective / Desired Outcome	Scientific, Ecological and/or Budgetary Uncertainties That May Prevent Desired Outcome	Management Action / Mitigation Measure Commitment	Residual Risk After Mitigation	Trigger, Detection / Monitoring Activity	Adaptive Implementation Program & Measures / Corrective Actions
	Likelihood, Consequence and Risk								
Direct impact from vehicle collisions on residential streets adjacent to the VMP areas	Possible	High	High	To avoid, reduce potential for road kill	Insufficient funds allocated to implement/install mitigation measures	**Construction Phase** • Construction traffic to utilise clearly defined access and egress points to and from the development site that avoid the retained areas of high quality vegetation (Figure 3) • Construction traffic within the development site to keep to designated routes where possible • Parking and equipment and material laydown areas to be located away from VMP areas • Construction traffic is to adhere to construction zone speed limits across the site • Exclusion fencing will be installed prior to site works commencing to delineate the limit of areas impacted by the works and accessible by construction traffic **Operational Phase** • Local roads will have speed limit restrictions of 50km/h	Low-medium	• Training & induction records • Pre-clearance surveys • Monitoring of fencing •	• Cessation of construction activities if fauna are present in immediate work area as directed by Project Ecologist

4. Environmental management measures and performance criteria

4.1. Implementation of management actions and performance measures

Table 7 details the requirements for implementation of the management measures to meet management objectives, performance targets and indicators, monitoring, the identification of responsibilities and timeframes for implementation of measures.

Table 7: Management actions to protect ecological communities and fauna

Management Objective / Outcome	Performance Target	Management Action / Measure	Monitoring Activity	Performance Indicators	Responsibility	Timing and Frequency
To ensure that construction works are completed in accordance with project approvals to minimise negative impacts to retained Protected Matters	No disturbance to or clearing of any vegetation / habitat beyond the approved project footprint resulting from construction activity	Ensure that all staff are inducted and aware of ecological sensitive areas (as indicated on Environmental Control Map), including the location of on-site VMP areas and riparian zones and for relevant staff Tree Clearing Protocol	Weekly inspection of fencing and any unauthorised disturbance of VMP areas	To ensure that construction works are completed in accordance with project approvals to minimise negative impacts to retained Protected Matters	No disturbance to or clearing of any vegetation / habitat beyond the approved project footprint resulting from construction activity	Ensure that all staff are inducted and aware of ecological sensitive areas (as indicated on Environmental Control Map), including the location of on-site VMP areas and riparian zones and, for relevant staff, Tree Clearing Protocol

Management Objective / Outcome	Performance Target	Management Action / Measure	Monitoring Activity	Performance Indicators	Responsibility	Timing and Frequency
To prevent any inadvertent damage to retained Protected Matters	Protective fencing around VMP areas maintained at all times during construction phase	Temporary and permanent protective fencing must be erected around all areas identified for conservation (VMP areas), Open Space areas and any trees identified for retention/salvage, prior to clearing activities commencing to minimise any inadvertent damage.	• Weekly inspection of fencing and any unauthorised disturbance of VMP areas • Incident reports	• Staff training and induction undertaken & records retained • Toolbox talks undertaken • Pre-start meetings held • Up to date Environmental Control Map • Incident reports acted on • Records of weekly inspection of signage / fencing and issues rectified as necessary	• Construction Manager • Project Ecologist	Pre-construction

Management Objective / Outcome	Performance Target	Management Action / Measure	Monitoring Activity	Performance Indicators	Responsibility	Timing and Frequency
To prevent injury / death of threatened fauna during clearing and construction	No death or injury of fauna species during vegetation clearing as a result of construction activity	The Tree Clearing Protocol (Section 4.3) is to be implemented for any tree clearing. Hollow-bearing trees within open space areas that potentially contain roosting and breeding habitat for threatened species or native fauna must be identified by a suitably qualified ecologist and, where possible, retained All trees identified as "to be retained" within the clearing area following project ecologist pre-clearing review, shall be clearly identified on the environmental control map and clearly marked onsite, with an easily visible and removable means of identification	• Pre-clearing report • Incident reports	• Project ecologist present during all clearing works • Daily tree clearing reports • Incident reports acted on • Trees to be retained identified on updated Environmental Control Map	• Project Ecologist • Project Manager • All staff	• Pre-clearing • Pre-construction

Management Objective / Outcome	Performance Target	Management Action / Measure	Monitoring Activity	Performance Indicators	Responsibility	Timing and Frequency
To increase habitat values in VMP areas	Fauna habitat features retained on-site or salvaged for reuse in on-site conservation areas	Any trees, or parts thereof, that would be appropriate for use as fauna habitat, is to be identified by a suitably experienced ecologist and salvaged for re-use within the on-site VMP areas.	• Pre-clearing reports	• Woody material salvaged and relocated to VMP areas in accordance with VMP Agreements • VMP site monitoring and annual reports	• Project ecologist • Project Manager • Construction Manager	• During tree clearing
To prevent the introduction and spread of invasive weeds to VMP areas	No weeds dispersed or introduced to VMP areas as a result of construction activity	Prior to entering and leaving the site, all vehicles and equipment involved in clearing and weed removal works should be cleaned to remove soil and plant material (Refer to Hygiene Protocol Appendix B). During vegetation clearing and weed removal, weed species are to be stockpiled separately and disposed of at an appropriate waste disposal facility.	• Daily checks of vehicles • Weekly inspection records • Incident reports • VMP site monitoring and annual reports that assess weed cover	• Pre-start checklists completed • Daily checks of vehicles undertaken as determined by retained records • Incident reports acted on • VMP site monitoring and annual reports completed	• All Staff	• At all times

Management Objective / Outcome	Performance Target	Management Action / Measure	Monitoring Activity	Performance Indicators	Responsibility	Timing and Frequency
To prevent the introduction of soil pathogens to VMP areas and retained Open Space Areas	No soil pathogens introduced to VMP areas as a result of construction activity	Prior to entering and leaving the site, all vehicles and equipment involved in construction, clearing and weed removal works must be cleaned to remove soil and plant material (Refer to Hygiene Protocol – Appendix I). Implementation of Erosion and Sediment Control Plan (ESCP –Appendix D). The ESCP will be designed stage by stage during detailed DA.	• Daily checks of vehicles • Weekly inspection records • Incident reports • VMP site monitoring and annual reports that assess weed cover	• Pre-start checklists completed • Daily checks of vehicles undertaken as determined by retained records • Incident reports acted on • VMP site monitoring and annual reports completed	• All Staff	• At all times

Management Objective / Outcome	Performance Target	Management Action / Measure	Monitoring Activity	Performance Indicators	Responsibility	Timing and Frequency
To prevent high levels of dust that may inhibit growth/health of vegetation	No deposits of dust affecting plant health in VMP areas as a result of construction activity	Implementation of Dust Management Control Plan (Appendix E) Dust control methods listed in the DMCP include: 1. Stabilised site access and egress routes 2. Minimise areas of bare soil (including stockpiles) wherever possible through phasing of works and covering/ stabilising with suitable materials.	• Water cart usage records • Covering of haul vehicles • Monitoring of stockpiles • Incident reports • VMP site monitoring and annual reports that assess vegetation health and condition	• Staff training and induction records • Toolbox talks records • Pre-start meetings • Weekly inspection records • Incident reports	• Construction Manager • All Staff	• At all times
To prevent the spread of litter and waste to VMP areas	No litter or waste in VMP areas as a result of construction activity VMP areas are free of rubbish and waste at completion of construction	The work site will be maintained free of rubbish and monitored daily to ensure compliance.	• Daily and weekly inspection of bins • Incident reports • Monthly audits	• Daily and weekly inspections undertaken • Bins and waste storage units not exceeding 100% capacity • Incident reports acted on • Monthly audits completed • VMP site monitoring and annual reports	• Construction Manager • All Staff	• At all times

Management Objective / Outcome	Performance Target	Management Action / Measure	Monitoring Activity	Performance Indicators	Responsibility	Timing and Frequency
To prevent the risk of spills of hazardous materials across development site and into VMP areas	No oil, fuel or chemical spills affecting VMP areas as a result of construction activity No pollution (including sedimentation) of water bodies as a result of construction activity	Staff will be trained in incident response plan, including spills management All hazardous material, including hydrocarbons (fuels) will be securely stored in a designated storage area away from water bodies Spill kits shall be provided, including in designated vehicles and all operators trained in their use. Vehicles and plant will be refuelled and serviced off site wherever practical Location of hazardous materials, storage locations and spills equipment is to be included within the Environmental Control Map	• Visual monitoring will be undertaken during the works to detect any fuel or chemical spills. • If any spills / turbidity plumes are observed, works will be stopped immediately; incident response plan implemented	• Incident response Plan training undertaken by all staff • All hazardous materials stored in designated location • Location of hazardous materials and spills equipment included on the Environmental Control Map	• Construction Manager • All Staff	• At all times

Management Objective / Outcome	Performance Target	Management Action / Measure	Monitoring Activity	Performance Indicators	Responsibility	Timing and Frequency
To avoid potential indirect impacts to fauna from lighting directed into VMP areas	All street lighting complies with Australian Standard 4282 – Control of the obtrusive effects of outdoor lighting	Work involving the use of machinery of any description will only be carried out from 7.00am to 5.00pm Monday to Friday, 7.00am to 1.00pm Saturday, with no work to be carried out on Sundays or Public Holidays. Lighting to comply with Australian Standard 4282 – Control of the obtrusive effects of outdoor lighting Position and direct lights away from conservation zones outside site boundaries	• Checking of position and angle of street light installation	• Lighting complies with Australian Standard 4282 – Control of the obtrusive effects of outdoor lighting	• Construction Manager	• At all times

Management Objective / Outcome	Performance Target	Management Action / Measure	Monitoring Activity	Performance Indicators	Responsibility	Timing and Frequency
To avoid potential indirect impacts to fauna from excessive construction noise	All construction work carried out in accordance with approved time frames All plant and equipment maintained and operated as per manufacturer's specifications	Work involving the use of machinery of any description will only be carried out from 7.00am to 5.00pm Monday to Friday, 7.00am to 1.00pm Saturday, with no work to be carried out on Sundays or Public Holidays as required by Council. All plant and equipment to be maintained and operated as per manufacturer's specifications and to be inspected prior to work. Any faulty plant or equipment is be stood down until repaired Limit idling/ revving of engines on mobile and stationary machines and shut down any equipment not in use. Limit the use of horns or other audible signals on mobile equipment to the maximum practical extent. Promptly respond to complaints and modify practices.	• Pre-start checklists • Maintenance logbooks • Incident reports • Random Checks	• Pre-start checklists completed • Maintenance logbooks maintained • Incident reports acted on • Random Checks undertaken	• Construction Manager / All Staff	• At all times

4.2. Fencing

The *Calderwood Mod 4 Vegetation Management Plan* (ELA 2022) provides detail on temporary fencing requirements for the VMP areas and temporary fencing measures for soil and water management as described below.

4.2.1. Temporary fencing

Temporary construction fencing is to be installed along the boundary of the 15 m buffer.

The edge of the VMP area (including 15 m buffer) where it borders the footprint is to be fenced with temporary construction fencing to prevent civil construction machinery from entering the VMP area unless under supervision from a suitably qualified ecologist or bush regenerator. Where the retained vegetation borders areas of existing development, no fencing is required.

4.2.2. Soil and Water Management

A detailed Erosion and Sediment Control Plan (ESCP), preferably as part of a Construction Environmental Management Plan, must be developed and implemented prior to any on-ground works. A preliminary ESCP is contained in Appendix D. The detailed ESCP should be in accordance with best management practices as described in Landcom's Managing Urban Stormwater: Soils and Construction Volume 1(2004).

Prior to construction commencing sediment fencing will be required around the construction area to prevent sediment running into the VMP area and limit the spread of weed propagules in soil sediments during the construction period. Sediment fencing, and erosion controls should be inspected by suitably qualified ecologist prior to the commencement of construction activities. Outcomes of the inspection should be detailed in a compliance letter report.

4.2.3. Permanent fencing

Fencing will be installed along the perimeter of all retained VMP areas. Gates will be included within the fence-lines to allow operational/management access and emergency services access.

The fencing design could incorporate high tensile steel cables to allow for appropriate vehicle access for management purposes, including emergency access. Fencing will be monitored as part of the VMP reporting requirements to ensure their integrity remains intact. The fence lines will be regularly checked for weeds, particularly prior to any mowing to ensure propagules are not dispersed into the conservation areas, with any weeds surrounding these areas to be removed during regular landscaping.

4.3. Tree Clearing Protocol

A pre-clearance survey must be undertaken of trees to be removed across the development footprint, and identification/location of hollow-bearing trees and active nests by a suitably qualified ecologist. The timing, method and effort are detailed below.

Timing: Trees proposed for removal should have a pre-clearance survey undertaken one week prior to the commencement of the staged clearing; this will ensure that any hollow-bearing trees or habitat trees are identified and checked for any recent occupation by fauna.

Method: The location of hollow-bearing trees or habitat trees should be recorded in the field via a GPS device or similar. Following field survey, a corresponding map showing the location of hollow-bearing or habitat trees should be provided which details the location and type of fauna habitat. The following data must be collected:

- Tree species
- Diameter at breast height
- Abundance of and size of each hollow
- Signs of occupation.

Effort: The results of the pre-clearance survey should identify the next steps required for fauna habitat clearing supervision and the re-use of hollow-bearing trees for habitat within the retained VMP areas.

The pre-clearance and clearing supervision protocol is provided in Table 8 and details requirements to meet Conditions of Approval 4c and 4f.

Table 8: Pre-clearance and clearing supervision protocol

Steps	Action
1. Pre-clearance	A qualified ecologist is to conduct a pre-clearance survey of trees identified to be removed as per the consent conditions. At this time, any hollow-bearing or habitat trees, will be clearly marked on site with spray paint and / or flagging tape. Habitat trees includes but is not limited to trees containing hollows, fissures, active nests, or other fauna habitat. Hollow-bearing and habitat trees will be marked using a GPS device. A corresponding map and table should be generated detailing the location and fauna habitat type/s.
Should any threatened species be identified roosting or nesting within the habitat tree a hold on works until the fauna is able to self-relocate OR when possible, time the works outside of the breeding season of the species.	
2. Clearance supervision	All identified habitat trees should to be removed by a qualified arborist. Trees that do not contain fauna habitat (hollows and/or nests) should be cleared 48 hours prior to the felling of the habitat trees. The clearing of this vegetation should result in the habitat trees becoming exposed and isolated. This will allow fauna opportunity to vacate the Action Area prior to the tree or area being cleared. Immediately prior to the clearing of habitat trees the project ecologist must conduct an inspection of any suitable ground debris, shrubs, and accessible hollows. These inspections must be conducted to determine and collect, if possible, any sheltering or nesting animals. Habitat trees and stags should be felled by an arborist in one to two metre sections, beginning at the top of the crown and lowered to the ground for inspection by the ecologist on site Lengths cut from the tree shall be in a manner that will preserve the hollow. If it is not safe for an arborist to remove the trees, the trees will be slow-felled with an excavator. Once felled, the ecologist should inspect all hollows for sheltering animals. Any sections containing threatened fauna should be reattached to a recipient tree within the nearby corridor as directed by a fauna ecologist. Any fauna present within the tree hollows/nests must be captured and released within the retained corridor. Works should cease until safe relocation has occurred. WIRES must be contacted in the instance of injured juvenile or nocturnal wildlife that require care prior to release at night. A Wildlife Injury Procedure is provided in Appendix H. Clearance supervision should be under the supervision and direction of a suitably qualified ecologist.

Steps	Action
3. Hollow-bearing tree relocation	Hollow-bearing tree and habitat tree relocation should be conducted at the time of clearance supervision and should be under the supervision and direction of a suitably qualified ecologist. Suitable hollow limbs present in association with the felled trees in the Action Area should be collected and re-located within those portions of vegetation that is to be retained within the VMP areas, where feasible. Where feasible, suitable hollows should be re-attached to a tree within the VMP areas. Re-location of hollow-bearing trees should be under the supervision of a suitably qualified ecologist and, if hollows are re-attached to trees should be undertaken by a qualified arborist. Hollow-bearing trees or limbs which cannot be re-attached to tree within the VMP area should be moved onto the ground within the VMP area, to create habitat for ground-dwelling fauna. The re-attachment of hollows or retention of hollow-bearing trees as logs should be conducted within the VMP area without causing harm to the Illawarra Forest. To ensure no harm to the Illawarra Forest, only hand machinery should be used to re-attach trees by a qualified arborist. Logs should not be moved into the VMP areas via an excavator or any other large machinery. Instead, any trees to be re-used as logs should be cut into manageable portions and moved into the VMP area by hand.
4. Reporting	The Ecologist or fauna handling specialist should prepare a summary report within 7 days of completing the clearance supervision / fauna relocation works. The report should detail that the works have been completed according to this procedure and would include information relating to the type of habitat removed, the number and type of native species relocated, location release point/s of native fauna and any threatened species encountered. In the event of fauna injury or death, this information is required for inclusion into the report.

4.4. Aquatic fauna handling procedure

All Dam De-watering procedures are to follow the Dam Dewatering Plans (DDPs) prepared for the Action Area as per Condition of Approval 4d. Detailed DDPs will be provided on a stage-by-stage during the detailed DA phase. The detailed DDPs will be appended to this CEMP in Appendix I.

4.1. Piped Stormwater Management

A piped stormwater management plan will be provided on a stage-by-stage- basis during detailed DA and relevant details will be appended to this CEMP in Appendix J (Condition of Approval 4d).

The stormwater management plan will address engineering considerations, whilst placing a strong focus on managing indirect impact and maintaining the biodiversity, ecological health, and positive water quality benefits across the action area. The objectives of the stormwater quality management strategy will be to ensure that post-development pollutant loads are consistent with Council stormwater pollutant load reduction target.

4.2. Lighting controls

A Lighting Control Plan will be provided on a stage-by-stage- basis during detailed DA and relevant details will be appended to this CEMP (Condition of Approval 4g). Generally, the potential for added light impacts will be addressed through a range of control measures on the lighting to be used within the residential area, including.

- Ensuring the development complies with the Australian Standard 4282 – Control of the obtrusive effects of outdoor lighting, which provides recommended limits for lighting.

- Incorporating a lighting strategy which prescribes limits on lights for various areas such as:
    - Post top overhead street lighting to be used facing down with minimal spill into adjacent areas in particular VMP areas.
    - Lighting to be set on timers where appropriate, and/or set on sensor switches.
    - Position and directional lighting to be located near the conservation area where deemed necessary but oriented away from the VMP areas and back into the development where suitable.

5. Monitoring

This CEMP includes a comprehensive monitoring program to ensure that management commitments are effectively implemented, and any incidents of non-compliance are detected, and appropriate corrective actions developed and implemented as part of an adaptive management program as per Condition of Approval 4i.

The Project Manager will be responsible for ensuring that all staff induction and training programs are implemented, and all monitoring requirements are undertaken.

The purpose of the monitoring program is to ensure that the CEMP's objectives are met.

5.1. Monitoring and non-compliance

Regular environmental inspections are to be undertaken of all work activities being carried out at the project site in accordance with Table 6 and the checklist in Table 7 Inspections shall be carried out in conjunction with personnel responsible for a particular work area and shall include the following:

- Daily and weekly Inspections of key environmental issues recorded on an Environmental Site Inspection Checklist (Appendix G) – site supervisory staff as part of their daily duties shall conduct daily inspections of the site (incl. all subcontractor activities), and issues noted in daily diaries if applicable. Near misses or non-compliances will be investigated, documented and reported with appropriate corrective action taken and documented.
- Regular Site Inspections – formal inspections by the Project Manager and Project Ecologist, recorded on an Environmental Site Inspection Checklist (Appendix G) will be undertaken. Near misses or non-compliances shall be investigated, documented and reported with appropriate corrective action taken and documented within clearly defined timeframes.
- Monthly audits – monthly audits by the Project Manager, recorded on a monthly audit Checklist will be undertaken. Near missis or non-compliances shall be investigated, documented and reported with appropriate corrective action taken and documented within clearly defined timeframes.

The report for any non-compliance is to be actioned no later than within 3 working days of receiving confirmation of the non-compliance. In some instances, further investigation or monitoring may be required to establish whether the CEMP has been adequately implemented, or whether the work is compliant with relevant legislation and guidelines. In these instances, an independent party, such as an Environmental Auditor, may need to carry out the investigation or monitoring.

The notification to the relevant authority of any emergency or incident which results in the loss or damage to Protected Matters, the release of contaminants and subsequent pollution to water, air or land, will include the following information.

- The location of the emergency or incident
- The name and telephone number of the designated contact person
- The time of the release
- The time the incident occurred

- The suspected cause of the release
- The environmental harm caused, threatened, or suspected to be caused by the release
- Actions taken to prevent any further release and mitigate any environmental harm caused by the release.

In addition to the inspections and monitoring undertaken by the approval holder described above, the approval holder will be implementing the management plans and monitoring/reporting program for the VMP area.

The VMP will provide the baseline data (permanent photo monitoring points and floristic/structural data) for the condition of the vegetation in the VMP areas. These monitoring sites are required to be assessed on an annual basis to provide an audit of vegetation health and condition, extent of exotic plant cover, presence/extent of feral animal species, presence of rubbish and erosion (refer to VMP (ELA 2022)) and adaptive management actions implemented.

5.2. Records management

In accordance with Condition of Approval 7, the approval holder must maintain accurate and complete compliance records.

To meet this requirement, the following records must be kept on-site:

- Conditions of approval EPBC 2021 / 8981
- All environmental training records, including signed and dated:
    - Environmental inductions
    - Environmental toolbox talks
    - Pre-start meetings
- All fauna preclearing records
- All daily, weekly and monthly environmental inspection reports
- Environmental incidents and rectification actions taken
- Project Ecologist summary and compliance reports
- CEMP audit reports
- SDS's and chemical register
- All non-conformances and incidents reports

5.3. Annual Compliance Reporting

In accordance with Condition of Approval 12, the approval holder must prepare a compliance report for each 12 month period following the commencement of the action.

The approval holder must:

a. Publish each compliance report on its website within 60 business days following the relevant 12 month period;
b. Notify the Department by email that a compliance report has been published on the website within five business days of the date of publication;

c. Provide the weblink for the compliance report in the notification to the department.
d. Keep all published compliance reports required by these conditions on the website until the expiry date of the approval.
e. Exclude or redact sensitive ecological data from compliance reports published on the website or otherwise provided to a member of the public.
f. If sensitive ecological data is excluded or redacted from the published version, submit the full compliance report to the department within 5 business days of its publication on the website and notify the department in writing what exclusions and redactions have been made in the version published on the website.

This annual compliance report will include a copy of the annual VMP Progress Reports.

The approval holder must notify, as soon as practical, and no later than two business days of the Department in writing, of any incident, non-compliance with the conditions of approval or non-compliance with the commitments made in any plans.

This notification must provide the Department with the details of any incident, non-compliance with the conditions of approval or non-compliance with the commitments made in any plans as soon as practical, and no later than 10 business days specifying:

a. Any corrective action or investigation which the approval holder has already taken.
b. The potential impacts of the incident and/or non-compliance.
c. The method and timing of any remedial action that will be undertaken by the approval holder.

6. Implementation and Operation

6.1. Roles and responsibilities

Key environmental management roles and responsibilities for each role is described in Table 9.

Table 9: Environmental management roles and responsibilities

Role	Responsibilities	Reports to
Project Manager	• Ensure all works comply with relevant regulatory and Project requirements • Ensure the requirements of this CEMP are fully implemented • Ensure all personnel and contractors have completed a site induction and orientation • Ensure all approval reporting and review requirements are met • Provide adequate resources (personnel, financial and technological) to ensure effective development, implementation, and maintenance of this CEMP • Ensure that all personnel receive appropriate induction training, including details of the environmental and community requirements • Liaise with government authorities as required • Stop work immediately where there is an actual or potential risk of harm to the environment	Lendlease Management
Construction Manager	• Plan construction works in a manner that avoids or minimises impact to environment • Ensure the requirements of this CEMP are fully implemented • Ensure construction personnel manage construction works in accordance with statutory and approval requirements • Ensure environmental management procedures and protection measures are implemented • Ensure all Project personnel attend an induction prior to commencing works • Stop work immediately where there is an actual or potential risk of harm to the environment • Implement corrective action reports	Project Manager
Environmental Manager	• Conduct site environmental inspections • Investigate and review nonconformances and identify, implement and monitor corrective and preventative actions for nonconformances • Prepare written Corrective Action Reports • Maintenance of training, nonconformance and complaints registers (See Appendix F) • Undertake or coordinate environmental monitoring events • Undertake scheduled and non-scheduled environmental audits	Project Manager
Project ecologist	• Manage fauna during tree clearing in accordance with the Tree Clearing Protocol (See Section 4.3). • Possess suitable fauna licences and permits • Provide tree clearing report	Project Manager
Project aquatic ecologist	• Manage aquatic fauna during dewatering of dams in accordance with the Dam Dewatering Plan (0) • Possess suitable fauna licences and permits • Notification of NSW Fisheries 48 hrs prior to fish relocation	Project Manager

Role	Responsibilities	Reports to
	• Provide fauna relocation report	

6.2. Environmental Training

To ensure that this CEMP is effectively implemented, each level of management is responsible for ensuring that all personnel reporting to them are aware of the requirements of this CEMP. The following environmental training will be undertaken.

6.2.1. Environmental Induction

All personnel, including sub-contractors, are required to attend a compulsory site induction that includes an environmental component prior to commencement on-site. The Project Manager (or delegate) will conduct the environmental component of the site induction. The environmental component will include an overview of:

- relevant details of the CEMP including purpose and objectives
- key environmental issues in the project area, i.e., protection of sensitive areas, erosion and sediment control, pre-clearance protocol, vehicle hygiene and fauna awareness
- conditions of environmental approvals
- specific environmental management requirements and responsibilities
- mitigation measures for the control of environmental issues
- environmental incident responses
- location of environmental sensitivities (Environmental Control Map)

A record of all environment inductions will be maintained and kept on-site.

6.2.2. Toolbox Talks

Toolbox talks will be used to raise awareness and educate personnel on construction related environmental issues. The toolbox talks will be used to ensure environmental awareness continues during construction.

Toolbox talks will be tailored to specific environmental issues including:

- vegetation clearing controls
- fauna management
- biodiversity values and conservation areas
- erosion and sedimentation control
- weed management
- Hygiene protocol
- concrete washout
- dam dewatering
- works in and near riparian areas
- noise
- housekeeping and waste
- dust control
- emergency and spill response

Toolbox attendance is mandatory, and attendees of toolbox talks are required to sign an attendance form and the records maintained.

6.2.3. Pre-Start meetings

The pre-start meeting is a tool for informing the workforce of the day's activities, safe work practices, environmental protection practices, work area restrictions, activities that may affect the works, coordination issues with other trades, hazards and other information that may be relevant to the day's work.

The daily pre-start meeting will be conducted for the site workforce before the commencement of work each day (or shift) or where changes occur during a shift. Pre-start meetings may be project-wide and/or held for specific work areas. The environmental component of pre-starts will include any environmental issues that could potentially be impacted by, or impact on, the day's activities. All attendees will be required to sign on to the pre-start and acknowledge their understanding of the issues explained.

Pre-start topics, dates delivered, and a register of attendees will be recorded, and the records maintained.

6.3. Emergency / incident contacts and procedures

Emergency contacts are shown in Table 10.

Table 10: Emergency contacts

Organisation	Name	Position	Contact Number
Project Contacts			
		Project Manager	
		Site Supervisor	
TBD		Project Ecologist	
		Project Arborist	
		Bushfire Consultant	
Department of Climate Change, Energy, the Environment and Water		Environment Compliance Branch Division	1800 110 395
Shellharbour City Council	-	Subdivision and Development Certification Department	(02) 4221 6111
Emergency Contacts			
Emergency Services	-	-	000
Shellharbour Hospital	-	-	0242952500
Environment Protection Authority	-	-	131 555
SafeWork NSW	-	-	131 050
Fire and Rescue NSW	-	-	02 9265 2999
State Emergency **Services**			132 500
WIRES	-	-	1300 094 737
Origin Energy			132 461
Energy Australia			133 466
TransGrid System Operations			1800 027 253 / 9284 300
Police Assistance Line (PAL)			131 444
Gas – Agility			131 909
Poisons Information			131 126
Telstra			132 200
RMS			132 213
NSW Rural Fire Service			(02) 4424 4424

7. Review and audit

In accordance with Condition of Approval 19, the approval holder must ensure that independent audits of compliance with the conditions or commitments made in plans are conducted if requested in writing by the Minister

Following any audit, the CEMP may be reviewed and updated where necessary. The CEMP will also be reviewed and updated after any significant changes to design or construction methods.

A copy of the CEMP shall be kept in onsite at all times.

8. References

Commonwealth of Australia 2014. Environmental Management Plan Guidelines.

Commonwealth of Australia 2015. Arrive Clean, Leave Clean.

Eco Logical Australia 2022. Calderwood Mod 4 Vegetation Management Plan. Prepared for Lendlease Communities (Calderwood).

Australian/New Zealand Standard (AS 4282-1997). 1997. Control of the obtrusive effects of outdoor lighting. ISBN 978 1 76072 359 0.

Department of Environment and Climate Change (DECC). 2009. Interim Construction Noise Guideline. © State of NSW and Department of Environment and Climate Change NSW. ISBN 978 1 74232 217 9.

Landcom, 2004. Managing Urban Stormwater: Soils and Construction.

Appendix A – Environmental Inspection Checklist and Corrective Action Required

Environmental Inspection Checklist- Calderwood MOD 4 Residential Development EPBC Site/ work zone inspected:	Compliance (Yes or No)	Corrective Actions / Maintenance Required (and due date)	Corrective Actions / Maintenance Completed (Signature/date of responsible manager)
Time & Date: Weather:			
VMP area:			
Loss or damage to vegetation in VMP areas as a resut of construction activity	☐		
Protective fencing/ barrier erected around all VMP areas	☐		
No damage to protective fencing/ barrier erected around all VMP areas	☐		
Weed species stockpiled separately from other waste	☐		
Vehicles/ plant entering and leaving site free of soil and weeds	☐		
Erosion and/or sedimentation impacting VMP areas	☐		
Deposition of dust impacting VMP areas	☐		
Spread of litter and/or waste into VMP areas	☐		
Fauna			
Loss of fauna habitat beyond approval	☐		
Habitat trees (with hollows and/or nests) in VMP area are not damaged	☐		
Trees or parts thereof to be re-used within VMP areas	☐		
Tree clearing protocol is implemented for any tree clearing	☐		
Injury of death of threatened fauna during clearing	☐		
Road mortality of any threatened fauna during construction	☐		
Dam dewatering protocol is implemented for any dam dewatering	☐		

Environmental Inspection Checklist- Calderwood MOD 4 Residential Development EPBC Site/ work zone inspected:	Compliance (Yes or No)	Corrective Actions / Maintenance Required (and due date)	Corrective Actions / Maintenance Completed (Signature/date of responsible manager)
Evidence of fauna disturbance from excessive construction noise	☐		
Waterways			
Hazardous materials/ fuels stored securely in designated storage area	☐		
Spill kits are available on-site in designated areas (including near fuel /hazard material storage and refuelling zones) and well stocked	☐		
No evidence of any spills or turbidity plumes in receiving water	☐		
Refuelling/ servicing of plant/ vehicles to occur off-site or in a designated area away from water bodies/ drainage lines	☐		
Site and waterways are free of rubbish and wastes (except within designated waste receptacles)	☐		
Waste containers are not filled beyond capacity	☐		
Waste containers are located away from water bodies / drainage lines	☐		
Concrete wash-out area lined with suitable material / bunded and not filled beyond capacity	☐		
Erosion and sediment controls are in place as per the Erosion and Sediment Control Plan	☐		
No evidence of run off/ sedimentation downslope of any sediment controls or offsite	☐		
Other	☐		
	☐		
Inspected by: Signature: Date:			

Appendix B – Hygiene procedures for vehicles and machinery to control the introduction and spread of *Phytophthora cinnamomii*

Guidelines taken from "Arrive Clean, Leave Clean" (Commonwealth of Australia, 2015)

Undertake visual inspections to confirm that vehicles, plant and equipment and footwear, are free of clods of soil, slurry (water and soil mixture) and plant material. Use facilities specifically designed for cleaning vehicles, plant and equipment and footwear.

Vehicles, machinery and large equipment

Use a wash-down facility for vehicles and machinery pay particular attention to cleaning mud flaps and tyres and undercarriage. Dispose of wash-down water so that it drains back into a low area away from waterways. If this is not possible, empty it into a waste container for responsible disposal offsite. Do not allow mud and wash-down effluent to drain into bushland and surface waters, such as rivers, creeks, reservoirs and dams. Don't drive through wash-down water.

Footwear, small equipment and hand tools

Set up a wash-down area for participants to wash and dry their face and hands and clean their footwear before entering and exiting the site. To clean footwear, first use a hard brush or stick to remove as much mud, soil and organic matter as possible before disinfecting with a solution of 70% ethanol or methylated spirits in 30% water—applied through a spray bottle or a footbath. Collect all removed mud, soil and organic matter in a bag or bucket, and keep it out of clean bushland.

Appendix C – Fencing

Example post and cable fencing around VMP areas

Appendix D – Erosion and Sedimentation Control Plan

GENERAL INSTRUCTIONS

1. The Construction Manager shall ensure that all soil and water management works are located as documented or as otherwise directed by the Environmental Manager.

All work shall be generally carried out in accordance with

   a. Shellharbour City Council
   b. EPA requirements
   c. NSW Department of Housing Manual "Managing Urban Stormwater, Soils and Construction" (4th edition, March 2004)

2. The Construction Manager shall maintain the erosion control devices to the satisfaction of the Environmental Manager and Shellharbour City Council.
3. The Construction Manager is to ensure all erosion & sediment control devices are maintained in good working order and operate effectively. Repairs and or maintenance shall be undertaken as required, particularly following storm events.

LAND DISTURBANCE

4. Where practical, the soil erosion hazard on the site will be kept as low as possible. To this end, works should be undertaken in the following sequence:

   a. Install a sediment fence along the boundaries as shown on plan. Refer detail.
   b. Construct stabilised construction entrance to location as determined by superintendent/engineer. Refer detail.
   c. Install sediment basins as shown and install sediment traps as shown.
   d. Undertake site development works in accordance with the engineering plans. Where possible, phase development so that land disturbance is confined to areas of workable size.

EROSION CONTROL

5. During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water to keep dust under control.
6. Final site landscaping will be undertaken as soon as possible and within 20 working days from completion of construction activities.

SEDIMENT CONTROL

7. Stockpiles will not be located within 2 metres of hazard areas, including likely areas of concentrated or high velocity flows such as waterways. Where they are between 2 and 5 metres from such areas, special sediment control measures should be taken to minimise possible pollution to downslope waters, e.g., through installation of sediment fencing.

8. Any sand used in the concrete curing process (spread over the surface) will be removed as soon as possible and within 10 working days from placement.
9. Water will be prevented from entering the permanent drainage system unless it is relatively sediment free, i.e., the catchment area has been permanently landscaped and/or any likely sediment has been filtered through an approved structure.
10. Temporary soil and water management structures will be removed only after the lands they are protecting are stabilised.
11. Acceptable receptors will be provided for concrete and mortar slurries, paints, acid washings, light-weight waste materials and litter.
12. Any existing trees which form part of the final landscaping plan will be protected from construction activities by:

    a. Protecting them with barrier fencing or similar materials installed outside the drip line
    b. Ensuring that nothing is nailed to them
    c. Prohibiting paving, grading, sediment wash or placing of stockpiles within the drip line except under the following conditions.

        i. encroachment only occurs on one side and no closer to the trunk than either 1.5 metres or half the distance between the outer edge of the drip line and the trunk, whichever is the greater
        ii. a drainage system that allows air and water to circulate through the root zone (e.g., a gravel bed) is placed under all fill layers of more than 300 millimetres depth
        iii. care is taken not to cut roots unnecessarily nor to compact the soil around them.

Appendix E – Dust Management Control Plan

The following strategies are suggested to minimise dust from this project during the bulk earthworks stage:

- Optimise the existing haulage route on-site to minimise travel
- Minimise speed along any haul roads to 15 km/hr on unsurfaced roads and 25 km/hr on surfaced roads
- Use water cart regularly along hauls roads
- Keep a daily site log observing wind, rain, dust leaving the site, dust on flora and any actions where relevant
- Minimise the use of stockpiles, alternatively cover, seed or fence
- Ensure all trucks moving on/off site are covered
- As soon as practical, landscape/plant any disturbed areas that are completed

Appendix F – Complaints Recording Template

Table 11: Complaints Record

Date Received	Received via phone / email / letter	Complaint	Name	Address	Contact	Follow-up Actions	Date Complete

The following checklist is to be completed by the Site Supervisor weekly during the construction period:

Site Supervisor – Weekly Environmental Checklist			
Site inspected:	Calderwood Mod 4 Residential Development, Calderwood Valley, NSW (EPBC ref 2021/8981)		
Site Supervisor:	Name:	Company	
Time:	Date:	Weather:	
DURING WORKS			
D1	**Incident Reporting** SCC have been notified of any complaints in relation to management of environmental issues.		☐
	Relevant authorities have been notified of any pollution incidents.		☐
D2	**Noise** Works are only occurring within the approved work hours. No work occurring on Sunday or Public Holidays.		☐
	Works are not occurring after sunset.		☐
	Equipment is oriented away from nearby residential receivers and potential fauna habitat.		☐
	Plant is used only where necessary and shut down when not required.		☐
D3	**Light** Site lighting is positioned away from houses and potential fauna habitat wherever possible.		☐
D4	**Rainfall** Weather forecast has been checked for this week. Work is planned, and no work is to be conducted out before or during high rainfall.		☐
D5	**Wind & Dust** Works are minimised during high wind periods.		☐
	Dust suppression methods have been implemented to limit dust generation.		☐
D6	**Emissions** Plant and equipment has been inspected with emission controls and the controls are operating efficiently.		☐
	Plant and equipment is maintained in accordance with manufacturers specifications.		☐
	Machinery is turned off whilst not in use.		☐
D9	**Chemical Storage & Use** Use of fertilisers and weed control chemicals are managed as per EMP.		☐
	Safety Data Sheets (SDS) for each chemical used are easily accessible onsite.		☐
	Detailed records of chemical application are kept onsite and are easily accessible.		☐
	Spills have been reported to relevant authorities.		☐
	A spill kit is available onsite and is easily accessible.		☐
D11	**Machinery**		☐

Site Supervisor – Weekly Environmental Checklist		
	Machinery has been cleaned, degreased and serviced recently.	
	All equipment is in a good working order.	☐
D15	**Protection of Retained Trees** There is no plant, equipment or stockpiles positioned under the drip line of retained trees.	☐
	All workers have been informed that parking or storing of vehicles within TPZ fencing is prohibited.	☐
D16	**Spread of Pathogens and Diseases** A copy of 'Saving our Species, Hygiene Guidelines' (DPIE 2020) is onsite and easily accessible.	☐
	A dedicated washdown location is setup at the entry/exit point of the site.	☐
	Phytophthora controls have been implemented to minimise the risk of spread.	☐
D17	**Weed Treatment** All weeds have been treated prior to becoming an environmental threat.	☐
D18	**Waste** All waste (not including general construction waste) has been classified in accordance with the Waste Classification Guidelines (DECC 2009).	☐
	Excess spoil or waste material is kept in a designed stockpile during construction works.	☐
	Ample bins are provided throughout the site to minimise littering.	☐
D19	**Traffic & Parking** Vehicles, materials and equipment are positioned to minimise impacts to public access and parking.	☐
	Heavy vehicles are restricted to specific routes.	☐
	Vehicles are restricted to the designed site compound shown in Appendix B.	☐
	Vehicles are not allowed to enter vegetation to be retained or protected.	☐

Follow Up Action	Responsibility	Date Completed

Weekly Checklist – Sign off
Completed by:
Signature:
Date completed:

Weekly Checklist – Sign off
Photos taken?
Location of photos:
Eastings:
Northings:

Appendix G – Environmental Checklists (Prior and Post Construction)

The following checklist is to be completed prior to construction works commencing:

Site Supervisor – Environmental Checklist			
Site inspected:	Calderwood Mod 4 Residential Development, Calderwood Valley, NSW (EPBC ref 2021/8981)		
Site Supervisor:	Name:	Company	
Time:	Date:	Weather:	
	PRIOR TO WORKS		
P2	**Site Inductions** All site personnel have been inducted on the environmental sensitivities of the site and relevant safeguards prior to commencement.		☐
	A copy of the site induction information material is kept in the site shed and is easily accessible.		☐
P3	**No-go Delineation** No-go zones onsite are marked, and fencing installed in accordance with the approved tree and vegetation plan for the site.		☐
P4	**VMP Bushland Fencing** Temporary fencing is installed around the VMP buffer area to protect vegetation to be retained. The fencing is monitored weekly and repaired if necessary.		☐
	Informational signage is installed and legible.		☐
	Project Ecologist has inspected fences and provided compliance report.		☐
P5	**Sediment Fencing** Sediment fencing is installed as per the Erosion and Sedimentation Control Plan (Appendix D) for the site and remains installed throughout the entirety of works. The fencing is monitored weekly and repaired if necessary.		☐
P6	**Soil and Water Management** Erosion and sediment controls have been installed in accordance with the 'Blue Book'.		☐
	Erosion controls have been checked daily and after rainfall.		☐
	Damaged controls have been fixed immediately, and accumulated sediment or waste has been removed from within the sediment controls regularly.		☐
P7	**Site Preparation** Site storage and parking areas are established and maintained.		☐
	Compound / laydown areas are established (within development footprint) and are maintained.		☐
	An adequate number of bins can be found onsite. Workers are shown bin locations during induction.		☐
	Site is clean and free of litter (incl. cigarette butts).		☐
P8	**Pre-clearance Survey (Habitat trees)** Pre-clearance survey conducted as per consent conditions, detailed in CEMP.		☐

Site Supervisor – Environmental Checklist		
P9	Pre-clearance report has been provided by Project Ecologist.	☐
	Pre-clearance Survey Pre-clearance survey conducted as per consent conditions, detailed in CEMP. Council are to be notified of any threatened species finds during pre-clearance surveys.	☐
P10	Pre-clearance report has been provided by Project Ecologist.	☐
	Establishment of Tree Protection Zones (TPZ) Tree protection measures have been installed as per AS4970 Protection of trees on development sites and the relevant tree protection plan prepared for the trees to be retained.	☐
	An AQF Level 5 Arborist has been engaged to inspect tree protection measures erected around trees to be retained.	☐
	Compliance report provided by Project Arborist.	☐
P12	**Resident Notice** All surrounding residents have been notified of any noisy works at least five days prior to works commencing.	☐
	Community is to be notified of any anticipated impacts of construction lighting.	☐

Follow Up Action	Responsibility	Date Completed

Prior to Construction Checklist – Sign off
Completed by:
Signature:
Date completed:
Photos taken?
Location of photos: Eastings: Northings:

The following checklist is to be completed following the completion of the construction phase:

Site Supervisor – Environmental Checklist			
Site inspected:	Calderwood Mod 4 Residential Development, Calderwood Valley, NSW (EPBC ref 2021/8981)		
Site Supervisor:	Name:	Company	
Time:	Date:	Weather:	
FOLLOWING WORKS			
C1	**Site Clean Up** All excess materials and excavated debris have been disposed of appropriately.		☐
	All onsite waste has been disposed of appropriately.		☐
C2	**Removal of fencing** Construction temporary BMP fencing has been removed without harming adjacent retained vegetation.		☐
	Sediment fencing has been removed with approval from the Project Ecologist.		☐
C3	**Removal of TPZ fencing** TPZ fencing has been removed without damaging retained trees.		☐
	AQF Level 5 arborist has attended site to conduct an inspection of the retained trees.		☐
	Compliance report has been provided by the arborist.		☐
	Any follow up actions have been conducted.		☐
C4	**Nest box monitoring** A bi-annual monitoring schedule has been implemented by the Project Ecologist.		☐
	Summary reports will be provided following each bi-annual inspection.		☐
C5	**Education of future residents** Signage installed on the edge of retained vegetation to inform residents of the presence of threatened species within the area and the importance of not littering.		☐
	The signage has been inspected by the Project Ecologist and is deemed compliant.		☐

Follow Up Action	Responsibility	Date Completed

Post Construction Checklist – Sign off
Completed by:
Signature:

Post Construction Checklist – Sign off
Date completed:
Photos taken?
Location of photos
Eastings:
Northings:

Appendix H – Wildlife Injury Procedure

Should any threatened fauna be observed near the works area, then the following procedure should be followed

1. Contact the site supervisor.
2. The site supervisor reviews if the animal is at risk of being harmed.

    - If yes, all works in the vicinity of the animal (works in other areas may continue) should be halted and the project ecologist contacted to conduct a "catch and release" in order to safely remove the animal from risk.
    - If the animal is not at risk of being harmed and can move on of its own accord, then works should be halted in the vicinity of the animal until it moves on (works may continue in other areas of the site). If the animal is not capable of moving on of its own accord, then the following steps should ensue.

If an animal is found within the study site that is injured the following procedure should be implemented:

1. Contact the site supervisor.
2. The site supervisor determines the most appropriate person to engage:

    - Project ecologist for any non-aquatic fauna
    - Aquatic ecologist for any aquatic fauna
    - The Wildlife Information and Rescue Services (WIRES), who will respond to all sick, injured or orphaned native wildlife queries.

3. If the injuries are too great for the animal to be relocated, then the animal should be taken to a WIRES Wildlife Carer or Veterinary Clinic.

Appendix I – Dam De-Watering Plans

Will be addressed on a stage-by-stage basis during detailed DA and amended to this CEMP (Condition 4e).

Appendix J – Stormwater Management Plan

Will be addressed on a stage-by-stage basis during DA and amended to this CEMP (Condition 4d).

Appendix K – Lighting Control Plan

Will be addressed on a stage-by-stage basis during detailed DA and relevant details will be appended to this CEMP (Condition 4g).

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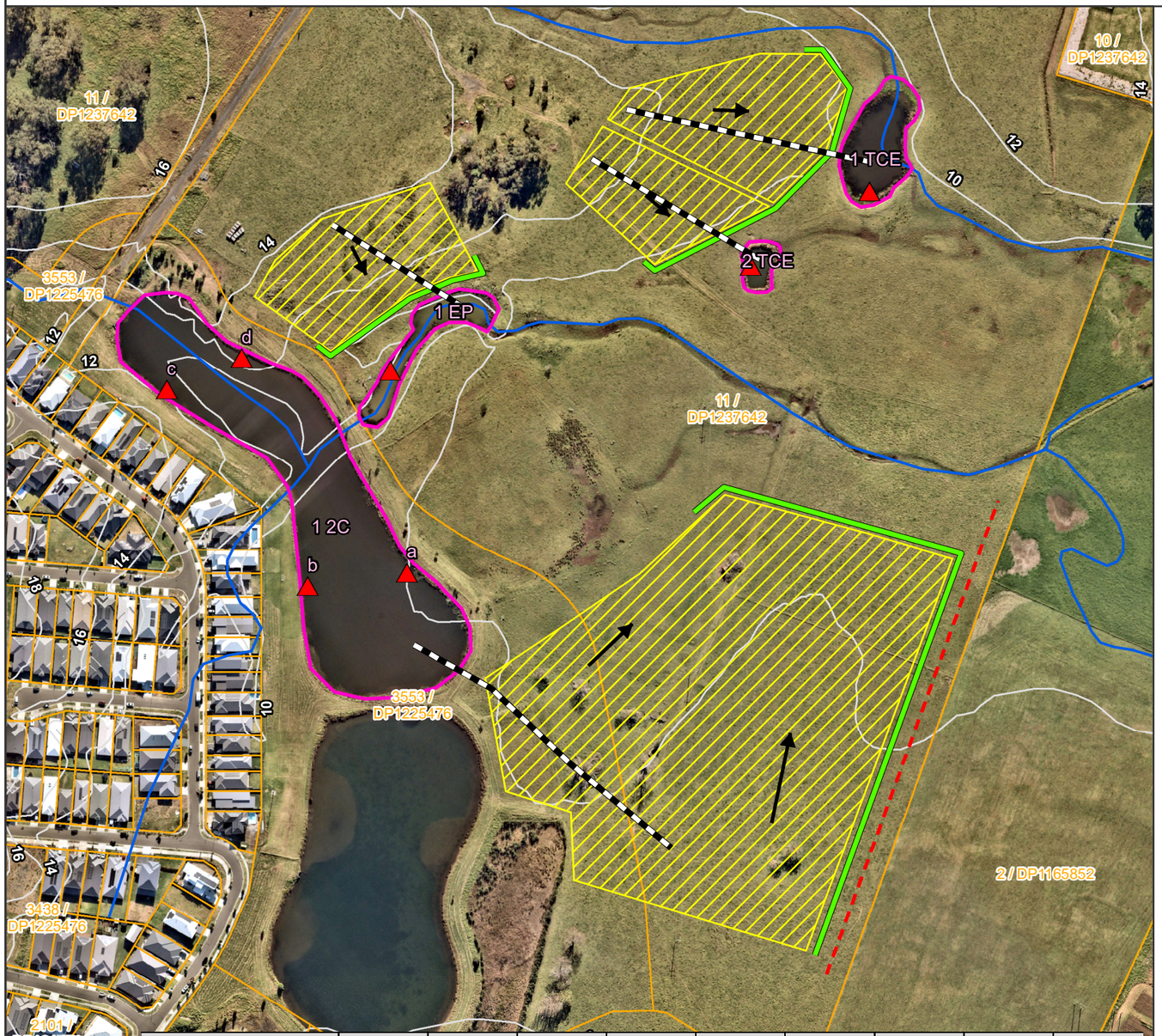
Appendix J Dam Dewatering Plan – Calderwood Road, Calderwood (Eco Logical Australia 19 August 2024)

Dam Dewatering Plan: Calderwood Road, Calderwood (Lot 11 / DP1237642 & Lot 3553 / DP1225476) - 1 of 2

Version 4: 19 August 2024



Site	Location	Estimated maximum depth	Surface area	Volume (0.4 x Depth x Surface Area / 1000)	Catchment size	Slope of irrigation area	Water quality analytes that did not meet guidelines (see table to left for full results)
Basin 1 2C a,b,c,d	-34.562228, 150.754749	1.5 m	19269 m^2	11.56 ML	41 ha	1:152	Chromium, Copper, Ammonia, Nitrite + Nitrate, Total Nitrogen, Total Phosphorus, Dissolved Oxygen (% saturation), Turbidity, Conductivity
Basin 1 EP	-34.561114, 150.755993	1.0 m	1943 m^2	0.78 ML	5 ha	1:20	Ammonia, Total Nitrogen, Total Phosphorus, Dissolved Oxygen (% saturation), Conductivity
Basin 1 TCE	-34.560253, 150.759100	2.0 m	2712 m^2	2.17 ML	25 ha	1:53	Copper, Zinc, Ammonia, Nitrite + Nitrate, Total Nitrogen, Total Phosphorus, Reactive Phosphorus, Dissolved Oxygen (% saturation), Turbidity, Conductivity
Basin 2 TCE	-34.560885, 150.758241	3.0 m	633 m^2	0.76 ML	5 ha	1:30	Ammonia, Total Nitrogen, Total Phosphorus, Dissolved Oxygen (% saturation), Conductivity

Water quality

Water testing and a brief field survey occurred on 17 August 2023, using a calibrated water quality meter and samples analysed at ALS Laboratories Smithfield. Water quality analytes that did not meet the adopted ANZ guidelines are summarised above and on the following page, including minor exceedance of some heavy metals and moderate exceedance of nutrients. Faecal Coliform count met the guidelines, therefore, the water is suitable for secondary human contact during dewatering. Sediment from the base of dam after dewatering is to be reviewed by the geotechnical consultant prior to onsite re-use. The contractor's unexpected finds protocol is to be used to ensure suitability for re-use or classification for waste disposal.

Dewatering method

The works could be completed at any time of the year, provided that daytime temperature does not exceed 36°C during the final stages (to prevent stress to fauna and ecologists). Livestock should be excluded from the site prior to dewatering and any rubbish should be disposed of before earthworks reshape the dam. Water should be pumped and slowly irrigated across the adjacent grassland prior to the removal of any vegetation. The intake pipe should be caged or shielded to minimise injury to aquatic fauna. Pumped water should be released at the highest ground and allowed to infiltrate the soil with minimal overland flow, using *AS/NZS 1547:2012 Onsite domestic wastewater management* as a guide to calculate flow rate. The contractor would be required make this calculation, considering soil permeability (including saturation from recent rain), pump size, hose length, slope and area. The flow rate and position of hoses would need monitoring and adjusting if soils become saturated in the irrigation area. As a guide, but not necessarily suited here, other dewatering in the Sydney-Illawarra start at a maximum of 36 mm/hr and adjust as suited to prevent runoff into the local watercourses. A large irrigation area would reduce soil saturation and minimise concentrated application of contaminants into the soil. Silt fences are recommended to filter sediments from inadvertent overland flow during pumping. Hay bales are suited to deflect and slow water across a broader irrigation area, rather than filter sediments. The bottom sludge material and any remaining turbid water should be excavated and dried onsite. All turbid water and sediment must be prevented from entering other waterbodies. Breaching the wall is not recommended as water collects clays and fines from the wall structure, resulting in turbid flows offsite.

Timeline of fauna relocation to be coordinated with Dam Decommissioning Work Method Procedure (or similar) and Project Aquatic Ecologist

Day 1	Day 2 - 5 (or longer)	Day 6	Day 7 - 8	Ongoing
Install erosion controls, such as silt fence (see map on left), hay bales and/or geotextile fabric, and prepare flat pump pad near the deepest end. The pump intake head is best positioned on a floating device above the deepest part of dam, held in position with ropes spanning the dam. It is difficult to move the pipe when the water is low, so it's easiest to install when dam is full. Test discharge to ensure no erosion/sedimentation occurs. Avoid disturbing vegetation (grass) where water will travel. **Notify Project Aquatic Ecologist to explain type of equipment in place and likely dewatering timeframe.**	Pump water and irrigate overland at a rate allowing infiltration to the soil. Check sediment controls if irrigation saturates soil causing surface runoff. Adjust pumping rate to slow runoff. **Update Project Aquatic Ecologist and send photos of water level to coordinate timing of fauna relocation.**	**During final 0.3 m of dewatering allow Project Aquatic Ecologist to rescue fauna in one day. Contractor must be able to pump all remaining water that day. Ecologist will instruct excavator operator to dig a solid surface around pump pit and carve steps for safe access up the bank. A suitable pump, excavator and communication with site staff is essential.** Water will become turbid as it lowers and when ecologists trample sediment. This water should be discharged overland and away from drainage lines. To allow rapid fauna rescue, the pump inlet needs to be large enough to suck sediment (e.g. 4 - 6 inch). Earthworks machinery can push sediment across the dam to assist final fish capture (adjusted to suit conditions and ecologist's instructions). Grade escape ramp for fauna hidden in bottom sediment overnight. **Project Aquatic Ecologist to advise on ramp design (slope and location).**	Leave escape ramp for fauna trapped overnight (minimum two nights).	Remove sediment and wall and commence construction.

Approvals and permits

This dam removal is part of Development Approval (DA). If the dam is licensed with Water NSW, they require notification of dam decommissioning to remove it from the register. To check status refer to Website: www.water.nsw.gov.au/Water-licensing/Applications/default.aspx; Email: Customer.Helpdesk@waternsw.com.au; Phone: 1300 662 077. The DA conditions of consent should state that an ecologist is present to relocate fauna. This will only be performed by a person with the following licenses/approvals: Section 37 *Fisheries Management Act 1994* (for fish) and an Animal Research Authority (issued by the Secretary's Animal Care & Ethic Committee). If there is no DA condition specifying an ecologist or qualified wildlife handler be presenter, then a Biodiversity Conservation Licence – *Biodiversity Conservation Act 2016* is required to relocate turtles, frogs and wetland birds.

Biodiversity

During a brief field survey, the following fauna species were observed: *Anas superciliosa* (Pacific Black Duck), *Ardea intermedia* (Intermediate Egret), *Chenonetta jubata* (Australian Wood Duck), *Crinia signifera* (Common Eastern Froglet), *Cygnus atratus* (Black Swan), *Egretta novaehollandiae* (White-faced Heron), *Fulica atra* (Eurasian Coot), *Phalacrocorax varius* (Pied Cormorant) and *Tachybaptus novaehollandiae* (Australasian Grebe). Based on dewatering activities nearby, the following native aquatic fauna could inhabit the site: *Anguilla australis* (Shortfin Eel), *Anguilla reinhardtii* (Longfin Eel), *Chelodina longicollis* (Eastern Long-necked Turtle) and *Philypnodon grandiceps* (Flathead Gudgeon). Pest species may also occur, including *Carassius auratus* (Wild Goldfish), *Cyprinus carpio* (European Carp) and *Gambusia holbrooki* (Eastern Gambusia). Dominant native macrophytes and sedges included: *Azolla pinnata* (Azolla), *Cyperus* sp. (Cyperus), *Eleocharis equisetina* (Sag), *Eleocharis sphacelata* (Tall Spikerush), *Juncus* sp. (Juncus), *Persicaria hydropiper* (Water Pepper), *Schoenoplectus validus* (River Clubrush) and *Typha domingensis* (Narrow-leaved Cumbungi). No noxious aquatic weeds were observed.

Analyte	1 2Ca	1 2Cb	1 2Cc	1 2Cd	1EP	1TCE	2TCE	ANZ Guidelines	Units
Date	18/08/2023	18/08/2023	18/08/2023	18/08/2023	18/08/2023	18/08/2023	18/08/2023		
Time	9:54 AM	10:08 AM	10:27 AM	10:43 AM	11:05 AM	11:43 AM	11:25 AM		
Total Metals (water)								ANZG (1)	
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.013	mg/L
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	mg/L
Chromium	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	mg/L
Copper	0.002	0.001	0.001	<0.001	<0.001	0.002	<0.001	0.0014	mg/L
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0034	mg/L
Mercury	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0006	mg/L
Nickel	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.011	mg/L
Zinc	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	<0.005	0.008	mg/L
Nutrients								ANZG (2)	
Ammonia as N	0.9	0.77	0.75	0.72	1.71	0.36	0.07	0.02	mg/L
Nitrite + Nitrate as N	0.15	0.15	0.18	0.21	<0.01	0.2	<0.01	0.04	mg/L
Total Nitrogen as N	1.6	1.6	1.6	1.4	2.3	1.7	0.4	0.35	mg/L
Total Phosphorus as P	0.09	0.06	0.07	0.07	0.06	0.18	0.06	0.025	mg/L
Reactive Phosphorus as P	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	0.02	mg/L
Biological								ANZG (3)	
Faecal Coliforms	28	43	28	75	8	10	6	1000	CFU/100mL
Physicochemical								ANZG (2)	
Temperature	12.9	13.34	13.91	13.51	13.68	14.67	12.9		°C
pH	7.77	7.78	7.66	7.76	6.57	7.17	7.13	6.5 - 8	pH units
Dissolved Oxygen (% saturation)	79.5	81.4	69.1	77.6	42.1	74.8	41.3	85 - 110	% sat
Turbidity	58.3	67.2	66.8	27.5	31.9	65.2	0.8	50	NTU
Conductivity	1060	1060	1070	1100	2990	781	1860	300	µS/cm
Salinity	0.5	0.5	0.5	0.5	1.5	0.4	0.9		ppt

Values in red are above or outside trigger values
Water sample collection was undertaken by Eco Logical Australia and samples analysed by Australian Laboratory Services (ALS)
(1) 95% Level of Protection for Freshwater
(2) Default trigger values for lowland rivers in south-east Australia (values for NSW & Vic east flowing coastal rivers)
(3) Guidelines for recreational water quality and aesthetics: Secondary contact

- Water quality sample point
- Diversion bund to prevent runoff to neighbouring lot
- 1:25,000 waterway mapping (DCCEEW Water Group)
- Recommended pump position
- Recommended erosion control
- Direction of slope
- Contours (2 m)
- Dam
- Recommended irrigation area
- Cadastre
- Key Fish Habitat (DPI Fisheries)

N

0 25 50 100
Metres

Datum/Projection:
GDA2020 MGA Zone 56
Project: 23WOL-6110 Date: 08/09/2024

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Imagery: 15/06/2023

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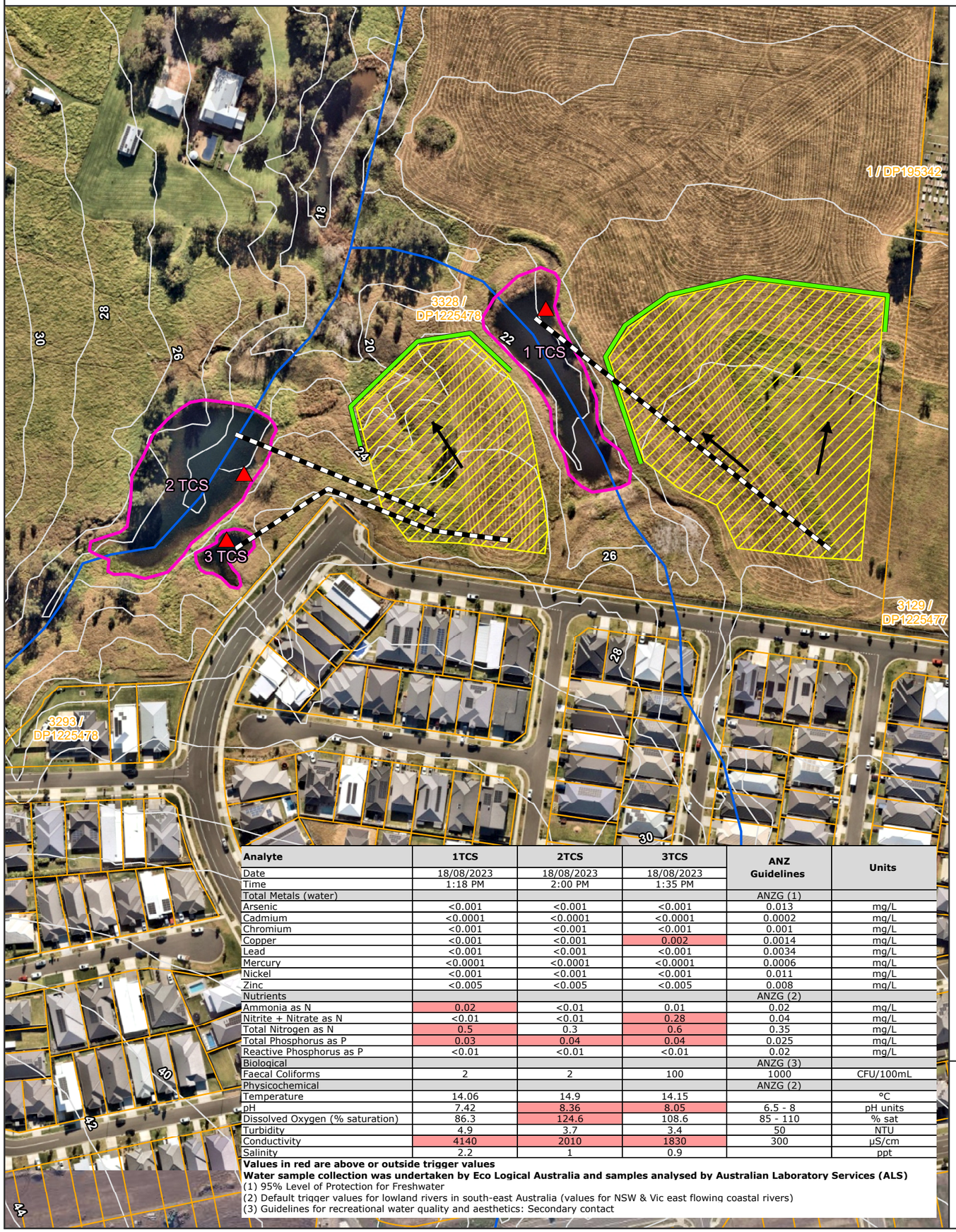
Dam Dewatering Plan: Calderwood Road, Calderwood (Lot 3328 / DP1225478) - 2 of 2

Version 4: 19 August 2024



Site	Location	Estimated maximum depth	Surface area	Volume (0.4 x Depth x Surface Area / 1000)	Catchment size	Slope of irrigation area	Water quality analytes that did not meet guidelines (see table to left for full results)
Basin 1 TCS	-34.557928, 150.746718	3.0 m	2513 m^2	3.02 ML	22 ha	1:46	Ammonia, Total Nitrogen, Total Phosphorus, Conductivity
Basin 2 TCS	-34.558326, 150.744971	3.0 m	3485 m^2	4.18 ML	25 ha	1:11	Total Phosphorus, pH, Dissolved Oxygen (% saturation), Conductivity
Basin 3 TCS	-34.558633, 150.745090	2.0 m	373 m^2	0.30 ML	10 ha	1:11	Copper, Nitrite + Nitrate, Total Nitrogen, Total Phosphorus, pH, Conductivity

Aquatic fauna handling procedure

i. **NOTICE:** The Aquatic Ecologist is to notify DPI Fisheries of the activity 48 hours prior to fish relocation (unless an agreement is in place), including locations of dewatered and relocation sites (see regional office contacts https://www.dpi.nsw.gov.au/contact-us/local-office. Fisheries require permits to be carried by the licensed ecologist, who should also display a sign clearly showing licence number (if working in public areas, especially when releasing fauna to local creek).

ii. **PLANNING:** The dewatering schedule should allow time for fish rescue, especially during the final 0.3 m water depth or as advised by Aquatic Ecologist. Fauna should be captured in one day, so pumps need to be of an adequate size and placed in an area free from mud and debris (e.g. inside excavator bucket or screened sump pit). If wetland birds are observed nesting, or young birds (chicks) are using the dam, advise the Aquatic Ecologist immediately for advice. Depending on species and age, birds may be able to relocate themselves. Chicks will need temporary refuge during dewatering, or works may need to be postponed.

iii. **CAPTURE:** Fish are to be collected by hand nets during the final day of dewatering. This is most effective when the water is <0.3 m deep. Dissolved Oxygen concentration will drop rapidly as water volume decreases, especially in warm water or if lots of fish are present. Larger bodied fish should be targeted first. Wetland birds will scavenge for small fish in the shallows (e.g. Gambusia). Most small fauna will likely remain uncaptured in the dam until the water becomes very shallow (especially eels and turtles). Eels are best captured by large hand nets in water <0.3 m deep, although they burrow into mud. When the water is extremely low, turtles and fish may head towards the intake pump (placed in deepest part). This area should be monitored to intercept fauna (stand in water next to intake on hard surface). Turtles will burrow into mud and may require observation and rescue the following morning but can also move themselves to suitable nearby habitat if an escape ramp is graded. Frogs can be collected by hand using a freezer/snap-lock bag if observed or heard around the fringe. Hygiene protocols are to be followed and each frog stored in a separate bag. For safety, at least two people are required when wading and handling heavy tubs of water/fish up banks (excavator should dig access steps/ramp).

iv. **RELOCATE:** Native fish healthy enough for relocation are to be contained and transported in an aerated tub/tank to an appropriate waterbody. DPI Fisheries advise that the host location should be large enough to accommodate additional fish, especially predatory eels. Additional release sites may be needed. Do not overstock tubs or leave in direct sun for extended periods. Aeration can be provided by battery aquarium pumps or manual turbulence if only stored for a short period. Turtles can be transported in a shaded tub with a wet hessian bag placed inside for moisture and support during transport. Frogs can be transported in an inflated freezer/snap-lock bag containing leaves moistened with bottled water or dam water. Tadpoles can be transported in small buckets with dam water.

v. **RELEASE:** Water from the receiving waterbody should be mixed slowly over 5 - 10 minutes with the tank water to allow fish to acclimatise to the new water quality. Eels are less susceptible to changes in water quality. Care should be taken when releasing fauna not to also transfer weeds or invasive species (e.g. Carp eggs and Gambusia). Transfer animals via hand nets, rather than tipping the tub with water in the host waterbody. Eels can be released on land a few metres from the edge and pointed towards the water. Frogs are to be released in dense shade alongside water in the nearest protected riparian corridor.

vi. **PESTS**: Exotic fish (e.g. Carp, Gambusia) are to be intercepted, euthanised and disposed of in accordance with the ecologist's Animal Research Authority (issued by the Secretary's Animal Care & Ethic Committee). Exotic *Trachemys scripta elegans* (Red-eared Slider Turtle) are to be contained humanly and DPI immediately notified (Biosecurity Line – 1800 680 244). They will collect the live turtle from the ecologist.

vii. **POST-DEWATERING:** An escape ramp should be graded to allow trapped fauna to escape overnight. The Project Aquatic Ecologist will advise on ramp design (slope and location) on the day. Sediment should be left up to two nights to allow hidden fauna to emerge, unless the ecologist confirms there are no fauna remaining (site specific assessment). Earthworks staff should notify the Project Aquatic Ecologist if stranded fish or turtles are observed post-dewatering.

viii. **REPORTING:** The Project Aquatic Ecologist should prepare a summary report suitable for submission to Council within 7 days of completing the aquatic fauna relocation works. The report would detail that the works have been completed according to this aquatic fauna handling procedure, and would include information relating to the location of the dam, the licences held by the staff involved in the works, the number and type of native species relocated, location of release point/s for native fauna and the number and type of exotic species dispatched. Photographic evidence of various steps in the procedure should be included.

Risk assessment to downstream biodiversity

Task	Risk	Mitigation	Risk to downstream biodiversity after successful mitigation
Dewater Basin 1 EP	Very poor water entering watercourse.	Dewater upslope of dam so any runoff re-enters the dam, rather than watercourse downstream.	Low
Dewater Basins 1 TCS, 2 TCS, 3 TCS, 1 2C, 1TCE, 2TCE	Moderately poor water entering watercourse. Overland flows scouring channel downstream.	Dewater upslope of dam (where possible) so any runoff re-enters the dam, rather than watercourse downstream. Where land is limited, dewater as far from other watercourses as possible. Irrigate slowly and monitor soil saturation. Monitor downslope gullies for erosion. Cease pumping if exposed soil is caused by dewatering.	Low
All Basins	Bottom sludge and turbid water entering watercourse.	Cease pumping if turbidity exceeds 50 NTU in any overland spills (as water level lowers, turbidity will increase). Bottom sludge is to be excavated onto land to dry, contained by a sediment fence. Water pump should be elevated/suspended to avoid sucking sediment-laden water.	Low

Analyte	1TCS	2TCS	3TCS	ANZ Guidelines	Units
Date	18/08/2023	18/08/2023	18/08/2023		
Time	1:18 PM	2:00 PM	1:35 PM		
Total Metals (water)				ANZG (1)	
Arsenic	<0.001	<0.001	<0.001	0.013	mg/L
Cadmium	<0.0001	<0.0001	<0.0001	0.0002	mg/L
Chromium	<0.001	<0.001	<0.001	0.001	mg/L
Copper	<0.001	<0.001	0.002	0.0014	mg/L
Lead	<0.001	<0.001	<0.001	0.0034	mg/L
Mercury	<0.0001	<0.0001	<0.0001	0.0006	mg/L
Nickel	<0.001	<0.001	<0.001	0.011	mg/L
Zinc	<0.005	<0.005	<0.005	0.008	mg/L
Nutrients				ANZG (2)	
Ammonia as N	0.02	<0.01	0.01	0.02	mg/L
Nitrite + Nitrate as N	<0.01	<0.01	0.28	0.04	mg/L
Total Nitrogen as N	0.5	0.3	0.6	0.35	mg/L
Total Phosphorus as P	0.03	0.04	0.04	0.025	mg/L
Reactive Phosphorus as P	<0.01	<0.01	<0.01	0.02	mg/L
Biological				ANZG (3)	
Faecal Coliforms	2	2	100	1000	CFU/100mL
Physicochemical				ANZG (2)	
Temperature	14.06	14.9	14.15		°C
pH	7.42	8.36	8.05	6.5 - 8	pH units
Dissolved Oxygen (% saturation)	86.3	124.6	108.6	85 - 110	% sat
Turbidity	4.9	3.7	3.4	50	NTU
Conductivity	4140	2010	1830	300	µS/cm
Salinity	2.2	1	0.9		ppt

Values in red are above or outside trigger values
Water sample collection was undertaken by Eco Logical Australia and samples analysed by Australian Laboratory Services (ALS)
(1) 95% Level of Protection for Freshwater
(2) Default trigger values for lowland rivers in south-east Australia (values for NSW & Vic east flowing coastal rivers)
(3) Guidelines for recreational water quality and aesthetics: Secondary contact

Water quality sample point
1:25,000 waterway mapping (DPE Water)
Recommended pump position
Recommended erosion control
Direction of slope
Contours (2 m)
Dam
Recommended irrigation area
Cadastre
Key Fish Habitat (DPI Fisheries)

N

0 12.5 25 50
Metres

Datum/Projection:
GDA2020 MGA Zone 56
Project: 23WOL-6110 Date: 08/09/2023

nearmap.com
Imagery: 15/06/2023

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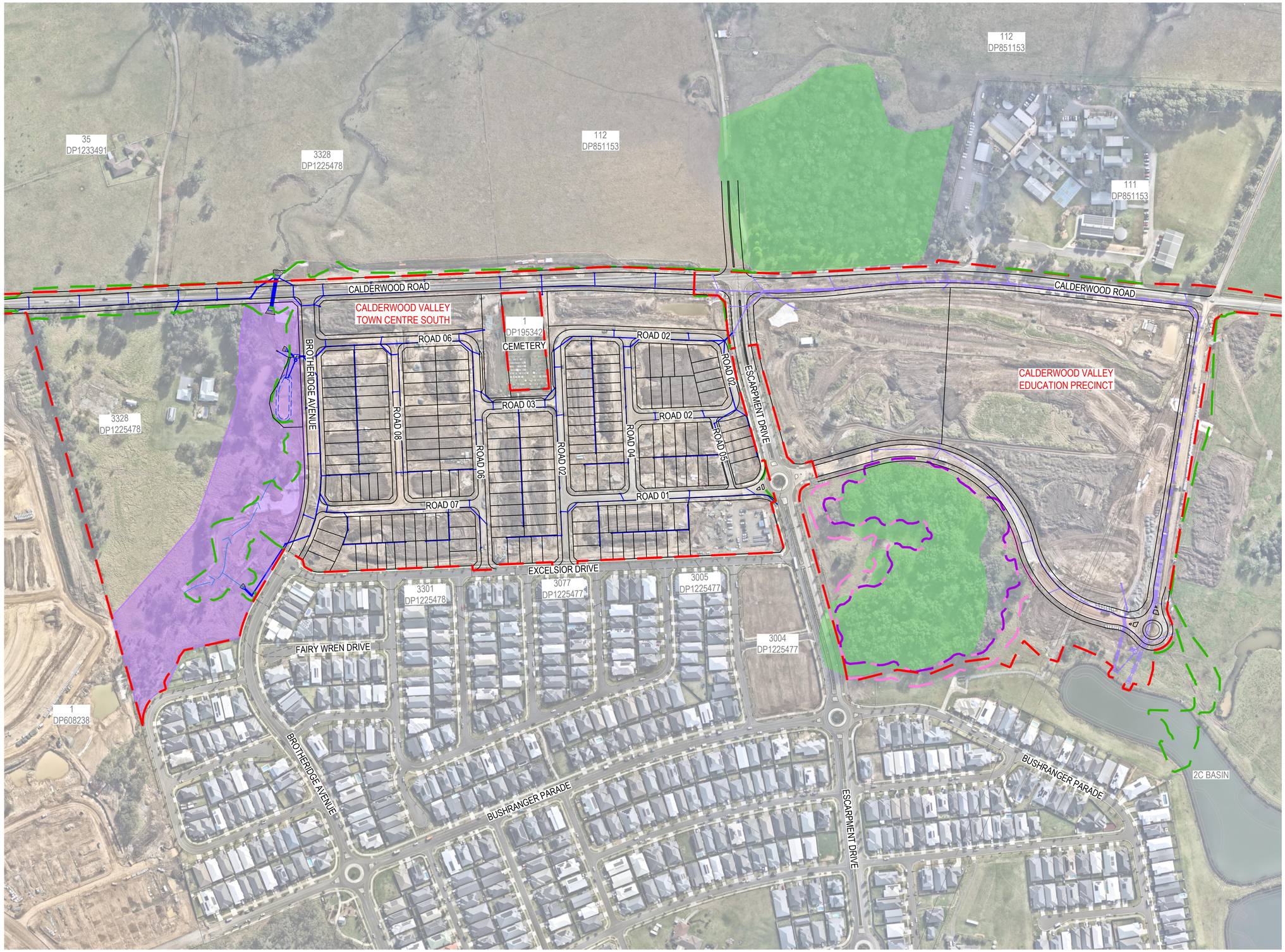
Appendix K Piped Stormwater Management Infrastructure (Stockland 22 October 2024)



PROPOSED

LEGEND

- SITE BOUNDARY
- CIVIL WORKS BOUNDARY
- LOT BOUNDARY
- TOWN CENTRE SOUTH STORMWATER PIPES
- TOWN CENTRE SOUTH STORMWATER STRUCTURES
- EDUCATION PRECINCT STORMWATER PIPES
- EDUCATION PRECINCT STORMWATER STRUCTURES
- RIP RAP

EXISTING

- LOT BOUNDARY
- EASEMENT
- ILLAWARRA & SOUTH COAST LOWLAND FOREST AND WOODLAND
- 15m BUFFER
- ENVIRONMENTALLY SENSITIVE LANDS
- VEGETATION MANAGEMENT PLAN EXTENTS

REV	DATE	DESCRIPTION	AMD BY	APP BY
P1	22.10.24	ISSUED FOR INFORMATION	MD	GB

0 20 40 60 80 100m
SCALE 1:2000 AT ORIGINAL SIZE

lendlease

MAKER ENG
SURVEY DESIGN DELIVER

DRAWN: M.DAVID	DESIGNED: -
DRAFT CHECK: C.WIEWIORA	DESIGN CHECK: -
APPROVED: G.BOKE	
NOT FOR CONSTRUCTION	

CALDERWOOD VALLEY
TOWN CENTRE SOUTH & EDUCATION PRECINCT
EPBC & VMP GENERAL ARRANGEMENT
LAYOUT PLAN

DRAWING NUMBER	SHEET No.	ORIG. SIZE	REVISION
ISC00156-00-SK061		A1	P1

Michael David, 22/10/2024 4:55 PM

C:\12dS\data\12DSYNERGY\ISC00156 LL Calderwood Valley TCS_13\02 Design\Drawings\00 - Sketches\ISC00156-00-SK061.dwg

Appendix L Notification of Commencement of Action under EPBC Approval 2021/8981 (Stockland 25 May 2023)

25 May 2023

Kate Gowland
Branch Head
Environment Assessments (NSW / ACT) Branch
Department of Climate Change, Environment, Energy and Water

Attention: Post Approvals Team

Notice of Commencement of Action under EPBC Approval 2021/8981

I am writing pursuant to Condition 5 of EPBC Decision Notice 2021/8981 granted on 19th April 2023. We advise that actions approved under the approval commenced within the action area on 22nd May 2023.

We propose a reporting date for annual compliance reporting of 19th April, with reports to be published within 60 business days.

Should you have any queries please contact Taylor Paynter via taylor.paynter@lendlease.com or myself via mark.anderson@lendlease.com.

Regards,

Mark Anderson
Senior Development Manger

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